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THE

CYCLOPÆDIA;

OR,

Universal Dictionary

OF

ARTS, SCIENCES, AND LITERATURE.

VOL. VIII.

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THE

CYCLOPÆDIA;

OR,

UNIVERSAL DICTIONARY

OF

Arts, Sciences, and Literature.

BY

ABRAHAM REES, D.D. F.R.S. F.L.S. *S. Amer. Soc.*

WITH THE ASSISTANCE OF

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CYCLOPÆDIA:

OR, A NEW

UNIVERSAL DICTIONARY

OF

ARTS and SCIENCES.

CHRONOMETER.

CHRONOMETER, from χρόνος, *temporis*, and μέτρον, *menſura*, is a term in *Horology*, which, in its comprehenſive ſignification, may mean any machine which *meaſures time*, of which there have been various kinds, ſuch as *Clepſydræ*, *clocks*, *watches*, *regulators*, and *time-keepers*, or *time-pieces*, but the application of this term has been more particularly confined by mechanicians to two kinds of machines; firſt to ſuch as meaſure very ſmall portions of time only, by ſubdividing the ſecond: and, ſecondly, to ſuch as continue to meaſure long periods, with great accuracy under all the variations of temperature that ariſe out of the changes of ſeaſon and climate.

The former of theſe two kinds of machines was originally conſtructed for philoſophical purpoſes, ſuch as meaſuring the time of the deſcent of a falling body through a given ſpace, of the efflux of a fluid out of a given aperture under certain circumſtances, of the paſſage of a heavenly body along the eye-piece of a teleſcope, of the velocity of ſound compared with that of light, &c.

The deſcription of a machine of this kind is given in Dr. Deſagulier's Experimental Philoſophy, and Dr. Hutton ſays he has ſeen one, that profeſſes to meaſure ſo ſmall a portion as the *fortieth* part of a ſecond, but that it cannot be ſtopped with certainty within the tenth part of the propoſed degree of accuracy. Mr. W. Nicholſon, however, ſays, (vol. iii. p. 50, in a note of his Philoſophical Journal, 4to ſeries.) "that there have been inſtruments made to divide the ſecond into a *hundred* parts; one of theſe, ſays he, made by Whitehurſt, and regulated by a fly, repeatedly meaſured the time of the fall of a leaden bullet, in ſome experiments which I ſaw, with no greater variation than *one-hundredth* part of the ſecond." The adoption of Mr. Atwood's machine has now ſuperſeded the uſe of ſuch a nice meaſure of time in the above experiment, and for all the other purpoſes, the *beat* of a watch, counted by the ear while the eye obſerves the object of experiment, ſeems to be not only the moſt convenient chronometer of any, but is ſufficiently accurate for any purpoſe when the beats are quick, and when their value is known. See our article BEATS, in *Horology*.

The ſecond kind of horological machines known by the appellation of chronometers, ſince Mr. Arnold the elder gave this name to his time-keepers, differs from an ordinary watch principally in the eſcapement and balance, and deſerves our more particular notice, inaſmuch as the act of navigating veſſels over the extenſive oceans of the univerſe, is greatly indebted to their accurate meaſurement of time, in all the variations of heat and cold, from the higheſt navigable latitudes to the equinoctial line. In ſteering a veſſel over the trackleſs deep, the great deſideratum is, to know at any given inſtant the relative longitude, or diſtance from the firſt meridian, and the latitude, or diſtance from the equinoctial line; a knowledge of theſe two guides will always ſuffice to direct on what point of the compaſs, where the variation is known, a veſſel is to be ſteered, if no current interfere, in order to gain a given harbour. The latter of theſe two guides, viz. the preſent latitude, can always be obtained, independently of the ſhip's reckoning by the log line, by an obſervation of any of the heavenly bodies when at its greateſt altitude, or even with ſufficient accuracy by two ſucceſſive altitudes taken at a diſtance from the meridian, provided the intermediate lapſe of time be accurately noted. The other requiſite, the preſent longitude, however, is not ſo readily obtained, the lunar method requiring tedious calculations not generally underſtood, and the occultations of the ſtars by the moon, and eclipſes of the ſun, moon, and Jupiter's ſatellites, not occurring with ſufficient frequency to be of much benefit, even if they could be obſerved with ac-

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curacy and convenience on board a ship. The method by a good chronometer is, however, not only simple in its application, but at all times readily attainable, and therefore is coming into general use. We will premise a few observations respecting the utility of a chronometer at sea, and the improvements it has successively experienced, before we proceed to describe the machine itself according to some of its more perfect constructions.

The earth, it is now generally believed, revolves on its axis, in every part of its annual orbit, in an uniform and equable manner, and, on this account, the period of its rotation has been fixed upon as the most proper standard of our measure of time, and, indeed, is the only invariable standard with which we are acquainted: this period, according to our mode of reckoning, is divided into 24 equal parts, as the rotation has a reference to the sun; and each of those 24 parts is called an hour, or a *solar* hour sometimes, by way of distinction from the *sidereal* hour, which is a 24th part of a rotation, as it regards a fixed star; hence an hour, or solar hour, means one 24th part of the time elapsed since any spot on the globe passed the sun on the meridian, or south point, in regard to that spot: two hours mean twice that space of time; and 24 hours the whole time of a solar rotation, which is longer than a sidereal rotation by 3^m 55^s 54^{th} of solar time, by reason of the sun having advanced apparently $59' 8'' 10'''$ in the ecliptic during a rotation; so that a solar, being only a relative rotation, is more than a sidereal or absolute rotation, by as much as, taken collectively, amounts to an entire rotation in each annual revolution of the earth, to which cause the apparent motion of the sun in the ecliptic is owing: and, to this cause, is to be attributed the reason why there is a sidereal more than a solar day in each year. But the period of a solar rotation of the earth, or any portion of it, may be, and frequently is, reckoned in other terms, implying space passed through in a rotation, instead of the time occupied by the motion through that space: mathematicians have long been in the habit of dividing a circle into 360 equal parts, one of which is called a degree, or $1°$; and, as an equatorial section of the earth would be a circle, geographers and astronomers have supposed the equinoctial line divided into $360°$, and each degree divided into $60'$, (60 minutes) or geographical miles, which minutes are again subdivided into $60''$ (60 seconds), as we divide an hour into 60^m, and each of those again into 60^s: hence, as the whole $360°$ of the earth's circumference pass the sun's meridian ray in 24^h, we know that $15°$ must pass the same in one hour, or $1°$ in four minutes of time, as also $1'$ in 4^s; consequently, when we know the time that has elapsed since any given spot on the globe has passed the meridian sun, we know also, by allowing $1°$ to 4^m of time, how many degrees of the equinoctial have passed in the same time; hours, with their divisions and subdivisions, and degrees, with their divisions and subdivisions, being mutually convertible one into the other by direct proportion, or more readily by tables constructed on purpose. It is necessary, however, that we should notice, that there is a difference between a *real* and an *apparent* rotation of the earth as it relates to the sun, partly by reason of the earth's axis being inclined in an angle of nearly $23\frac{1}{2}°$ to its annual orbit, causing thereby a necessary reduction of apparent motion in the ecliptic, or earth's path, to real equable motion in the equator, and partly by the alternate acceleration and retardation of the earth's motion in her orbit at different times of the year, which irregularity requires a correction called the "Equation of the Center:" these two causes of apparent irregularity in the earth's rotations have their joint effects allowed for, by what is called "Equation of Time," usually inserted in a table with this title, and also placed in the column of "clock fast," or "clock slow," in the almanacs; the quantity, therefore, corresponding to any given day in the year, in the equation table or almanac, must always be added to or subtracted from the time shown by an accurate chronometer, to make it agree with *apparent*, or what the French (and lately some of our English authors) improperly call *true* time; that time in our opinion being *true*, which is mean, and which corresponds to the real rotations of the earth; for these rotations, considered by themselves, are equable, and not affected by the causes of those two *apparent* irregularities we have noticed, as arising solely out of the relative positions and situations of the earth and sun.

But we have not to regard only the period of the earth's solar rotation; its direction, also, must be considered, which is from that point of the horizon, which we call west, to that which is denominated east; thereby causing the sun, which is really a stationary body, or nearly so, to *appear* to move on the contrary from east to west every solar day, and the stars likewise, in the same direction, once in every sidereal day; but these latter bodies, being placed at an immense distance beyond the earth's orbit, have no apparent change of place, and, therefore, require no correction; consequently, there is no difference at any part of the year between a *mean* or *true*, and an *apparent*, sidereal day, which must have been the case, notwithstanding the immense distance of the stars, if the rotations of the earth had not been uniformly equable. It is on account of this equality among the sidereal days that astronomers have proportioned the pendulums of their regulators to vibrate sidereal seconds, that the right ascension of the heavenly bodies is given in sidereal time, and that the late Margetts made his chronometers, with great ingenuity, to show at the same time both solar and sidereal time, and, consequently, the sun's mean right ascension at any time, which is always equal to their difference: and we may add here, that the constant variation that is taking place between mean and apparent solar time, was the reason why a clockmaker in London, whose name is unknown, and after him on the continent, H. Sully, Alexander le Bon, Julien le Roy, Enderlin, l'Admiraud Passemant, Rivaz, Berthoud, and others, have made equation clocks on different constructions, to indicate both mean and equated, or apparent time.

From these introductory remarks on time, and its connection with, or rather dependence on, the earth's rotation on its axis, it is easy to conceive, that all places on the globe which pass the sun's meridian ray soonest, count their 12 o'clock, or noon, earlier than those which follow in succession; but the eastern parts pass first, and thence have their time more advanced, or earlier than the following more western parts have; and the difference is, as we have said, at the rate of 4^m for every degree of distance. This distance is called *longitude*, by reason of the equatorial diameter of the earth being *longer* than the polar diameter, in the direction of which latter, the breadth or *latitude* of the earth is counted both ways from the middle. The longitude may have its reckoning to commence at any assignable point on the globe, and all the other parts will be called east or west of that point, which is called the first meridian, accordingly as they precede or follow it in each rotation of the earth, and the quantity will be either so many hours, minutes, and seconds of time, or so many degrees, minutes, and seconds of space, as correspond to that time. Now, it is very obvious, that, if we could at the same instant know the time accurately, as counted at each of two different places, situated respectively east and west of one another, the difference of of thofe two times fo indicated, would be their difference of longitude in time, which, converted into degrees, minutes, and feconds, would be their difference of longitude in this denomination, from which, in a known latitude, the actual diftance of the two refpective places may, by calculation, be afcertained. What, therefore, a chronometer has to do, is, *to tell at all times the hour, minute, and fecond, as counted at the firft meridian*, whether London, Paris, or any other place, to the time of which it was accurately put previoufly to the commencement of a voyage; for, as the time at any ifland, or place of a fhip, can be had by means of Hadley's quadrant, or fextant, or more accurately by means of Troughton's reflecting circle, from a celeftial obfervation; the quantity that this time exceeds or falls fhort of the time indicated by the machine, as being the time at that moment at the firft meridian, will be the ifland's or fhip's comparative longitude in time, eaft, if the chronometer is behind, but weft, if before the time by a celeftial obfervation. In our Englifh fhips, the chronometer is a kind of travelling companion which tells, whenever confulted, what the exact time is at Greenwich; nor is it indifpenfably neceffary that it fhould keep time exactly with the clock at Greenwich obfervatory, provided the daily gain or lofs, called the *rate*, be afcertained and applied as a correction accordingly as it accumulates. It is, however, an indifpenfable requifite, that the daily gain or lofs fhould not differ materially from itfelf at different periods, or under the changes of temperature experienced in different climates; and the fulfilment of this condition conftitutes any portable horological machine, a marine *chronometer*, or time-keeper, whatever may be its conftruction or price. Any of the other methods of afcertaining the longitude may be occafionally put in practice with advantage, as a check upon the fimple determination by the chronometer; for their operations will detect its daily errors, and afcertain nearly their amount at the time.

The firft perfon who propofed to afcertain the relative longitude of any place or fhip at fea, by means of an horological machine for indicating the time of the firft meridian, was, as has been afferted, Gemma Frifius, about the year 1530; (vide "De Principiis Aftronomiæ et Cofmographiæ.") This method was defcribed and recommended in Carpenter's Geography fo early as the year 1635; but the ftate in which horological machines was, at that time, prevented his accomplifhing the defign: the idea, however, once fuggefted, was valuable; and ftimulated ingenious mechanifts, in times fucceeding, to attempt the accomplifhment of an object of fuch national importance. The difcovery of the ifochronifm of the pendulum turned the minds of ingenious men to the improvement of clocks; and we find that lord Kincardine tried a marine pendulum clock by Dr. Hooke in the year 1662; and that Chriftian Huygens, the celebrated Dutch mathematician and mechanician, contrived a time-keeper, actuated by a fpring, and regulated by a pendulum, which was tried at fea by major Holmes in the year 1664, and fpoken of by him in favourable terms. The efcapement was of the crown-wheel kind, which, from its nature, is almoft conftantly under the influence of the maintaining power; but a fmall weight connected with the crown-wheel, was raifed every half-fecond by the maintaining power, and gave an impulfe to the pendulum, which, therefore, was not affected by the irregular tranfmiffion of the maintaining power through the train of wheel-work: this contrivance was ingenious, and obtained the name of *remontoir*. The pendulum, however, was not only unfteady in its action during the toffing of a fhip, but was fubject to a variation in its length by change of temperature, as well as to a change of weight depending on the parallel of latitude; the latter of which changes, indeed, was afterwards difcovered. There was, moreover, a pair of cycloidal cheeks of brafs fo fixed, as that the thread of fufpenfion, by being evolved from them alternately at each fucceffive vibration, might make the bob of the pendulum defcribe the involute of a cycloid, which this author firft proved, was itfelf a cycloid, poffeffed of the peculiar property of rendering the vibrations in long and fhort arcs of equal duration; this cycloidal doctrine was plaufible in theory, but could not be reduced to practice, becaufe it fuppofed; 1ft, the pendulum invariable in length; 2dly, the collection of all the weight to be into one point; and 3dly, the abfence of friction and other kinds of refiftance, to which mechanifm is fubject. Huygens's contrivances, notwithftanding, together with the doctrines contained in his "Horologium Ofcillatorium," may be confidered as having laid the foundation of horological fcience.

The balance, which had preceded the pendulum, was again reforted to as a regulator of portable time-keepers; and though it was found incompetent to its office in a detached ftate, yet, by the aid of a flender fpring to quicken and regulate its fluggifh vibrations, it has ultimately turned out to be of eminent utility. It has been contefted by Huygens and Dr. Hooke, which of thefe two fkilful mechanicians firft introduced the fpring, called ufually the pendulum fpring, from the ifochronal property which it poffeffes, like the pendulum, when of a proper ftrength, fhape, and length; and F. Berthoud afferts, that though Hooke applied it firft in a ftraight form, yet Huygens firft adopted the fpiral fhape, as being more favourable to ifochronifm; while others are of opinion, with more probability, that Hooke actually applied it in a fpiral form among the *twenty* feveral methods that he faid, in his lectures at Grefham college, in the year 1664, might be ufed to anfwer the fame purpofe (vide "Lectiones Cutlerianæ," 1673.) Indeed the account of the fpiral fpring, adopted by Huygens, was not publifhed in the Philofophical Tranfactions, until the year 1675, N° 112, whereas Hooke had difcovered the ifochronifm of fprings, and regiftered his difcovery by an anagram compofed of the Latin fentence "Ut tenfio fic vis," in the year 1658.

But whoever was the inventor of the fpiral form of the fpring attached to the balance, and making with it a regulator for portable machines, they both ftill remained fubject to alterations in their dimenfions by the fucceffive changes of heat and cold; for, by the former of thefe oppofite temperatures, the fpring became weaker, and the fize and confequent momentum of the balance greater, in confequence of their enlargement, fo as to produce a very fenfible lofs in the daily rate of going of a watch with fuch a regulator; alfo an acceleration beyond a mean rate was foon obferved to be the confequence of increafed cold, which, on the contrary, diminifhed the dimenfions of the metallic parts, and thereby, at the fame time gave additional ftrength to the fpring, and likewife reduced the fize and momentum of the balance. About the fame period Leibnitz attempted to confine the vibrations of the balance with a fpiral fpring, to be of equal extent, by means of an additional fpring to be applied to the balance wheel, and to be, like Huygens' remontoir, wound up by the maintaining power; but his endeavours, whatever ideas they may have fuggefted to Harrifon, Mudge, or Haley, for their auxiliary fprings, were not crowned with complete fuccefs. Hautefeuille alfo, in the year 1674, prefented to the Academy of Sciences, at Paris, a balance with a ftraight fpring, acting fomehow inftead of an efcapement, but how far it refembled the fpring detent of Arnold we know not, nor do we find that it was adopted in practice. This fociety, notwithftanding, thought the fubject of fuch importance, that, in the year 1720, they proposed the following question to be determined for a public reward: viz. "What is the most perfect method of preserving on the sea the equable motion of a pendulum, either by the construction of the machine, or by the suspension?" A memoir written by Massy, a Dutch clock-maker, obtained the prize, but he had not the satisfaction of seeing his plan executed. About a year afterwards (1724) Henry Sully, an English clock-maker, who had settled at Paris about eight years previously, presented the same academy with a marine time-keeper, made in 1721, and published a description of it in French, by the title of "Description abrégée d'une horloge de nouvelle invention pour la juste mesure du temps en mer." Besides the above, Sully made a second marine time-keeper, which was tried at sea in 1726, but the inventor died two years afterwards, a martyr to his horological studies, before he had brought his machines to that state of perfection which their object demanded. His pieces had vertical balances carrying cycloidal metallic pieces, round which a thread, or slender wire, was wound at the upper end, while the lower end was attached to a lever with an adjustable weight to effect the isochronism of the balance, instead of a spiral spring: the horizontal pivots of the balance also moved on the angular point included between two large rollers, which method of lessening friction, we believe, was the invention of this author. He also made a marine watch with a spiral pendulum spring, into which friction rollers, like Mudge's, were introduced, and had he lived longer, chronometry would no doubt have been greatly promoted by his labours.

It was about this period, that jewelling, another essential improvement in time-pieces, was introduced, according to Berthoud, by Mr. Fatio, a native of Geneva, who, not meeting with encouragement in France, came over into England, and brought his invention into notice.

The Academy of Sciences at Paris again proposed a reward for the year 1747: the subject was "The best method of finding the hour at sea, whether by day, by twilight, or at night, when the horizon cannot be distinguished." The reward was obtained by Daniel Bernouilly's memoir, intitled, "Recherches mechaniques, et astronomiques," in which was displayed much science, but the author's want of skill in mechanical operations prevented his labours being attended with complete success.

In the mean time, the changes in the length of the pendulum began to be compensated, first by means of quicksilver contained in a tubular rod, by Graham, and soon after by the opposite expansions of different metals, by Harrison, who, stimulated by the British parliamentary reward that had been previously offered to the public for marine time-keepers, applied the same principle to a watch to effect a self-regulating kirb (or curb), for limiting the effective length of the spiral pendulum-spring to correspond to the successive changes of heat and cold, which changes were now known to alter the force of this spring, and the momentum of the balance. From this origin we may date the beginning of all the different kinds of compensation-mechanism that have proved permanently useful in time-keeping; and if we add to Harrison's invention of the metallic compensation, his remontoir, and his addition of a secondary spring as an equivalent substitute for the maintaining power during the time of winding up, which is an essential requisite in producing permanent motion, he may be fairly considered as the parent of modern chronometry.

The British parliament had, indeed, before the French academy, offered, so early as the year 1714, in the reign of queen Anne, a reward of 10,000l. for any method of determining the longitude within the accuracy of one degree of a great circle; of 15,000l. within the limit of 40 geographical miles, and of 20,000l. within the limit of 30 such miles, or half of a degree, provided such method should extend more than 80 miles from the coast: and after this act, two others passed in the reign of George II. stat. 14 and 26, to promote the same purpose; but an act passed in the present reign, in the year 1774, repealing all the former ones, and offering separate rewards to any person who should invent a practical method of determining, within certain circumscribed limits, the longitude of a ship at sea: for a time-keeper, the reward held forth to the public is, 5000l. for determining the longitude to or within one degree; 7500l. for determining the same to 40 geographical miles, and 10,000l. for a determination at or within half of a degree. This act, notwithstanding its abridged limits and diminished rewards, has produced several candidates since Harrison, who received the whole reward of the first act, for parliamentary remuneration, of whom Mudge, the two Arnolds, and Earnshaw, have had their labours, as will be seen hereafter, crowned with partial success. Besides these, there have been various other chronometer-makers, whose pieces have performed with great accuracy, but whose names we omit to introduce here, lest we should seem partial to some at the expence of the reputation of others. Indeed, the art of constructing chronometers is lately become so general, that it is difficult to decide whose name ought to stand first on the list of excellent makers, and we hope that the spirit of competition for public fame will continue to entitle our English manufacturers to that preference among naval officers, which the excellence of their workmanship entitles them to expect. For, even in a commercial point of view, it was proved to the late Mr. Pitt, when he laid a tax on watches, by the committee of watch-makers convened in the parish of Clerkenwell, that a piece of the value of 500l. had been manufactured out of materials which did not, in their native original state, cost more than *sixpence!* This representation, we are credibly informed, induced the noble statesman to abandon his plan of taxing an article, the value of which depended so much upon ingenuity and labour, and by the manufacture of which thousands of subjects are entirely supported: nay, further, on learning that the French and Swiss could afford to sell three gold watches for the price of one English one, the same minister took off the duty of sixteen shillings per oz. from watch-cases of this metal, and substituted only one shilling, the price of the trial at Goldsmiths'-hall. We have just said that Harrison obtained the first and most ample reward for his inventions, but we are not to conclude from thence, that his pieces excelled all others; they were specimens of great ingenuity and proofs of unwearied industry, which certainly were not overpaid; but the inventor himself was candid enough to confess that the balance, balance-spring, and compensation-curb, were not contemporaneously affected by heat and cold, but that small pieces of metal were sooner affected than large ones, and also pieces in motion before pieces at rest; whence he was led to conclude, that if the provision for heat and cold could properly be in the balance itself, as was the case with his gridiron pendulum in clocks, the time-piece might be made much more perfect.

Harrison's suggestion of a compensation-balance, in place of a compensating curb for the balance-spring, found its way into France, and roused the attention of the watch-makers of that nation; and, to do them justice, we must allow that Peter, the eldest son of Julien le Roy, who was himself an eminent watch-maker, had the honour to be the first who accomplished the suggested desideratum, by means

of

of two thermometers, one of mercury, and the other of alcohol, attached to and carried by the balance itſelf, which contrivance effected the compenſation, by bringing a portion of the mercury nearer to, or by removing it farther from the centre of the balance, according to the different ſtates of the atmoſphere. (See the Deſcriptiou under COMPENSATION-*balance*.) A chronometer on this conſtruction was preſented by Peter le Roy to the king of France, on Aug. 5th, 1766, for which the prize of the Academy of Sciences was awarded him on the laſt day of the ſame month: he alſo publiſhed an account to accompany the piece, entitled, "Memoire ſur la meillure manière de meſurer le temps en mer, &c." in which memoir he aſſerts, a circumſtance very worthy of notice, that he made another compenſation-balance entirely of pieces of different metals; viz. of braſs and ſteel riveted together, like Harriſon's compenſation-curb, but bent into two ſeparate ſemi-circles in ſuch a way, that each, carrying a metallic weight near its extremity, brought it alternately nearer to, or removed it farther from the centre of the balance thus formed, agreeably to the variations of the atmoſpheric temperature; and though the inventor preferred at the time the thermometrical compenſation, yet the metallic one, ſpoken of in the memoir in queſtion, was, no doubt, the archetype of all our preſent compenſation-balances. It might now have been expected that a time-piece, with a movement aided by friction-rollers, or by jewels in the pivot-holes, and with a compenſation-balance regulated by a ſpiral-ſpring, would have performed alike under all circumſtances, but ſtill it was found that, however well the fuſee was ſhapen, and adjuſted to the different intenſities of the main-ſpring, yet ſuch an unequal tranſmiſſion of that power took place, even in the beſt movements, in conſequence of there being alternately favourable and unfavourable poſitions of the acting teeth of the wheels and pinions, and in conſequence of the impediments to free motion occaſioned by the variable denſity of the oil uſed, and by the acceſſion of particles of extraneous matter, that the action of the pallet-wheel upon the pallets then in uſe was found ſufficiently irregular to occaſion an inequality in the impulſes given to the balance, and a conſequent inequality in the magnitude of the arcs of vibration. This inequality in the magnitude of the arcs of vibration would not, indeed, have affected the rate of the going of the chronometer, if all lengths of the regulating-ſpring had been found on trial to be equally iſochronal, but the ſame Peter le Roy diſcovered what Dr. Hooke knew long before, (vide his Poſtſcript to "a Deſcription of Helioſcopes, &c.") that there is a *certain length* in each good uniform ſpring *which only* is iſochronal, or, in other words, which has the property of regulating the balance ſo, that all arcs of vibration, long or ſhort, ſhall be performed in the ſame time. This diſcovery, or rather re-diſcovery, of Peter le Roy, at a time when chronometry had made conſiderable advances towards perfection, was calculated to do away the ſanguine hopes that had been entertained of the good performance of time-pieces on Harriſon's conſtruction, in which the effective length of the regulating-ſpring was conſtantly altering with the variations of temperature; and to this circumſtance principally may be imputed, perhaps, the ſmall number of time-pieces that were manufactured after Harriſon's model, notwithſtanding the large premium which was awarded him. A remedy for the unequal tranſmiſſion of the maintaining power had been, however, adopted by Harriſon, when he introduced the remontoir to produce equable action at the contrate-wheel of his pieces, a contrivance worthy of his genius, whether the idea was original, or borrowed by him from Huygens; but this was a remedy for only one of the two cauſes of irregularity in the momentum of his balance; it might, and probably did, equalize the maintaining power nearly, but would not counteract the iſochronal defect produced in the regulating-ſpring by the compenſation-curb, in all the various arcs of vibration which every piece is liable to experience in their different ſtates of foulneſs.

The obſtacles to equal tranſmiſſion of force in a chronometer, led to the invention of various eſcapements, both on the continent and in England; ſome of which were intended to act iſochronally in concert with the regulating ſpring, and others were ſo conſtructed as to give the impulſe almoſt inſtantaneouſly, and at the moſt favourable inſtant of the vibration of the balance, ſo that the force derived from the maintaining power, to perpetuate the vibrations, might derange the natural iſochronal property of the balance, and its regulating ſpring as little as poſſible.

On conſidering this ſubject, it occurred to the moſt ſcientific artiſts, that the regulating power of the balance and balance-ſpring, which was found to be too much under the dominion of the maintaining power with the common eſcapements, would be the leaſt deranged if the impulſe derived from the maintaining power were momentary, particularly if it were applied at that point of the vibration where the momentum of the balance is a maximum; it alſo occurred, that the momentum of the balance itſelf ought to be as great as practicable, compared with the impulſe given to the pallet-wheel, and likewiſe that a momentum compoſed more of velocity than of weight would be moſt favourable for a balance with ſlender pivots. Theſe, and ſimilar conſiderations, the reſult of much thought and reaſoning, ſuggeſted a great variety of deſigns for new eſcapements, many of which have been brought into practice with an advantage correſponding to the importance of the object; the moſt recent of which promiſes to be of permanent utility in chronometry. Theſe eſcapements have obtained the appellation of *free* or *detached*, from the circumſtance of their being detached from the balance during the greateſt part of its vibration. It has been matter of contention among horological writers, who was really the firſt inventor of a detached eſcapement, but it ſeems now to be pretty generally admitted, that Peter le Roy, whom we have mentioned as the inventor of the firſt compenſation balance, was alſo the inventor of the firſt detached eſcapement. It would lead us far beyond the limits of our preſent article minutely to deſcribe here all the variations in the ſhape and mode of action of the different eſcapements, by Julien and Peter le Roy, Berthoud, and others, that have been made on the continent, as well as of thoſe made in Britain; on which account we ſhall reſume the ſubject under the article ESCAPEMENT, and there give a detailed account of the ſucceſſive eſcapements, as nearly in their order of time as can be aſcertained. In the mean time, the reader will obtain, we preſume, a ſufficient knowledge of the eſcapements at preſent in uſe, from the deſcriptions that are ſubjoined to this article, of ſome of the beſt chronometers of modern makers, where we have given drawings and an account of an entire piece by Brockbank, and of ſuch parts of the pieces of other modern makers as differ from it in conſtruction. We wiſh it, however, to be diſtinctly underſtood, that we diſclaim all partiality to individuals, and give a drawing of Brockbank's chronometer in an entire ſtate, for no other reaſon but becauſe we are unwilling to diminiſh the ſale of the pamphlet containing the drawings and deſcriptions of thoſe by Arnold and Earnſhaw, lately publiſhed by order of the commiſſioners of longitude; and alſo becauſe Meſſrs. J. Brockbank and Co. have been ſo obliging as to allow us to take ſuch original drawings as it is preſumed will ſhew the relative ſituations of the different parts in a favourable point

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of view, for giving a clear idea of their relative offices and modes of action.

A method having been deviſed of limiting the quantity of impulſe given to the balance, ſo as to be juſt ſufficient to keep it vibrating when put in motion, but not ſufficient to produce motion from a ſtate of quieſcence, as will be ſeen hereafter, and a ſelf-compenſating mechaniſm having been adapted to the balance itſelf, it may now be fairly inferred, that chronometers have arrived nearly at their *ne plus ultra* of perfection, and that they may ſhortly be expected to find the permanent level of their price, uninfluenced by the recommendation of a ſuppoſed ſuperiority ariſing out of the *name* of the *maker*, or rather, as we might ſay, of the *vender;* for it is a fact not to be controverted, that more chronometers have been ſold by one individual than have been or could be made in the ſame time under his own roof. Still, how[illegible]*uſtment* of a chronometer for rate, temperature, heat, and poſition, is an object of the utmoſt importance to the due performance of even the beſt machine of this kind that ever was made; and if improvements are yet neceſſary in this delicate but important branch of our manufactures, they are ſuch as ought, and may reaſonably be expected, to conduce to accuracy and expedition in completing thoſe four kinds of operations; operations which have been found to be very troubleſome in ſome of the conſtructions, inaſmuch as one of the adjuſtments, however delicately made, may not only be over or under-done, but may and frequently does derange another adjuſtment previouſly made. Indeed, in the preſent advanced ſtate of chronometry, one maker's excellence is often diſtinguiſhed from that of another by ſome ſlight deviation from his contemporaries' method of ſhaping certain parts, or of adjuſting the balance according to ſome ſecret method peculiar to himſelf, which he does not chooſe to diſcloſe, and for which, perhaps, he cannot give a good reaſon; hence, an important trifle, no way dependent on or connected with ſcientific principles, has been found, in certain inſtances, to lay the foundation for pretenſions to excluſive merit.

We will conclude our narrative of the improvements in chronometry, by pointing out briefly ſome of the diſtinguiſhing features of the different conſtructions of our contemporaries; and leave to the public the exerciſe of their own choice in the ſelection of a particular maker. Without entering more minutely into a detail of the French chronometers in this place, it may be ſufficient to ſtate here generally, that their detached eſcapements have detents, or pieces to ſuſpend the maintaining power for a certain time, moveable on an arbor with pivots, as will be ſeen under the article Escapement; whereas the Engliſh detents act by means of ſprings without pivots, which conſequently require no oil, and are alſo of a more ſimple conſtruction.

The late Mr. Arnold took out two patents for improvements in his chronometers, the one in April 1776, and the other in 1782. The former of theſe patents was for the invention and application of compenſation bars in the conſtruction of his balance, together with the invention and application of what he calls the helical, but which is properly the cylindrical balance-ſpring. The ſecond patent was for three different ways of applying the compenſation-bars, for an improvement in the balance-ſpring, particularly in the bending of the laſt coil at the end of it, for his invention and application of the ſpring-detent, and alſo for the cycloidal, or more properly epicycloidal ſhape of the tooth of the balance-wheel. It has been already ſaid, that Peter le Roy was the firſt who applied a metallic compenſation to the balance itſelf, but it does not neceſſarily follow from thence, that Arnold did not alſo invent the one he adopted. We are perſuaded that a man of Mr. Arnold's known integrity and veracity would not make oath, in taking out a patent, of an invention which he did not at leaſt conſider as his own; and we ſhall have occaſion to ſhew, under our article Compensation-*balance*, a variety of different ſhapes given by Arnold to his balances, and actually tried in practice *before* he adopted the one in preſent uſe; ſome of which balances are yet in exiſtence. At all events, Mr. Arnold muſt be allowed the merit of having introduced the compenſation-balance into general uſe, when Peter le Roy preferred the thermometrical tube. The late Mr. Brockbank was the firſt perſon who united the two metals by fuſion, which le Roy had united by pins, that muſt have interfered with the regularity of the flexure by different temperatures. Mr. Brockbank was alſo the firſt who uſed the method of turning an expanſion-rim out of a ſolid compound plate, made by covering the ſteel plate in a crucible of fuſed braſs, and of cutting it into portions afterwards, thereby enſuring the uniformity both of figure and weight, which two properties are equally eſſential in any balance, as the name imports; ſo that if it ſhould be contended that the conſtruction of the compenſation-balance was not invented in this country, at leaſt the practical application of the principle is our own; to which conſideration we may add, that Arnold ſenior invented and introduced the uſe of the ſpring detent, which requires no oil. Mr. Arnold was likewiſe the firſt watchmaker in England who laid much ſtreſs not only on the ſhape, but alſo on the particular length of the balance-ſpring in practice, which Dr. Hooke and Peter le Roy had both ſhewn was neceſſary to be attended to in order to render the ſpring iſochronal under all arcs of vibration, which is an eſſential object of adjuſtment, and which no doubt influenced his choice of the ſhape of the ſpring; and we are informed that he was ſo far ſucceſsful in his attempt to aſcertain the preciſe point for limiting the beſt practical length of ſome of his balance-ſprings, that, after the example of Peter le Roy, to whoſe contrivances, it muſt be confeſſed, he ſeems to have paid great deference, he ſucceeded in making a movement go accurately without a fuſee, by the mere regulation of an iſochronal ſpring, which is an indubitable proof that the irregularities of the maintaining power can have but little influence on the rate of a chronometer with an iſochronal balance-ſpring, eſpecially when it has, moreover, a detached eſcapement. Mr. Pennington affirms that there are many iſochronal points in every ſpring, which diſcovery accounts for the different lengths of the various balance-ſprings that are made of the ſame clue.

The late Mr. Mudge laboured to effect an equalization in the impulſe given to the balance by remontoirs of ſpiral ſprings, acting ſo conſtantly at each vibration, that the eſcapement of his time-keepers could not properly be called a detached one; though the one introduced into her majeſty's watch of his contrivance, and copied by the late Margetts, and by Emery, which gives an impulſe at every vibration, ſufficiently great to produce motion from a ſtate of reſt, may be claſſed among the detached kind.

Emery's balance had weights ſliding on its croſſes, and having their poſitions regulated under different degrees of heat by the variable flexure of compenſating bars compoſed of two different metals, in the ſhape of an S, as explained under our article Compensation *balance*, where it will appear that this was one of the varieties invented by Arnold, whoſe workman afterwards went to Emery. The Brockbanks have their chronometers diſtinguiſhed by the poſition of their locking and unlocking ſprings, and alſo by a peculiar method of banking by means of the protruſion of the coils of the balance-ſpring, as will be hereafter explained.

Earnſhaw's

Earnſhaw's chronometers differ from Arnold's in the ſhape and poſition of the detent and ſprings, in the ſhape of the balance wheel, and ſtructure of the balance ſpring and balance, all which will preſently be explained.

Recordon, ſucceſſor to *Emery*, at Charing Croſs, has a compenſation-balance perforated at the circumference with various tapped holes, into which the ſcrews of adjuſtment for temperature and poſition may be ſucceſſively removed, according to circumſtances: this mode of adjuſtment is practiſed by Pennington, and was, we underſtand, originally his contrivance.

Haley, a watch-maker at the corner of Wigmore-ſtreet, Cavendiſh-ſquare, took out a patent on the 17th of Auguſt, 1796, the particulars of which are given in the ſixth volume of the "Repertory of Arts." The principle on which the patent was granted, conſiſted chiefly of a ſecond cylindrical ſpring and ſpring-arbor with pallets, &c. interpoſed between the eſcapement-wheel and the balance to give an impulſe to the balance at each vibration, inſtead of the impulſe uſually given by the force tranſmitted through the train. See ESCAPEMENTS *for Watches*.

Grimalde, in the Strand, who now makes a conſiderable number of chronometers, ſome of which, we learn, have the teſtimony of naval officers in their favour, has informed us, that he places the cock ſo conveniently, and adjuſts for poſition ſo readily, by a particular contrivance, which does not require the cock to be taken off, that it would, we think, contribute to the ſtock of improvements already known, if he would make his method public.

Mr. *Hardy* has lately introduced a new mode of banking, by a lever attached to the exterior coil of an heliacal ſpring, which is thrown out to catch a pin in the balance; and has propoſed a new mode of making the ſpring iſochronal, by making the ſtud moveable on a ſecond ſpring; but experience muſt prove their utility.

We might add a long liſt of the other perſons who make chronometers, not in London only, but at Edinburgh and Liverpool, were we aware that there is any material difference in the conſtruction of their mechaniſm, or methods of adjuſtment, from thoſe, or ſome of thoſe, which we have noticed.

To aid the reſearches of thoſe readers who wiſh to trace more minutely the riſe and progreſs of the art of meaſuring time by mechanical inventions, we ſubjoin a liſt of the principal authors who have, from time to time, written on this intereſting ſubject, viz. Hieronomi Cardani de Varietate rerum; 1557, fol. Baſileæ. Conrandi Daſypodii Deſcriptio Horologii Aſtronomici Argentinenſis; 1578, 4to. Argentorati. Guidonis Pancirolli Antiqua deperdit a & Nova reperta; 1607, 8vo. Ambergæ. L'uſage du Cadran ou de l'Horloge phyſique univerſel par Galilée; 1639, 8vo. Paris. Benedicti Haefteri Monaſticæ Diſquiſitiones; 1644, fol. Antwerpiæ. Horloge magnetique, elliptique ou ovale nouveau, pour trouver les Heures du Jour & de la Nuit, par Pierre Georges; 1660, 8vo. Toul. P. Gaſparis Schotti Soc. Jeſu, Technica Curioſa, ſeu Mirabilia Artis; 1664; 4to. Herbipoli. Chriſtiani Hugenii Zulichemii Horologium oſcillatorium; 1673. Pariſiis. Lectiones Cutlerianæ, by R. Hooke; 1673. London. Gulielmi Oughtred Etonenſis Opuſcula Mathematica hactenus inedita; 1677, 8vo. Oxonii. Matth. Campani de Alimentis Horologium, ſolo naturæ motu atque ingenio, dimetiens et numerans momenta temporis conſtantiſſime æqualia; 1677, 4to. Romæ. Pendule perpetuelle, par l'Abbe de Hautefeuille; 1678, 4to. J. J. Becheri Theoria et Experientia de nova Temporis dimentiendi ratione & Horologiorum Conſtructione; 1680, 8vo. Londini. Gilberti Clark Oughtredus explicatus, de Conſtructione Horologiorum; 1682, 8vo. Londini. Horological Diſquiſitions by Smith; 1698. London. Memoirs by De la Hire, Leibnitz, Saurin, Maſſy, D. Bernoully, Romilly, J. and P. Le Roy, &c. &c., contained in the "Memoirs de l'Academie des Sciences à Paris," and in "Machines Approuves," in various volumes. Artificial Clock-maker, by Derham; 1714. London. Deſcription d'une Montre de nouvelle Conſtruction, par H. Sully; 1716. Regle artificielle du Temps, par H. Sully; 1717, (& 1737, a Paris, par Jul. Le Roy). Traité des Forces mouvantes, par Camus; 1722. Deſcription abregée d'une Horloge d'une nouvelle Conſtruction pour la juſte Meſure du Temps ſur Mer, par H. Sully; 1726. à Bordeaux. Traité general des Horloges, par Alexandre; 1734. Traité d'Horlogerie pratique, par Thiout & Euderlin; 1741, 2 vols. 4to. à Paris. Traité des Echappemens, par Jodin; 1754, 12mo. à Paris. Traité d'Horlogerie, par Le Poute; 1755, 4to. à Paris. L'Art de conduire & de regler les Pendules & les Montres, &c. par Ferd. Berthoud, 1759, 12mo. à Paris. Etrennes Chronometriques, par Pierre Le Roy, 1759. Eſſai ſur l'Horlogerie, par Ferd. Berthoud; 1763, 2 vols. 4to. & 2d ed. 1786, à Paris. Inſtitutiones Horologicæ, in vol. ii. of Mathem. Inſt. by Ben. Martin; 1764. The Elements of Clock and Watch-work adapted to Practice, by Alexander Cumming; 1766, 4to. London. The Principles of Mr. Harriſon's Time-keeper, with Plates of the ſame; 1767, 4to. London. Dr. Maſkelyne's Obſervations and Calculations on ditto; 1766 and 1767, London. Journal du Voyage de M. le Marquis De Courtenvaux; 1768, 4to. à Paris. Voyage par M. Caſſini; 1770, 4to. à Paris. Encyclopedie, Arts & Metiers. Voyage par M. d'Eveux-de-Fleurieu; 1773, 2 vol. 4to. à Paris. Traité des Horloges Marines, par Ferd. Berthoud; 1773, 4to. à Paris. Eclairciſſemens ſur l'Invention, la Theorie, &c. par Ferd. Berthoud; 1773, 4to. à Paris. An Introduction to the mechanical Part of Clock and Watch-work, by Thomas Hatton; 1773, 8vo. London. Precis des Recherches faites en France, &c. par M. Le Roy (fils de Julien); 1773, 4to. à Paris. Deſcription concerning ſuch Mechaniſm as will afford a nice and true Menſuration of Time, by James Harriſon; 1775. Les Longitudes par la Meſure du Temps, par Ferd. Berthoud; 1775, 4to. à Paris. Voyage par Verdun, Borda, & Pingré; 1778, 2 vols. 4to. à Paris. De la Meſure du Temps, par Ferd. Berthoud; 1787, 4to. à Paris. Horlogerie Pratique, par M. Vigniaux; 1788, 8vo. a Paris. Traité des Montres & Longitudes, par Ferd. Berthoud; 1792, 4to. à Paris. Dr. Maſkelyne's Anſwer to Mudge's Narrative; 8vo. 1792. Atwood's Inveſtigations for determining the Times of Vibration of Watch-balances, in the Philoſophical Tranſactions of London; 1794. Mr. Mudge's Reply to Dr. Maſkelyne's Anſwer; 8vo. 1792. Suite du Traité des Montres & Longitudes, par Ferd. Berthoud; 1797, 4to. à Paris. Voyage de La Perouſe; 4 vols. 4to. à Paris, 1797. A Deſcription, with Plates, of Mudge's Time-keeper; 1799, 4to. London. Ausfvhricke Geſchichte, &c. by John Henry Maurice Poppe; 1801, 8vo. Leipſic. The article WATCH-WORK in the 2d volume of the Supplement to the Encyclop. Britannica. Hiſtoire de la Meſure du Temps, par les Horloges, par Fred. Berthoud; 1802, 2 vols. 4to. à Paris. A Journal of Natural Philoſophy, Chemiſtry, and the Arts, by W. Nicholſon; 4to. ſeries, and 8vo. ſeries; ſee various volumes. Eſſai ſur les Montres à Repetition, par François Crêſpe; à Genéve, 1804, 8vo. p. 284. Explanations of Time-keepers conſtructed by Mr. Thomas Earnſhaw, and Mr. John Arnold, publiſhed by order of the

Commiſſioners

Commiſſioners of Longitude; 1806, 4to. with plates. London. Mr. Dalrymple's pamphlet; 1806. Appeal by Sir Joſeph Banks; 1806. Dr. Maſkelyne's Anſwer; 1806.

Chronometer, or *Time-keeper*, by Harriſon. It was our intention to have given a perſpective drawing of one of Mr. James Harriſon's chronometers, or time-keepers, with a correſponding deſcription, but on an application by our draftſman to the aſtronomer royal to inſpect the interior parts of one of the machines, by the maker in queſtion, placed at the Obſervatory, he was informed that permiſſion to undo any of the covers or other parts of the mechaniſm could not be granted; we muſt therefore ſatisfy ourſelves with a verbal deſcription of the conſtruction, which, indeed, it is preſumed, will be deemed ſufficient, now that preferable conſtructions have been more recently adopted. We might, it is true, have copied the plans given in the ten plates of the pamphlet entitled the "Principles of Mr. Harriſon's Time-keeper," but ſome of them are ſo imperfectly explained, as to be unintelligible to any reader, except perhaps to ſuch as may have had occaſion to examine the original mechaniſm, and therefore would not be ſatisfactory to the public. The following particulars, relating to the dimenſions and other properties of the mechaniſm, apply more particularly to the *fourth* piece made by the inventor, and are extracted chiefly from the pamphlet juſt mentioned. The firſt obſervable diſtinction between Harriſon's train of wheel-work and that of an ordinary watch, is, that the numbers of his wheels and pinions are higher than had been uſual, as will appear from the ſubjoined arrangement, viz.

First or great wheel 96
Center pinion acting
with it - - - 21—120 ſecond wheel, which is concave
Its pinion 18—144 third wheel,
Its pinion 16—120 contrate wheel,
Bal. wheel pinion 12—15 bal. wheel,
2 pallets

If theſe numbers be examined according to our mode of *notation* under the article Clock-*Making*, the value of the train will be $\frac{120 \times 144 \times 120 \times 15 \times 2}{18 \times 16 \times 12} = 1800$ vibrations in an hour, or juſt five vibrations in each ſecond. The firſt or great wheel will revolve in $\frac{96}{21}$ of an hour, or make one revolution, along with the fuſee, in $4\frac{4}{7}$ hours, ſo that $5\frac{1}{4}$ turns or ſpirals on the fuſee will maintain a motion of 24 hours, $6\frac{1}{4}$ will actuate the works $28\frac{4}{7}$, and $6\frac{9}{16}$ juſt 30 hours.

The balance-wheel does not differ eſſentially from that in a common watch, but peculiar care is neceſſary in ſhaping the pallets, as will be ſeen more particularly under the article Escapement.

The bad effect produced in ordinary watches by an irregular tranſmiſſion of the maintaining power through the train, is here guarded againſt by the introduction of a ſlender ſpring, or remontoir, which is wound up eight times every minute by the maintaining power, or main-ſpring, and which actuates the contrate and balance-wheels, and conſequently impels the pallets with a conſtant impulſe, independently of the maintaining power, the latter being employed for no other purpoſe but for winding up the former as before ſpecified. This ſlender ſpring, which is ten inches long, though it weighs only $3\frac{1}{2}$ grains, is coiled in a ſpring barrel, apparently concentric with the contrate-wheel, and has its outer end attached to a hook in the barrel, with its inner end attached to another hook on the contrate-wheel. In order to make this delicate ſpring anſwer its purpoſe perpetually, two wheels, and as many pinions, in addition to the foregoing train, called the fourth and fifth wheel, and fourth and fifth pinion, are introduced in connection with a *fly*; as is likewiſe a detent with five arms, reſembling a ſtar, turning on the pivots of a common arbor. The action of theſe parts is not eaſily underſtood, even from a reference to the original drawings, much leſs from a verbal deſcription; but the intelligent reader will form a general idea from being told, that there are eight pins placed equidiſtantly on the plane of the contrate-wheel in a ſmall circle round the arbor; that one of the five arms of the detent acts with theſe ſucceſſively as the wheel itſelf revolves; that a ſecond arm carries a ſmall roller acting againſt a piece of braſs on the fifth wheel; that a third is bent at the end ſo as to catch a pin in the rim of the fifth wheel; and that the fourth and fifth arms are mere counterpoiſes to the other three, to preſerve an equilibrium. The numbers of theſe wheels and pinions appear to be as follow: of the fourth wheel 112, which ſtands concentrically over the contrate-wheel and ſpring-barrel, of its pinion 14, of the fifth wheel 104, and of its pinion 12; and it is to the arbor of this laſt pinion, we preſume, that the fly is attached, though it does not appear evident either from the drawings or deſcription, at leaſt to our apprehenſion. The mode of applying the three effective arms of the detent bears ſome reſemblance to the action of the detents in the ſtriking part of a clock, in which the count-wheel is uſed inſtead of a ſnail, and where the locking and unlocking are alternately effected at meaſured intervals of time. The detached eſcapements, however, have now rendered this complex mechaniſm ſuperfluous, and, indeed, it is manifeſt that the propoſed object, of having a completely detached power to act alike at all times on the pallets, is not thus perfectly effected; for the locking and unlocking eight times in every minute, to be produced by the ſlender ſpring in queſtion, muſt be ſuppoſed to interfere in a certain degree with its regularity of action on the pallets; and if it ſhould be contended, that the eight deductions from the force of the ſpring are regular and periodical in every minute, and that therefore they produce an equable effect, yet the ſame argument may be uſed in favour of a well made train, in which the irregularities in the tranſmiſſion of force from the main-ſpring may likewiſe be periodical, the wheels and pinions not being compoſed of *prime* numbers.

But it was not enough for Harriſon, that nearly an equable force was applied to maintain the motion of the balance, while the balance itſelf and alſo the balance ſpring were ſubject to alterations in their dimenſions by changes of temperature; he well knew that the ſpiral ſpring uſed in watches, had more power when contracted, and leſs when elongated, than a mean power, and alſo that an enlarged balance has a greater momentum than a diminiſhed one, and *vice verſâ*; the mode alſo of effecting an adjuſtment to counteract the conſequent loſs or gain in the rate of going, was well known not only to him, but to all watch-makers, and mechanically applied with ſucceſs, as at the preſent day, by a moveable ſtud to limit the effective length of the ſpring; but this adjuſtment was not a *ſelf-acting* one, an index was required to be moved by a manual operation, which index was connected with the moveable ſtud, and pointed out the quantity of the adjuſtment; it remained for Harriſon to deviſe a mode of action, entirely dependent on the ſtate of the atmoſphere at any moment, which of itſelf, would produce the requiſite adjuſtment; this he did, as we have already ſaid, by riveting together a ſlip of braſs and a ſlip of ſteel, which two metals are of unequal expanſibilities, to the remote end of which compound bar he attached his clip to hold the exterior thread of his ſpring, after the outer

outer end of it had passed through and been pinned to a stud of brass attached to the upper plate of the frame; the consequence proved, what none but a real genius would have foreseen, that the brass elongating and contracting alternately in opposite temperatures more than the steel, produced a curvature in the compound piece, the concave side of which was always occupied by the metal least elongated, that is, by the steel in hot, and by the brass in cold weather; hence the compound piece, which carried the stud backwards and forwards, was called a *kirb*, a Lincolnshire word for *curb*, which contrivance is destined to curb or command the effective length of the regulating spring. The only material objection that experience has pointed out against this self-compensating mechanism, is, as we have before observed, that small pieces of metal and pieces in motion do not alter their temperature at the same time with large pieces and pieces in motion; nor yet steel so soon as brass, even in similar circumstances; which consideration constitutes an objection to the use of the thermometrical curb; an objection first raised by Harrison himself, when it was greatly his interest to have suppressed such a suggestion, as he was a candidate for the parliamentary reward. Vide COMPENSATION-*balance*.

Harrison had besides remarked that in an ordinary watch the power which the main spring has over the balance, through the medium of the train, compared with the power that the regulating spring has over the same, is as *one* to *three* generally; this power from the main spring, he observed, being sufficient to put the watch in motion from a state of quiescence, must be too imperious for the balance, small and light as it was, to control it; accordingly he proposed, reasoning thus *a priori*, to give an additional momentum to his balance, compared with his maintaining power: but momentum was to be attained in three different ways, namely, by additional weight given to a balance of the usual diameter, by enlarging the diameter without increasing the weight, or lastly, by increasing both in a certain degree: the first mode was objectionable on account of the friction likely to be produced on the balance-pivots by a heavy balance; the second was also objectionable on account of the resistance of the air it was likely to experience; and therefore he fixed upon the last mode of gaining momentum, by partly enlarging the diameter, and partly increasing the weight of the balance in use; by which means he constructed a balance over which the force from the maintaining power of the remontoir has not more than *one-eightieth* part of the dominion that the balance-spring has. Hence in the time-keeper there is not force enough in the maintaining power to excite motion from a quiescent state, though there is power enough to overcome all the obstacles to continued motion, and to keep the piece going, when put in motion.

The balance of the time-keeper before us is described to be of more than three times the weight of that of a large ordinary watch, and of three times its diameter; for, according to the notes taken by Dr. Maskelyne, at the time of its examination, its diameter was $2\frac{1}{4}$ inches, and that of the plate $3\frac{8}{10}$; hence a point in its circumference will pass through 24 inches, or about four times the space of an ordinary watch, in each second, as Harrison calculates from the arc of its vibration; an advantage which has not been lost sight of by some of the modern makers of chronometers; and it may be considered as an axiom in chronometry, that the perfection of a balance, considered simply as a regulator, independently of its compensation-mechanism, consists in its having the greatest possible quantum of momentum with the least force from the train, and smallest quantity of friction and resistance from the air.

Notwithstanding, however, the above-mentioned contrivances in the construction of the balance, others were still wanting. Harrison inferred that large arcs were described in less time than small ones, from the circumstance of the piece going slower in a vertical position than in a horizontal one, where the vibrations were observed to be visibly longer, before any correction was applied; he therefore wanted, moreover, a compensation for the errors of position. The time-piece, he observed, did not go alike when in a vertical position, the hours III, VI, IX, and XIII, were successively uppermost, which defect he remedied by making the relative weights or dimensions different, at different sides of the balance, thereby equalizing the arcs of vibration in each vertical position. Again, to render the time of an horizontal vibration equal to that of a vertical one, he introduced a contrivance which he calls a cycloid-pin, which, when in contact with the regulating spring, quickens its vibrations; but as the longest vibrations seemed to require such secondary assistance the least, in those the spring left the pin for a longer time than in the smaller arcs of vibration, and therefore they were less affected by it. This cycloid-pin is very imperfectly described in the account of the plates, and, it appears, was added to the piece sent on trial to Jamaica, after its return; and it appears by no means certain, that any good end was obtained by its adoption. The idea of using adjustments for position, however, has proved of permanent utility. It may be necessary to add here, what will appear extraordinary, that there was no adjustment for mean time in Harrison's time-keeper, the compensation curb having usurped its place; but he professed to be able in general to ascertain its comparative rate of going by his regulator, or gridiron pendulum clock, near enough in three hours; and to apply the daily error in seconds to the time indicated, plus or minus, as the case might be; of course a longer trial was necessary for a very nice rate, before a voyage was commenced. Still it was necessary in a machine professing to measure the constant lapse of time perfectly, that it should not cease to go while the main-spring was in the act of being wound up; here was another field for our artisan's ingenuity; but with a great genius, as with a great warrior, or statesman, difficulties thrown in the way only tend to call forth the resources of an active and inventive mind; the auxiliary spring was the result of our inventor's sagacity, and the fusee itself, which before had been shapen to equalize the varying force of the main spring in its different states of tension, was now made to contain moreover within it a second spring, so bent in a contrary direction, that the force exerted by the first or main-spring wound it up to a resisting force exactly equal to the power necessary to be exerted on the train, before this power began to be transmitted further along the train. The contrivance will not be easily understood by a verbal description, except by men conversant in watch-work; it is thus; a concave ratchet with 55 teeth, is fixed to the inside of the large end of the fusee, the concavity of which is sufficiently large in diameter to admit the secondary spring-barrel within it, into the cavity of the fusee; a second ratchet of 75 teeth, at the outer edge, inclined in an opposite direction to those of the ratchet 55, and having the secondary spring-barrel attached to it, is placed contiguous to the great wheel of 96, plane to plane, and revolves on a tubular piece projecting from the plane of the great wheel; it does not appear how the click of the concave ratchet is placed to act with its teeth at the inner edge, but this click is no doubt placed on the plane of the large ratchet of 75, or on the barrel; the inner end of the secondary spring is hooked to the tubular piece on which the barrel and large ratchet attached to it revolve, and the outer end,

end, as uſual we preſume, to the ſide of the barrel within. There are two clicks to the large ratchet, one on each of its circumferences, which clicks are faſt to the plane of the frame-plate, together with their reſpective ſprings. The parts being thus connected, and the barrel inſerted into the cavity of the fuſee, the effect produced is this: ſuppoſe the key applied to the ſquare of the fuſee arbor to wind the piece up, the inclined teeth of the ratchet ſlide along the end of the click in this retrograde motion of the fuſee, during the act of winding, and no impediment occurs to free motion of the fuſee until the *garde* (or guard,) gives notice of the concluſion of winding; but let the key be withdrawn, and it will be obſerved, that the main-ſpring by its effort to relax, will urge the fuſee, in a direction contrary to the motion of winding, till ſome obſtacle oppoſe its motion; that obſtacle is the click of the concave ratchet, which if fixed in a ſtationary ſituation, would inſtantly arreſt the ſaid returning motion of the fuſee; but we have ſaid the click is fixed to the large ratchet or attached barrel, which contains, we will ſuppoſe, a relaxed ſpring; the returning motion of the fuſee, therefore, goes on, after the ratchet of 55 has caught its click, until the ſecondary relaxed ſpring in the little barrel is wound up as far as the ſtrength of the main-ſpring will wind it; the inner end of the ſecondary ſpring at that inſtant begins to act on the tubular projection of the great wheel, which may be called the barrel arbor, and urges it on as though the click had been fixed to the great wheel, and as though there had been no large ratchet, which Harriſon calls the perpetual ratchet, nor any ſecondary ſpring interpoſed between the firſt ratchet and the great wheel; and thus it is that the power is continually tranſmitted through the medium of an *intenſe* ſpring, after it has been firſt wound up from a ſtate of relaxation. Conceive again the key applied for the ſecond winding as before; the returning motion of the fuſee will now be but little, becauſe the ſecondary ſpring has been already wound up; but the effect of the contrivance here becomes evident; the ſecondary ſpring being previouſly wound up, the two clicks of the large ratchet of 75, to which the ſecondary ſpring-barrel is attached, keep it from relaxing, while the preſſure of the main-ſpring is taken off by the act of winding; the force of this ſecondary ſpring, however, will exert itſelf ſomewhere to return to its natural ſtate, and becauſe the motion of the ſpring is ſtopped at the outer end, by the juſt mentioned clicks preventing the returning motion of the large or perpetual ratchet, the inner end of it will exert its whole force on the pin of the tubular part of the great wheel, conſidered as the barrel's arbor, and will thus impel the great wheel for a limited time with the ſame force with which it was acted upon itſelf, when wound up to the extreme, that is, with the whole force of the maintaining power to which it becomes a temporary equivalent. Thus we ſee four ſprings were uſed by Harriſon, which we are told were all made by Maberley, except the balance-ſpring that required rubbing away till it was found of a proper ſtrength to regulate for mean time nearly; the temper was given to this ſpring and the ſteel pinions by a melted mixture of one pewter and fixteen lead; and to the balance-ſpindle by a mixture of one pewter and twelve lead, the latter of which mixtures, in a ſtate of fuſion, the author ſays, is equal to 567° of Fahrenheit.

The effect of the thermometrical-curb was increaſed by rubbing the ſides thinner, and decreaſed by thickening the edge with a burniſher.

The fuſee has $6\frac{1}{2}$ turns; the pivot-holes are all buſhed with rubies containing pieces of diamond at the bottom of each; and the pallets are of diamond. The fly at the fifth pinion is uſed to regulate the velocity with which the ſpring at the contrate-wheel is wound up every eighth part of a minute by the main-ſpring when unlocked. The dial-work is $\frac{112}{28} \times \frac{96}{32} = 12$, and the ſeconds are concentric by means of a wheel of 104 attached to the contrate-wheel driving another of the ſame number round an outer cannon in the centre.

The firſt time keeper which Harriſon made was in 1726, which Dr. Hutton aſſerts, did not err a ſecond in a month for ten years together; but the firſt time that one was publicly tried, was in a voyage to Liſbon, in the year 1736, which, being placed in a box, hung in gimbols, anſwered his expectation, and corrected the dead reckoning about a degree and a half; in conſequence of which, according to Dr. Mackay, the board of longitude granted him a gratuity, and deſired him to proſecute his labours.

In 1739, he finiſhed a ſecond piece more perfect than the firſt, and in 1749, according to Dr. Mackay, (but according to Dr. Hutton, in 1758,) a third, which was pronounced more ſimple in its conſtruction than either of the former; but his labours did not ſtop here; in 1761, his fourth piece, of which we have given a deſcription as nearly as we could without perſpective drawings, was produced for trial, and Mr. William Harriſon, the ſon, offered to take charge of it, in a voyage to and from Jamaica, which was accordingly performed in this and the following years. Mr. Robertſon, maſter of the Academy at Portſmouth, was fixed upon to take the rate of this piece, which he did, and reported that, on the 6th of November, 1761, at noon, it was 3^s ſlow after having loſt 24^s in nine days on mean ſolar time. The Deptford, in which ſhip the voyage was made, left Portſmouth on the 18th of the ſame month, and arrived at Madeira on the 9th of December following, when it was found that the reckoning was corrected by the time of the piece about a degree and a half. In the run from Madeira to Jamaica the reckoning was corrected 3°: and at the ſeveral iſlands, where the ſhip touched, the known longitudes agreed very nearly with thoſe given by the time-keeper. On Jan. 19th, 1762, the ſhip arrived at Jamaica; the time of mean noon was obſerved, by equal altitudes, at Port Royal, on the 26th of the ſame month, which, according to the piece, was $4^h\ 59^m\ 7^s.5$; but the original error on the 6th of November, 81 days, 5 hours before, was 3^s ſlow, this quantity, therefore, was to be applied as a correction, together with the accumulation of the daily error of $\frac{24^s}{9}$ in $81^d\ 5^h$, viz. $3^m\ 36^s.5$; this ſum of $3^m\ 39^s.3$ added to the time indicated, which, it has been ſaid, was $4^h\ 59^m\ 7^s.5$, make $5^h\ 2^m\ 47^s$ for the difference of longitude between Portſmouth and Port Royal; which determination was only 4^s of time leſs than the determination at Kingſton of the ſame, from the tranſit of Mercury over the ſun's diſc. This ſmall error in time correſponds to leſs than one nautical mile in the parallel of Jamaica.

The Merlin, on board of which the piece was now put, ſet ſail from Jamaica on the 28th of January, 1762, and experienced ſuch a violent ſtorm in the paſſage, as obliged young Harriſon to remove his piece into an expoſed ſituation; however, the ſhip arrived at Portſmouth on the 26th of March, and on the 2d of April the time of mean noon was found, from equal altitudes, to be $11^h\ 51^m\ 31^s.5$, to which its former error of 3^s, together with the accumulation of the daily error, viz. $\frac{24^s \times 147^d}{9} = 6^m\ 32^s$ being added, make the time of mean noon by the time-keeper $11^h\ 58^m\ 6^s.5$. From

From this report it appears, that from Nov. 6th, 1761, to April 2d, 1762, though the piece had experienced many violent agitations at sea, and had been exposed to great changes of temperature, the whole error amounted to only $1^m\ 53^s.5$, or $28\frac{1}{3}'$ of longitude on the equator, which quantity, (one second less than Dr. Hutton has stated), is not quite 18 nautical miles in the parallel of Portsmouth.

Though various objections were made to this trial, principally arising from the observations by which the longitude of Portsmouth and Jamaica had been ascertained, yet Harrison, we are informed, obtained a reward upon it from parliament of 5000l., and was ordered to make a second trial to Barbadoes. But previously to the second trial to the West Indies, the Board of Longitude, on the 17th of August, 1762, wished to place Harrison's piece in the hands of the astronomer royal, at that time Mr. Bliss, for trial at the Observatory, which wish was not complied with, by reason of some alteration to be made, probably by adding the cycloid-pin to aid the regulating spring; the same wish was repeated by the Board at their sitting on the 4th of August of the year 1763, which was again not complied with by the jun. Harrison, by reason of his not being yet sufficiently rewarded; however, on being desired to send the rate of going of his time-keeper, sealed up, to the secretary of the Admiralty, previously to his sailing, he consented to this request, and proposed to abide by the sealed rate on the trial to Barbadoes, which had been proposed. The annexed is a verbal copy of Mr. W. Harrison's declaration of the rate of going, or, more properly speaking, of the daily error of the time-keeper, to the Board of Longitude, dated Portsmouth, March 26th, 1764.

"My Lords and Gentlemen,

In obedience to your instructions, dated the 9th of Aug. 1763, I humbly certify that I do expect the rate of the going of the time-keeper will be as followeth; viz.

When the thermometer (Fahrenheit's, no doubt,) is at 42° it will gain 3 seconds in every 24 hours.

When the thermometer is at 52°, it will gain 2 seconds in every 24 hours.

When the thermometer is at 62°, it will gain 1 second in every 24 hours.

When the thermometer is at 72°, it will neither gain nor lose.

When the thermometer is at 82°, it will lose 1 second in every 24 hours.

Since my last voyage we have made some improvement in the time-keeper; in consequence of which, the provision to counterbalance the effects of heat and cold, has been made anew; and for the want of a little more time, we could not get it quite adjusted; for which reason the above allowances are necessary. This is its present state; and as the inequalities are so small, I will abide by the rate of its gaining, on a mean, one second a day for the voyage. I would not be understood, that it will always require so long time to bring those machines to perfection; for it is well known to be much harder to beat out a new road, than it is to follow that road when made. During the time of this experiment, the mean height of the thermometer shall be each day carefully noted down, and certified, which I will lay before the Board at my return. I am, &c.

WILLIAM HARRISON."

After having compared the time-piece with Mr. Short's regulator, in Surry-street, London, which had its error newly ascertained by an excellent transit instrument, Mr. Harrison junior went on board the Tartar on the 13th of February 1764, and proceeded to Portsmouth, where he again compared it with an astronomical clock in Mr. James Bradley's temporary observatory. It may not be foreign to our purpose to mention here, that the observatory just spoken of, was fitted up for the express purpose of observing the eclipses of Jupiter's satellites, as well as of keeping the clock in just time, in order that, to avoid future objections, the observations to be made by Messrs. Maskelyne and Green, at Barbadoes, on the same satellites, particularly the first, when compared with Bradley's, might ascertain the comparative longitudes of these two places, which was accordingly determined to be $3^h\ 54^m\ 20^s$.

Before leaving Portsmouth, which took place on the 28th of March 1764, Mr. Harrison took the rate of his time-keeper by equal altitudes, employed between the 29th of February and the 26th of March; and on April the 18th found, from comparing his observations of the sun at 4 P. M. at the ship, with the corrected time given by it, that the ship was at that instant only 43 miles eastward of Porto Santo, in consequence of which determination, sir John Lindsay, the master, steered accordingly, and saw the island in question before him at one o'clock the next morning, agreeably to expectation. On the 13th of May, the vessel arrived at Barbadoes, and on the four following days its error was ascertained by Messrs. Maskelyne and Green by equal altitudes of the sun, and also by a comparison with the astronomical clock at the observatory near Bridgetown; and it was found that the amount of the daily deviations from mean time was only 43^s in excess, or $10\frac{3}{4}'$ of a degree in longitude. Mr. Harrison set out on his return from Barbadoes in the New Elizabeth on the 4th of June; and, arriving at Surry stairs on the Thames, on July the 18th, found, from a comparison with Mr. Short's clock, the error of which had been ascertained on the very day, that the whole gain in the 156 days was only 54^s, allowing the sealed rate, of one second gain per day, as a correction: and it has been observed, that, if the allowances had been moreover made for the state of the thermometer, as stated in the declaration, the piece in that case would have been found to have been about 15^s only at variance with mean time, and this in the opposite extreme. Soon after this very satisfactory trial, a committee of seven scientific gentlemen and mechanicians were appointed by the Board of Longitune for examining the principles of Mr. Harrison's time-keeper, whose report was as follows: viz. "That Mr. Harrison has taken his time-keeper to pieces, in presence of us, and explained the principles and construction thereof, and every thing relative thereto, to our entire satisfaction; and that he also did, to our satisfaction, answer every question proposed by us, or any of us, relative thereto; and that we have compared the drawings of the same with the parts, and do find that they perfectly correspond." The committee were the Rev. N. Maskelyne, Rev. John Mitchell, Rev. William Ludlam, Mr. John Bird, Mr. Thomas Mudge, Mr. Larcum Kendal, and Mr. William Matthews. Mr. Harrison had then another 5000l. ordered him, with a promise that the residue of the whole parlimentary reward; which, by the act of queen Anne, was 20,000l., should be given him when a proper person could be found to execute his plan with equal success. Mr. Larcum Kendal, one of the committee already alluded to, undertook the task, and finished a time-piece on the same construction, or at least on the same principles, which was approved by Mr. Wales, in his voyage in company with captain Cook in the years 1772, 1773, &c. and which Dr. Hutton says performed even better than Harrison's, allowing for an accelerstion in its rate. In consequence of this success, the parliament, to which an appeal was made, ordered the residue of the proposed reward

 to

to be paid; in addition to which, the gratuities of the Board of Longitude, of the Eaſt India company, and of others, contributed to augment the whole ſum to about 24,000l.

It ſhould ſeem from Dr. Hutton's account, under the article *Longitude* of his Mathematical Dictionary, contrary to Dr. Mackay's authority in his book on the longitude, that the parliamentary rewards were made to the Harriſons by two equal payments of 10,000 l. each; to reconcile which accounts, we applied to Dr. Maſkelyne for authentic information, but, with his uſual reſerve, the Doctor declined giving us any information on the ſubject. The diſcrepancy in the dates of our two authorities, which agree in the whole amount, is not, however, of much importance. The compliment of the 20,000 l. was granted by parliament in the year 1774, and at the ſame time the new act paſſed for regulating the future rewards. For the credit of our ingenious countryman, we ſhould have been happy to cloſe our narrative of Mr. Harriſon's fourth time-piece here, but, as we profeſs to give an impartial detail of all the facts that have come to our knowledge, relative to the different trials made of it, we are under the neceſſity of adding a further notice, which is calculated to detract conſiderably from its merit, that might ſeem to have been already indubitably eſtabliſhed. Though the piece had agreed with the longitudes of Portſmouth, Jamaica, and Barbadoes, to a great nicety, and had alſo accorded very well with the known longitudes of ſome intermediate iſlands, yet it was by no means certain that the reſults would have been ſo exact if taken on intermediate days; or, in other words, a coincidence of the rate with mean time at the end of the voyage, was no proof that there muſt have been the ſame coincidence in every part of it: to put the piece, therefore, to a more rigorous teſt, the Board of Longitude, held April 26, 1766, came to a reſolution to have it examined at the Royal Obſervatory from nearly the beginning of May of that year, to the end of February of the year following; accordingly, Dr. Maſkelyne received the piece from the hands of Philip Stephens, Eſq. now Sir Philip Stephens, who was at that time ſecretary to the Admiralty, on the 5th of May, and, in the preſence of Captain Thomas Baillie, of the Royal Hoſpital, Greenwich; of Mr. John Ibbetſon, ſecretary to the Board of Longitude; and of Mr. Larcum Kendal already mentioned, it was depoſited in a deal box made purpoſely to contain it, with a glaſs cover made ſecure with putty. The box had two locks of different wards, and two keys to each lock; alſo a pane of glaſs in the ſide ſecured with putty; and whenever the piece was afterwards wound up, one of the keys was uſed by Dr. Maſkelyne, or one of his aſſiſtants, Joſeph Dymond and William Bayly, and the other by Captain Baillie, or one of the officers at Greenwich Hoſpital; and the conſtant formality of a written teſtimony was uſed, we are told, not only when the piece was wound up, but alſo when a compariſon of the rates of it and the obſervatory regulator was taken and regiſtered. Dr. Maſkelyne afterwards publiſhed the reſults, under the title of "The original Obſervations of the going of the Watch from Day to Day," in a quarto pamphlet, from which we have extracted, or rather deduced, the ſubjoined notices. The trial commenced on the 6th of May, 1766, and ended on the 1ſt of March, 1767, including a ſpace of 298 days, in which period the piece gained on mean ſolar time $1^h\ 10^m\ 27^s.5$; this accumulated error, divided by 298, gives $14^s.2$ very nearly, for the rate, or mean daily gain. On examining the different columns of the pamphlet, and the calculations grounded thereon, to aſcertain the daily errors, both of the regulator and time-piece, as compared with the ſolar tranſits properly equated, we find a daily gain of the piece on mean time, on June 8th, amounting to $30^s.2$, or more than half a minute; which greateſt deviation was when it was in a vertical poſition with XII. higheſt, and the thermometer at 60°; the barometer being at the ſame time at 29.9; but on ſome other days the piece was, on the contrary, loſing, particularly in January 1767, when the thermometer was down at the freezing point; on one day in particular, the 4th, the daily loſs was as much as $6^s.5$, when the poſition was horizontal with the face upwards. Dr. Hutton, ſpeaking of this trial, has ſaid in his Dictionary, that "the watch was now found to go faſter than during the voyage to and from Barbadoes, by 18 or 19 ſeconds in 24 hours;" this obſervation, however, is only accurate for the months of May, July, and about the end of October and beginning of November, and that when the poſition was horizontal and face upwards; but, even in this poſition, the temperature, in other months, produced conſiderable irregularity in the daily rate. Whenever the poſition was vertical, or inclined 20° from a horizontal line, the rate depended greatly on the hour of the dial plate that was uppermoſt, independently of temperature: from all which deductions, it is evident, that the time-piece wanted three adjuſtments to be made at the time of its trial at the obſervatory; viz. firſt an adjuſtment for an error of $14^s.2$ in the mean rate, ſuppoſing the gains to have been equable at equal intervals of time; ſecondly, an adjuſtment for poſition; and, thirdly, an adjuſtment for temperature; and, indeed, we find, according to Dr. Hutton, that Harriſon "had altered the rate of its going, by trying ſome experiments, which he had not time to finiſh before he was *ordered* to *deliver up* the watch *to the Board.*" Thus this trial, with all its precautions and formalities, was more calculated, perhaps, to prejudice the public opinion reſpecting the future dependence to be placed in a time-keeper, than to appreciate the intrinſic value of a well-regulated and well adjuſted machine; and we cannot forbear adding, as our concluding remark, that Kendal's time-piece, tried and approved by Mr. Wales, was made after Harriſon's model during or after this trial; and that the inventor's ſubſequent appeal to parliament was attended ultimately with the deſired ſucceſs.

CHRONOMETER, or *Time-keeper*, by Mudge. *Plate* XIII. of *Horology*, contains ſo much of the eſſential parts of Mr. Thomas Mudge's time-keeper, as will enable the reader to form a competent idea of its conſtruction and manner of performance. In the "Deſcription of the Time-keeper," publiſhed in 1799, by Mr. Thomas Mudge, Jun. there are nine plates, eight of which are taken up in exhibiting the different plans and ſections of the various parts ſeen in different points of view; they were drawn by Mr. Pennington, the original workman employed by the two Mudges, father and ſon; but inſtead of copying any of the plates, except our figures 6 and 7, which are from his Plate II., we have judged it to be more deſirable to procure original drawings of a time-keeper, from one in the poſſeſſion of the ſaid Mr. Pennington, who now lives at the corner of Orchard Row, Camberwell, and who has obligingly given us his aſſiſtance as well as permiſſion to analyſe the piece. It is not neceſſary to give a particular account of the calliper of Mudge's time-keeper, as it does not differ in any material particular from that of the chronometers by other makers; nor is there any thing worthy of particular notice in the fuſee, different from that of an ordinary watch, except that there is the auxiliary ſpring making with it a *going fuſee* of the ordinary conſtruction. (See the deſcription of Brockbank's *Chronometer.*) The barrel however, which contains the main ſpring, is very ſimilar to Harriſon's, and differs from ordinary barrels. *Fig.* 6, repreſents this barrel with the chain coiled round,

round, as it appears before it is wound up. A is the edge of the upper plate, and B of the pillar plate of the frame; the barrel is compoſed of two diſtinct parts, C and D, which together may be denominated an entire box, of which D is the body or box portion, and C the cover or lid; this lid C, which is attached to the arbor EF, is of itſelf, by Mr. Mudge, called the chain barrel, becauſe the chain is wound round it; and the box part, D, is alſo of itſelf called the ſpring barrel, becauſe it contains within it the main ſpring. A ſection of this *fig.* 6. is ſeen parallel to it in *fig.* 7, where the ſame letters imply the ſame parts; from the latter of which it appears clearly that the portion C of the greater diameter may revolve with its arbor EF, ſeparately from the other portion D. G in both *figs.* 6 and 7, denotes a ratchet-wheel made in form of a rim or broad ring, with its inclined teeth on the outer or convex circumference, and is ſoldered, or ſcrewed, to the lower end of the rim of the box D, in ſuch a way, that a very ſmall portion of the interior, or concave part, projects inwards into the box: this projecting part has a ſhoulder turned away in the lathe from its upper plane, which makes the part within the box thinner than the part without, as may be ſeen in *fig.* 7; the bottom of the box *a a* is detached, and is of a diameter juſt ſufficient to allow it to enter the inſide of the box; it has a correſponding ſhoulder turned in the lathe at the circumference on its lower plane, which ſhoulder reſts on the above deſcribed ſhoulder in the concave projecting part of the ratchet; the uſe of this contrivance is this; the box, with its looſe bottom in it, is placed on the plane of the plate A, and the bottom *aa*, perforated in the centre for the revolving arbor, is ſecured to it by two ſcrews or more, entering from the plate, ſo that though the box may be ſaid to be attached to the plate by its bottom, yet its rim is at liberty to turn along with the ratchet firmly faſtened to it, while the bottom is at reſt ſcrewed to the plate, and the motion of the ratchet will be free or impeded in proportion to the quantity of preſſure which the fixing ſcrews occaſion on the two ſhoulders already deſcribed. The parts being thus arranged, it is eaſy to conceive that a click, ſcrewed to the plate A at any convenient part of it, and taking into the teeth of the ratchet G, will hold the box, or ſpring-barrel, from going in a retrograde direction, as well as if the box itſelf had been ſcrewed to the plate A, but it will ſtill be at liberty to revolve in the contrary direction on the application of any external force to it. Suppoſe now the outer end of the ſpring, hooked as uſual, to the interior ſide of the barrel or box oppoſite D, while the inner end is hooked on a pin in the arbor within the box alſo; the conſequence will be, that the chain, which is coiled round its barrel or lid C, being wound away by the fuſee, in the act of winding, will pull the arbor round, and its force will apply directly to the interior end of the main ſpring firſt, becauſe this is hooked to the arbor, and the coils of the ſpring will follow one another ſucceſſively up to the centre, as the intenſity of the ſpring is increaſed by winding; whereas, in ordinary watches, where the ſpring-barrel itſelf revolves without the arbor, the outer end of the ſpring is firſt acted upon in winding up, and the coils near the centre are laſt affected by the force that winds. When the ſpring requires to be ſet up or down, it is done by turning the ſpring-barrel and ratchet together with the contained ſpring, while the click is raiſed from the teeth of the ratchet, the arbor of the chain-barrel then being ſtationary, or revolving no otherwiſe than according to the ſlow motion which the train regulates. The chain is wound round the fuſee in a direction which actuates the wheels of the train in a backward manner, compared with the motion of an ordinary train, which direction of motion requires an additional wheel in the dial-work; for a ſmall wheel of 45 fixed to the arbor of the contrate wheel drives another of the ſame number of teeth in a proper direction for indicating ſeconds, on a ſeparate graduated circle, at a diſtance from the centre of the face; nor is the ſecond, uſually called the centre wheel, placed in the centre of the hour and minute circles, as is common in watches; though oppoſite the centre of the face; but its prolonged pivot bears a minute wheel of 52, driving a ſimilar detached minute wheel, and alſo an attached pinion of 8 driving an hour wheel of 96, both which driven wheels have cannons to carry their reſpective hands round two concentric circles, placed at the other ſide of the centre of the dial. This method of placing the hands allows the contrate and centre wheels to have ſmall pivots. The numbers of the movement publiſhed by Mudge are as follow: viz. the great wheel has 100 teeth, the pinion acting with it 20, the centre wheel or ſecond wheel 120, the next pinion 16, the third wheel 120, the pinion driven by it 15, the contrate wheel 120, the pinion driven by it 12, balance wheel 15, pallets 2; whence it ſeems that the fuſee revolves in $\frac{100}{20}$ or 5 hours, and the contrate wheel in $\frac{120}{16} \times \frac{120}{15} = \frac{60}{1}$, or 60 times in the hour, and the value of the train is, according to our method of eſtimating Harriſon's train, $\frac{120 \times 120 \times 120 \times 15 \times 2}{16 \times 15 \times 12} = 18000$ vibrations in each hour, or five in each ſecond. With this movement a fuſee with $7\frac{1}{5}$ turns or ſpirals in the groove, actuates the piece 36 hours; but there is a face laid down in Mudge's book for a continuance of eight days, the circles for the hours and minutes in which are at oppoſite ſides of the prolonged pivot of the centre wheel arbor, and the hour circle counts up to 24, which is certainly more convenient for aſtronomical calculations, than one with only 12 hours. On ſearching for an account of the train of this conſtruction, we are only informed, by Mr. Mudge, jun. that ſuch of the time-keepers as went eight days, were charged higher than thoſe which continued at one winding only 36 hours; but the numbers of the movement are not given by him; on application to Mr. Pennington, however, we have been favoured with them, which are as follow, viz. great wheel 108, pinion on the centre wheel 12, centre wheel 128, pinion following 12, ſecond wheel of the train, or third of the whole movement 120, pinion driven by it on the next arbor 12, contrate wheel 120, pinion following on the balance wheel arbor 12, crown wheel 15, pallets 2; ſo that the value of the train is $\frac{128 \times 120 \times 120 \times 15 \times 2 = 55296000}{12 \times 12 \times 12 \; 1728} = 32000$, on a ſuppoſition that the centre wheel revolves in an hour; but we find from the dial-work, which has what is called *borrowed minutes*, that this wheel revolves in $\frac{112}{63}$ of an hour or in 1.7 hours, therefore $\frac{63}{112}$ of $32000 = 18000$ is the true train by the wheels and pinions before us; the hour hand revolves in $\frac{135}{10}$ of $1^h.7 = 24^h$; and the fuſee revolves in $\frac{112}{63} \times \frac{108}{12}$ of an hour, which is $= 16$ hours; therefore a fuſee with juſt 12 turns will continue to go eight days, as was intended.

Fig. 1. of *Plate* XIII. is a perſpective view of the cock of Mudge's time-piece, ſuppoſed to be detached from the upper plate of the frame: the dotted ſpiral round the centre is the balance regulating-ſpring, to which there is a correſponding one underneath, called the compenſation-ſpring.

Directly over these springs is placed a smaller concentric frame supported by three pillars, *a, a, a*, on the principal cock, and bearing four friction-rollers, of which the centres are marked by four points at the extremities of the dotted spiral; these points are here supposed to be demitted from the same plate to the large cock, as the former is taken off to show the spiral-spring; the pivot of the balance-arbor runs in the central point where the four rollers nearly meet, and touches the circumference of each, so as to produce a rotatory motion in each that lessens the friction at the pivot; *b b* is a metallic sliding-piece filed away on the side next the centre, to avoid the regulating-spring, and placed on the plane of the cock, to adjust one of the curb-pins for regulating the piece, which it carries underneath it; the cock has an oblong slit in it near the screw at *b*, for the pin to move backwards and forwards during the act of adjustment, and the slider itself has two oblong slits, one at the said screw, and the other at one of the little frame pillars, which slits not only admit of a longitudinal motion of the slider, but also keep it in its due line of position during the motion of adjustment: at *c* is an arbour, square at the end to admit a key, but round below, and has a fine screw at the remote end, which presses against a stud *d* in the cock, where is a third opening for the stud, thereby moving the slider in consequence of the part *e*, which is turned up at its end, being tapped to suit the screw of the arbor of adjustment: on the middle of the said arbor is a nut between *e* and *c*, divided into 30 on its edge, which is pointed to by a fixed line on a stationary piece adjoining, through which the arbor passes. There is, moreover, a scale, *f*, attached to the large cock, to which a line on the slider near *e* points as an index of adjustment, and moves one space for every entire turn of the screw, which is an addition of Pennington's to the original construction. *g* is an horse-shoe-spring placed on the cock to force back the slider, when the screw has a retrograde motion. These parts and their uses, it is presumed, will be easily apprehended from our drawing, without the variety of views which Mr. Mudge has given in his plates. The slider is held down to the plane of the cock by the screw near *b* at the curb-pin, and also by a collet going over the stud *d*, and pinned on. There is a second curb-pin fixed on a detent, or straight piece of steel, riveted to the under side of the piece *h*, and crossing the slider at right angles; this curb-pin is borne by the interior extremity of the detent, and the adjustment is made by the screw and studs *i* screwed into the cock, and fitted sideways into two notches in the piece *h*; the screw on *h*, which holds the whole down, passes through an oblong hole, covered by its head, to admit of the adjustment of distance. The mechanism of this second curb-pin, we fear, will not be very intelligible, as some of the parts are necessarily out of sight: *k* is the stud of the regulating spring, and *l* a piece made purposely to cover the second screw of the large cock, which screw, therefore, cannot be taken out for dismounting the cock until this cover is taken off, and the cover itself cannot be removed till the regulating spring-stud is previously taken off: this precaution was necessary to prevent the derangement or breaking of the balance regulating-spring, one of which would follow, if the cock were dismounted without the stud being first unscrewed; the nature of the precaution is this; the cover *l* moves on its centre, below *b*, as on a pivot, and the round part at the upper end covers one of the two screws of the cock, until the stud, embraced by the semi-circular fork of the other end, is removed, when the cover *l* then is at liberty: the other corresponding screw for fixing the cock is visible at the opposite projection above *c*. *Fig.* 2, represents the second balance-spring and mechanism of compensation for the effects of heat and cold, as they appear when the cock in *fig.* 1. is removed from the upper plate of the frame; *a a* is a piece of brass screwed to the plate by the three screws *d, d, d*; *e* and *f* are two similar compensation-bars, composed of brass and steel soldered together, with their positions reversed; that is, the piece *e* has the brass side next to *c*, and the piece *f* has the steel side next to *f*: these compound pieces, seen in a detached state in *fig.* 3, with their interior curved ends passing each other, are screwed, each by two screws, at their outer ends, to the similar pieces *g* and *g*, which are themselves screwed to the long piece *a a*, but in such a way that they are adjustable, when their fixing screws are not home; the adjustment is made by the two similar horizontal screws at *h* and *h*, which fit the studs that appear at *i* and *i* in the oblong apertures of the pieces *g* and *g* left for the studs; and by these, together with the narrow apertures, and two other smaller studs *k* and *k*, one at each interior end of the said pieces *g* and *g*, is preserved the parallelism of the motion of adjustment: *l l* is a lever or detent, carrying a curb, or piece with two pins at the upper end, a little distance from the stud *m* of the regulating spring, and having a little curve to avoid the balance-verge, together with two short levers or tails, near the rounded projection of the cocks *b* and *c*; this detent is fixed on an arbor, which is pivoted above into the cock *b*, and below into the foot *n* of the cock *c*, which is let down, out of sight, through an aperture in the plate; the lever of the detent, however, is prolonged back to a considerable distance behind the cock to the end *q* of the cross-piece of *a a*, on which is described a portion of a circle divided into 20 equal spaces, to indicate, as a thermometer, the situation of the curb at any particular time; which is another addition contrived by Pennington. Now the action of the compensation-bars in the time-keeper, denominated *blue*, is this; because brass is more elongated by heat, and also more contracted by cold than steel, the former will be longer in summer and shorter in winter than the latter; the consequence of which will be, (as we have already said, when speaking of Harrison's compensation mechanism, from which it should seem the principle of this is borrowed,) that the metal most elongated will become convex in hot, and concave in cold weather; for instance, the compound bar *e*, with the brass side next to *e*, will become concave in cold weather on the brass side, and, its remote end being fast by the screws to the fixed piece *g*, the interior end will move forward to form the curve and press below the remote tail-piece of the detent, which detent will therefore move and bring the curb towards *o*, the other compound bar *f* in the mean time becoming convex on the side *f*, will make way for the motion of the other tail-piece that points to *e*, by falling back at the same rate with which the other bar moves forward; but in hot weather the contrary will take place, i. e. the interior end of the piece *f* will come forwards and press on the other remote tail-piece, and the end of the piece *e* will give way for the backward motion of the tail-piece pointing to *f*, the curb in the mean time having its motion in a direction towards *p*: the former of these two contrary motions of the curb will shorten the spiral-spring, or, at least, the effective portion of it, as the curb limits its action, and the latter will lengthen the same: but it is well known, that a short spring has greater force than a long one, *cæteris paribus*; likewise, that the altered momentum of the balance retards the rate in hot weather, and *vice versâ*; hence, the increased force of the spring in cold weather thus becomes a compensation for the sluggish motion of the balance occasioned by the same natural cause, and the contrary in the opposite extreme of temperature. Mr. Mudge junior might seem to have been guilty of an error

error in his "Defcription, &c." page 169, of this part of his mechanifm, but he is there defcribing the time keeper *green;* the compenfation-bars in which were made to act with the tail-pieces of the detent, which point refpectively *towards* them inftead of thofe which point *from* them : the nature of the action of the tail-pieces in *blue*, is, on the contrary, as we have defcribed, and as is clearly feen by the view we have given of the pofition of thefe bars in *fig.* 3. There is an error in the account by Mudge of this part of his mechanifm, where he afferts, that "the natural effect of heat is to leffen the momentum of the balance: and of cold to increafe it." We beg leave to obferve on this, perhaps unguarded, affertion, that whatever caufe enlarges the dimenfions of the balance muft undoubtedly increafe its momentum; and that heat has this effect is evident from the curve formed by the fuperior elongation of brafs compared with the lefs expanfible metal, fteel. Hence, the fpiral is fhortened by the curb in fummer and lengthened in winter.

In *Fig.* 4 (*Plate* XIII.) *a* is a cock in which the upper pivot of the upper pallet runs; the cock *b* is that in which the lower pivot of the lower pallet runs; *c* is the cock, on the nofe of the potence, on which both thofe pivots run that are near the axis of the balance-wheel; *d* is the cock in which one of the balance-pivots runs; *e* the cock for the other pivot of the balance-wheel; and *f* the potence fcrewed to the under fide of the upper plate, and bearing the fmall cocks, nearly in the relative pofitions in which they ftand in the figure; it may be proper to add, that the femicircular vertical excavation in *e* is to admit the arbors of the pallets within it, and that the pivot holes on thefe cocks are all jewelled.

Fig. 5 (*Plate* XIII.) exhibits a perfpective view of the balance, on an enlarged fcale, which is in the original of half an inch diameter, together with the auxiliary fprings which are fubftituted for the maintaining power, the balance-wheel, and the pallets. A B is the balance, and E F its verge, fhaped like a crank, of which the pivots I and K run in two fyftems of rollers, that have each a little frame, one of which has already been defcribed under our defcription of *fig.* 1, to which the lower one, placed at K, and fupported by a pillar fixed to the upper plate, is fimilar: one of the croffes of the balance bears a piece, M, to counterpoife the crank of the verge, and to keep the balance in equilibrio. C is the ftud of the regulating fpring, placed, as we have already feen, on the cock of the balance; and D is the ftud of the compenfation-fpring, fcrewed to the upper plate of the frame; thefe two fprings are both attached by their interior ends to the upper part of the verge above the crank, and have thin helices wound in the fame direction. The reafon why the verge has the fhape of a crank, is, that the little cocks or bearing pieces, reprefented in *fig.* 4, may have room for being fixed in their refpective fituations to catch the pivots of the balance-wheel arbor, and of the two pallet arbors, *c d* and *g h*, which arbors are exhibited in *fig.* 5, without their cocks, in order that the acting parts of the efcapement may be prefented to view; *a* is a pin, projecting from the upper bend of the crank verge, which in its motion meets with another longer pin, *b*, made faft to the arbor of the upper pallet, which pallet is feen a little curved with a fmall bend or hook at the outer end, between the letters *c* and *d*: this pallet-arbor has the upper auxiliary fpring fixed to it by its interior end, the outer end being pinned to the ftud at H; G is the pallet-wheel with its arbor difcontinued near the place where the contrate-wheel pinion is fixed. Mr. Nicholfon has given a very good account of the action of Mudge's efcapement in the 2d volume of his Journal, 4to feries, page 57, but has reprefented the fhape of the tooth in this balance-wheel fimilar to that in an ordinary watch, which, indeed, Mr. Atwood had done before him in the Philofophical Tranfactions of 1794; thefe authors have alfo omitted to mention the fpring of compenfation, which we here notice, becaufe their readers would otherwife be at a lofs, from the view of the figure, to know how the compenfation for temperature is effected, or, indeed, whether there is any at all; their object being only the account of the fprings as they related to the balance and efcapement. Pennington, who made the drawing for Mr. Atwood's paper, tells us, however, that the fhape given to the teeth is not of much importance. There is another pin, *e*, at the bottom of the crank, fimilar to *a* above, and alfo a fecond pallet-arbor, *g h*, carrying another pin, *f*, and a fecond auxiliary fpring, the outer end of which is pinned into the ftud I: the helix of this fpring is wound in a direction contrary to that of the upper auxiliary fpring. We have endeavoured to give fuch a perfpective reprefentation of the mechanifm of efcapement, together with the balance and compenfation, in one figure, as might exhibit to view all the parts of action; and the effect produced when the time-keeper goes, may be thus defcribed.

There are fix fprings employed in the time-keeper: the main fpring, the fpring of the going-fufee, the regulating or pendulum-fpring pinned at C, the fpring of compenfation pinned at D, and the two auxiliary fprings on the two pallet-arbors; let us fuppofe all thefe fprings exactly in their natural ftate of quiefcence, and that the crank verge, and pins on the two bends of it, are fo adjufted as to reft quietly againft the pins *b* and *f* of the pallet-arbors: alfo let the two pallets be at liberty, one remaining in the fpace diametrically oppofite the acting tooth which refts againft the other, which will be the cafe as the number of teeth is an odd number (15); in this fituation all the arbors will remain at reft till fome force is impreffed on the balance-wheel, provided the piece be fuffered to lie on a table; now wind up the main-fpring, and the fpring of the going-fufee will be firft put into a ftate of intenfity, and then the power will be tranfmitted through the train, with fome occafional variations of intenfity, arifing from the unavoidable friction of the teeth of the train, up to the balance-wheel, which will be impelled forward, till, pufhing againft one of the pallets, fay the upper one, it meets with fome refiftance from the auxiliary fpring on the pallet-arbor; however, the power of the main-fpring is fufficient to wind this auxiliary fpring up till the tooth of the balance-wheel, fliding on the concave fide of the pallet, is ftopped by the little hook at its extremity, which hook of the pallet now acts as a detent, and arrefts the further motion of the pallet-wheel as urged by the main-fpring; the quantity that the pallet-arbor revolves during this fhort action of the pallet-wheel, we are told, is about 27°. Now all is at reft again, and would continue fo, if no external force were to put the balance in motion: let therefore an impulfe be given to the balance fufficient to make it move through a femi-vibration, which in one of the original machines was 133° with one of its balances, and 119 with another; during this femi-vibration, the pin *a* of the crank catches the pin *b* of the pallet-arbor at the 27th degree from the ftate of quiefcence, and confequently difengages the pallet, and goes on winding up the auxiliary fpring the remaining 106°, the balance-wheel in the mean time running on, on being difengaged from the detaining pallet, by the impulfe of the main-fpring, till it arrives at the hook of the lower pallet; but during this unreftrained motion, it has no connection whatever with the balance; on which account it is that the efcapement is called a detached one; detached, as it relates to the main-fpring, except for the moment of unlocking,

locking, which is not more than $\frac{1}{25}$th part of the time of a vibration, but not detached, as it relates to the auxiliary ſpring, which is uſed as a ſubſtitute for the maintaining power; for we have ſeen that the pin in the crank of the balance verge impels the pin in the pallet-arbor all the time that the auxiliary ſpring is wound through a ſpace of 106°. The balance wheel by the impulſe of the main-ſpring having now urged the lower pallet till it is detained by the bend in its extremity, the pin *f* in the lower pallet-arbor has alſo in its turn been moved 27° from the place of reſt, in which ſituation it is now ready to be caught by the pin *e* in the lower bend of the crank verge; at length the balance begins to return from the point at 133°, the extremity of its vibration, and in its turn is impelled by the pin *b*, acting againſt the pin *a* of the crank, during the whole ſemi-vibration of 133°, ſo that it is itſelf impelled 27° more than it impels the pin, and the difference of the continuation of the two alternate impulſes conſtitutes the quantum of maintaining impulſe, that keeps the piece in continual motion; which quantum, in fact, is a deduction from the retarding force in the latter ſemi-arc of vibration, rather than an addition to the impulſive force in the firſt ſemi-arc. The balance-crank in its return on paſſing the point of original quieſcence, has done with the ſpring of the upper pallet, which now remains in the poſition we at firſt found it; but when the crank has paſſed the point of original quieſcence the ſpace of 27°, its pin *e* meets with the pin *f* of the lower pallet-arbor, which is in its turn impelled by the ſaid pin *e*, the ſpace of 106°, exactly as the former one was; the former, or upper pallet, in the mean time being again carried forward 27° by the next following tooth of the wheel; at length this ſemi-vibration is complete, and the balance-crank returns, driven by the pin *f* through the whole 133° to the point of its ſpring's quieſcence as it was before by the pin *b*, and thus the proceſs is finiſhed through two ſucceſſive excurſions; which proceſs may be conceived to continue for months, or even years, without interruption. Some of the balance-wheels were made of tempered ſteel and ſome of braſs, and the acting portions of the pallets of flint, agate, ruby, or ſapphire. The two ſlender ſprings within the crank, which have been juſt deſcribed, are denominated *auxiliary* ſprings, becauſe they *aid* the two other ſprings in the reſpective returning parts of each vibration, and in this point of view may be conſidered alſo as regulating ſprings, but, being only $\frac{1}{20}$th of the ſtrength of each of the others, are too weak of themſelves to perform this office without the addition of the other more powerful ones, one of which has its effective length conſtantly, though very ſlowly, changing by the ſucceſſive changes of atmoſpheric temperature, which is the reaſon why we called it the compenſation-ſpring.

It is of the utmoſt importance that all the four ſprings of the balance ſhould be at their reſpective points of quieſcence when the balance is at reſt, otherwiſe the law of their forces, which is aſſumed to be directly as their tenſions, will not be the ſame in all, and ſome may be accelerating while others are retarding, whereas they ought all, like one ſpring, to accelerate and retard the balance conjointly in every part of the vibration, unleſs, indeed, the large ſprings are found not to be iſochronal, and the ſmall ones have their points of quieſcence ſo placed as to effect a compenſation, which Mr. Atwood, in his ingenious paper of Feb. 27, 1794, in the Philoſophical Tranſactions, has ſhewn to be a feaſible adjuſtment. For inſtance, if the point of quieſcence of each of the auxiliary ſprings, or even of one of them, be placed ſomewhere in the firſt ſemi-arc of vibration of the balance, the acceleration effected thereby will be leſs in this than the retardation will be in the following ſemi-arc; in conſequence of which the time-keeper will go ſlower; but if the point of quieſcence of the auxiliary ſpring be in the latter ſemi-arc of vibration, the contrary will be the caſe, that is, the time-keeper will accelerate its rate; nay, if the quantity of deviation from the exact point of quieſcence be only one degree of a circle, the ſame author has calculated that where the balance is of one inch radius, and of a correſponding given weight, the daily gain or loſs will be about $19\frac{1}{2}^{s}$, and the quantity increaſes with the diminution of the arc of vibration; ſo that if the arc of vibration were to become 60°, in one caſe the daily loſs would be $44^{s}.33$, and in the other the daily gain would be $43^{s}.6$; which conſideration ſhews the imperious neceſſity of having the points of quieſcence of all the ſprings exactly adjuſted; and alſo that the pins in the pallet-arbors be ſteadily fixed; for an alteration in their poſitions is in fact an alteration in the quieſcent points of the auxiliary ſprings.

If we were to reaſon from theory, we ſhould be diſpoſed, from the conſideration we have given this mechaniſm, to ſay, that the principle upon which it is conſtructed is excellent, inaſmuch as the impulſes given to the balance, and the oppoſitions made to it during its vibrations, are in proportion to the diſtance from the point of reſt at all times, agreeably to the laws of gravity in a pendulum; the diſcontinuance of the retarding force for a ſpace of 27° in each excurſion, deranges as little as may be the ſcale of varying forces by which the regulation is effected; whereas in the other detached eſcapements, where the impulſe from the train is momentary, ſuch impulſe, to be powerful enough to maintain the continual motion of the balance, may be ſuppoſed to partake of the nature of a *jerk*, and to derange the regularity of the ſcale of forces, according to which, the balance-ſpring ought naturally to act; however, in practice it has not been proved that this conſtruction exceeds ſome of the more ſimple ones; but we will not undertake to affirm, that the aſſertion is quite accurate which ſays, that the great number of pivots requiring oil, and the various ſprings that require adjuſtments for time, temperature, power, and poſition render it extremely difficult to obtain a permanent rate. It is ſaid by the younger Mr. Mudge, that his father conceived the idea of making a time-keeper, and had organized his notions reſpecting its conſtruction, ſo early as Auguſt 1771, before he knew the conſtruction of Harriſon's; which ſeems probable, from various obſervations made in his "Thoughts on the Means of improving Watches," publiſhed in 1763, and written ſome time before; but were we diſpoſed to judge alone from a compariſon of the principles of his and Harriſon's time-keepers, we ſhould at leaſt ſay, that there is a remarkable reſemblance, almoſt too great for accidental coincidence; the principle of the compenſation mechaniſm is preciſely the ſame, and the auxiliary ſprings, though greatly different in their mode of acting, the one being before and the other behind the balance-wheel, the one wound up eight times in a minute, and the other once at each vibration, yet the object is the ſame in both, namely, to give a regularly modified impulſe to the balance, which balance again has a great momentum in both conſtructions, in conſequence of its enlarged dimenſions. Mr. Mudge, in a letter dated Plymouth, Oct. 5, 1775, and addreſſed to his excellency count Bruhl, his friend, ſays, "I do not think it difficult to deduce from reaſons, *a priori*, that there is one diameter (of a balance), with a proportionable weight, by which a greater momentum will be procured than by any other; and that you will loſe momentum either by increaſing or diminiſhing that diameter;" he does not, however, give thoſe reaſons, but has recourſe to experiment. The original balance was ſuppoſed to be too heavy in proportion to its diameter, a larger but lighter one

was

was therefore made and tried, but the alterations neceſſary to be made in the cock rendered the trial doubtful, though the opinion entertained was in favour of a diminiſhed momentum being occaſioned by the alteration; a third was then made, one-tenth of an inch bigger than the firſt, and nearly four-tenths leſs than the laſt, " and I find (ſays our author) upon comparing the diameters, vibrations, and weights of the two (laſt made) that the momentum of the leaſt is to the momentum of the biggeſt as 9 to $7\frac{2}{3}$ nearly." The ſubjoined are the data and calculations on which the above concluſion was founded; viz.

leaſt balance
Inches
Diameter 2.15 × 266° = 571.9 = the velocity
Vibration 266°
Weight 56.5 grains
Then 571.9 × 571.9 = 327069.61 × $56^{gr}.5$ = 18479433 = momentum.

Inches
Diameter 2.47 × 238° = 587.86 = the velocity
Vibration 238°
Weight 45.5 grains
Then 587.86 × 517.86 = 345579.3796 × $45^{gr}.5$ = 15723862 = momentum.

Let it be remarked here, that Mr. Mudge has ſuppoſed all the weight at the circumference of the balance, and has aſcertained the velocity from the diameter, which we apprehend ſhould have been from the radius or diſtance from the centre of motion, which mode would not indeed affect the relative, but would double the real velocities; alſo the ſquare of the velocity is multiplied by the weight, contrary to the opinion of thoſe who aſſert that the ſimple velocity ſhould be uſed as a multiplicand for the weight uſed as a multiplier, in order to effect a product equal to the momentum. According to this latter rule, if we take the double velocity as before, the reſpective momenta will be 371.9 × 56.5 = 32312.35 and 587.86 × 45.5 = 26747.33, which reſults are very nearly as 6 to 5.

It does not appear, notwithſtanding the above calculation, what was the relative power derived from the auxiliary ſprings, conſidered as a maintaining power, compared with the regulating power, which we have ſeen was 1 : 80 in Harriſon's time-keeper; nor is it quite certain, though very probable from the account, that the balance, with the greateſt momentum, was uſed in the trials of the going of the firſt time-keeper, on which an application was made for the parliamentary remuneration. Pennington found, from ſome experiments on a time-keeper that ſtopped in a voyage, that the neceſſary force of a main-ſpring ſhould be to the force juſt ſufficient to keep the piece in motion at firſt, as $17\frac{1}{2}$ to $10\frac{1}{2}$: i. e. when $10\frac{1}{2}$ oz. will produce a continuance of motion at firſt, 7 oz. more muſt be added for foulneſs in wear. Theſe were the exact proportions in *green*, though in *blue* they were found ſomewhat different.

Though Mr. Mudge had made and approved his firſt time-keeper, previouſly to Harriſon's having obtained his laſt 10,000l., the complement of his rewards, which ſum was granted by parliament in 1774, yet he was unfortunate enough to omit making application for the trial of his time-keeper till the act had paſſed, which limited the whole reward to 10,000l., or one half of that propoſed by the act of queen Anne, and alſo rendered the limits of trial more circumſcribed; the latter of which circumſtances rendered the attainment of even a portion of the diminiſhed reward more difficult, than the attainment of the whole great reward which Harriſon was fortunate enough to obtain by his indefatigable perſeverance. The act of queen Anne allowed to Harriſon's trial a voyage of only ſix weeks, at the end of which, if his time-keeper was found to have kept time within four minutes of error, or one degree of longitude, he might claim a portion of the reward thereon; but the time ſpecified in the act of 1774 was ſix months, during which, the error was not to exceed four minutes, for the ſmalleſt portion of the reward. In the four trials made of the time-keepers of Mr. Mudge by Dr. Maſkelyne, from the years 1776 to 1790, the firſt of which trials was of N° 1, in 1776, 1777, and 1778, and the ſecond, third, and fourth of the pieces denominated *blue* and *green* in 1779 and 1780, again in 1783 and 1784, and again in 1789 and 1790, it appeared from the Doctor's reports to the Board of Longitude, that none of the time-keepers had kept time within the limits preſcribed by the act of Geo. III. On the 1ſt of March, 1777, however, the aſtronomer royal reported to the Board, that the (1ſt) watch made by Mr. Mudge had gained only 1^m 19^s in 109 days, in conſequence of which, it was reſolved, that a letter be written to the Navy Board to pay Mr. Mudge 500l. to enable him to finiſh two more watches on a ſimilar conſtruction, which was deemed preferable to any other that had been previouſly tried; but after this, the main-ſpring of this piece broke, and on being replaced, the piece was found, on a trial of 15 months, commencing on Nov. 11, 1776, to have gained daily $8^s.6$ at the end, more than at the beginning of this ſecond portion of the trial. With reſpect to the three trials of the time-keepers, *blue* and *green*, we ſhall have occaſion to ſpeak of them hereafter. Since the publication of the " Narrative" by Mr. Thomas Mudge junior, it is well known what the difficulties were that Mr. Mudge encountered from the oppoſition which the Board of Longitude raiſed againſt him in his appeal to the Houſe of Commons, after his memorial to the Board had been unſucceſsful on the 11th of June, 1791. To inquire into and aſcertain the comparative merits of Mr. Mudge's time-keeper, however, a committee was appointed by the houſe in conſequence of the appeal conſiſting of the following honourable members: viz. Mr. Pitt, Mr. Fox, Mr. Ryder, Mr. Bragge, Sir Gilbert Elliot, Mr. Gregor, Sir George Shuckburgh, and Mr. Windham, of whom Sir George Shuckburgh was conſidered as the friend of the Board of Longitude, and was therefore candidly propoſed by Mr. Windham to witneſs all the meaſures about to be taken. The committee very properly directed their attention, in the firſt inſtance, to two material objects; 1ſt, to appoint a ſub-committee of ſcientific gentlemen, and men of practical ſkill in mechanics, to examine and report their opinion of the principles upon which the conſtruction was founded; and ſecondly, to aſcertain by a compariſon with other chronometers the accuracy which Mr. Mudge's time-keeper had given proof of in its actual meaſurement of time. The ſub-committee nominated was compoſed of the following liſt: viz.

The Biſhop of St. David's, Mr. Atwood, Mr. De Luc.	Scientific Gentlemen.
Mr. Ramſden, Mr. Ed. Troughton.	Mathematical Inſtrument Maſters.
Mr. Holmes, Mr. Haley, Mr. Howells.	Watch Makers.

This ſub-committee after due examination made the ſubjoined report to the ſelect committee, viz.

" We whoſe names are underwritten, to whom it hath been referred, by a Select Committee of the Honourable Houſe of Commons, to receive confidentially from Mr. Mudge, a communication of the principles of his time-keeper, and to report thereon, being aſſembled at the houfe of his Excellency Count Bruhl, in Dover Street, on Tuefday the 14th inftant, did caufe a time-keeper, which was produced to us as one of the two made by Mr. Mudge, and fubmitted to trial at the Royal Obfervatory at Greenwich, for twelve months, from June 1789 to June 1790, to be taken to pieces in our prefence, by Mr. Matthew Dutton; and having carefully examined the parts of the fame, we find a contrivance in it for deftroying the inequalities of the maintaining power derived from the main fpring, which as far as we know and are informed is altogether new; and having confidered the fame, and put many queftions concerning it to Mr. Mudge, jun. and Mr. Matthew Dutton, we are of opinion, that the faid contrivance is well calculated for producing the defired effect, and that a difclofure of it may conduce to confiderable improvements in the art of making time-keepers. We moreover declare that we find great fkill and ability difplayed in every part of the workmanfhip, as well as much ingenuity in this particular invention. At the fame time it is our opinion, and we think it our duty to declare it fo to be, that no judgment can be formed of the exactnefs of any time-keeper by theoretical reafoning upon the principles of its conftruction, with fuch certainty as with fafety to be relied upon, except it be confirmed by experiments of the actual performance of the machine.

Samuel St. David's,
George Atwood,
Jesse Ramsden,
Edward Troughton,
John Holmes,
Charles Haley,
William Howells,
J. A. de Luc."

Dover Street,
the 20th of May, 1793.

Notwithftanding this report and the teftimonies produced by Mr. Mudge in favour of his three time-keepers, one made in 1774, and the other two in 1777, from regifters kept by Doctor Mafkelyne, Doctor Hornfby, Count Bruhl, Doctor (now Baron) Zach, of Saxe Gotha, and Mr. Dutton, who had been partner with Mr. Mudge, yet the committee, at a lofs for an unerring rule by which to afcertain at all times an exact rate to be depended upon in future trials, declared it as their opinion that fome of Mr. Arnold's chronometers, particularly No. 36 and No. 68, "had gone with a degree of accuracy greater than could be fhown on any correfponding trial of Mr. Mudge's;" but in another part of the report of the felect committee, which is too long to be copied at full length, it is faid, alluding to the foregoing report of the fub-committee that "in virtue of this report, and of fuch other evidence as the inquiry has furnifhed, your committee have no difficulty in declaring, that they confider the improvement in queftion fufficiently afcertained, and as likely to conduce to advantages fufficiently important to attract the notice of Parliament;" then, after the attention of parliament had been directed to the circumftances of a life, fpent in hope of benefiting the public, more than of enriching the individual, the report concludes with thefe words; viz. "For thefe confiderations, joined to thofe above fet forth, your committee think themfelves authorized to recommend the petitioner to the attention of the Houfe, conceiving that the circumftances attending his cafe give him a ftrong plea to favour; and that the invention of which he is the author, contains an important improvement in the art of conftructing time-keepers, fuch as the Houfe might well wifh to fecure to the public, as well as to reward the perfon by whom it was produced." Accordingly, in the year 1793, the Houfe of Commons, after the examination of various witneffes, notwithftanding the oppofition of the Board of Longitude, granted to Mr. Mudge, in addition to the 500l. previoufly received by way of encouragement, the further fum of 2500l. under the act of 1774.

We have faid that the felect committee were without a certain rule that would apply in all cafes to afcertain the true rate of a time-keeper at each fucceffive period of trial, a ftandard rate previoufly obtained being in point of accuracy no longer applicable than while the piece conforms to that rate in going. The rule called "Dr. Mafkelyne's method" is this; when the period of obfervation, or trial, continues many months, he takes a mean rate from the going in the *firft month*, and applies it as the ftandard to any fix fucceffive months after, mediate or immediate, which method allows of fix periods in a year of fix months each, or twelve in a year and half; and when a mean rate taken from the firft month was thus applied, whether it was additive or fubtractive, the aggregate amount of the daily errors thus equated, taken on any day of a period, is called *the error* of that day, and the evidences brought againft the going of Mudge's watches were the *greateft error*, and alfo the *mean error*, on an average of the whole period. Mr. Mudge, on the contrary, wifhed the mean rate to be taken on a period of at leaft fix months, as Harrifon's had been on fix weeks, or whole time of trial, and produced as evidence in favour of the going of his watch, the rate taken from a mean of the daily errors during fix months of the trial, and alfo the greateft deviation from that rate on any two fucceffive or remote days, without regarding the aggregate of the daily errors, or what is called *the error* at any particular part of the trial, it being contended that *the error* would never be very great if the rate were properly taken. In confequence of thefe different opinions in refpect to the mode of judging of the performance of a time-keeper, fome of the members put queftions to the witneffes, particularly to Dr. Mafkelyne, tending to afcertain, whether or not a rate could be taken at fea as well as by land? and, on being anfwered in the negative, in what time, on touching at any known point of land, the longitude of which is known, a rate could be obtained? to which the Doctor's reply was "a month:" and his reafon for requiring fo long a time to get a rate, was, that in a voyage only the rates on the firft and laft days can, he fays, be afcertained accurately, but by land the fucceffive daily errors can be compared together, fo that if a fudden change takes place in the rate, the date of that change can thus be afcertained, which he contends is not the cafe on a trial at fea. It would fwell our prefent article too much were we to infert here all the trials in favour of and againft Mudge's time-keepers, and alfo of thofe with which they were contrafted; fuffice it therefore that we refer the reader, who wifhes to know all the particulars, to the "Narrative" publifhed by Mr. Mudge, to Dr. Mafkelyne's "Anfwer to the Narrative," and Mudge's "Reply to the Anfwer." It will fatisfy the ordinary reader, we prefume, to know the annexed particulars refpecting the moft and leaft favourable trials. In the firft trial by Dr. Mafkelyne, made during 15 months; from April 20, 1779, to July 17, 1780, the errors obtained by Dr. Mafkelyne's method of the time-keepers denominated *green* and *blue*, eftimated from eight periods of fix months each, were thefe; viz.

Of *green* the mean error of eight periods was	11′	1″
The greateft - - -	16	25
The leaft - - -	7	20
Of *blue*, the mean error of the fame periods	22	30
The greateft - -	36	26
The leaft - - -	5	53

In

In *green*, the daily error, or rate, was altered at the end of the trial $11^s.3$ which was in excefs.

In *blue* the fame was more in excefs, viz. 18^s.

This trial was the leaft favourable to both time-keepers.

The moft favourable trial of *Green* feems to have been from 21ft July 1783, to 12th Sept. 1784, by Dr. Mafkelyne, in which its mean error on feven periods was $3^m\ 8^s$, the greateft $7^m\ 10^s$, and the leaft $1^m\ 25^s$, the rate at the end having become fafter by 3^s.

But the moft favourable trial of *Blue*, feems to have been its laft under Dr. Mafkelyne in the years 1789 and 1790, in which the leaft error, eftimated on fix periods of fix months each, was $3^m\ 5^s$, and the greateft $6^m\ 0^s$, the acceleration of the rate being at the end $2^s.5$ per day. The proof in favour of Arnold's No. 36 was, that the greateft variation in its daily rate on a trial of 15 months by Dr. Mafkelyne was 7^s; that its greateft error on eleven periods of fix months each, was $2^m\ 31^s$, and its mean error only 54^s. The proof of Mr. Arnold's No. 68 was from a trial of Mr. Everard, of Lynn, in Norfolk, from which it appeared, from 46 periods of fix months each, that the mean error was, according to Dr. Mafkelyne's method, only $2^m\ 33^s$, in only eight of which periods the error exceeded 4^m, and that the greateft variation in its daily rate was 5^s taken on any two parts of its trial. To thefe and other comparative proofs againft Mr. Mudge's time-keepers, the inventor oppofed various trials, as we have before faid, under Doctor Hornfby, Count Bruhl, Admiral Campbell, and Baron (then Doctor) Zach, as well as fome under Mr. Dutton, but as the difference in the daily rates, and not the aggregate, or what is called *the error* is chiefly given as the refult of each trial, we cannot well make a comparifon of refults comprifed in terms of different denominations.

Mr. Mudge junior, previoufly to his father's death, eftablifhed a manufactory for time-keepers, and employed Meffrs. Howells, Pennington, Pendleton, and Colman, to make them for him; fome few of which performed in a way that merited the approbation of certain naval officers of great refpectability, particularly lord Keith Elphinftone, and lord Hugh Seymour, but the difficulty of making the adjuftments fo accurately as Mr. Mudge fen. had done, and the high price put upon them, about 150 guineas each, (which indeed was too fmall, as the younger Mudge was a great lofer by the manufactory) induced the Admiralty to decline giving any other than occafional orders for his majefty's navy; the chronometers of Arnold and Earnfhaw, which were deemed equally good by the Board of Longitude, being fold at an inferior price; though Kendal's price for making a time-keeper after Harrifon's model was 400l. We decline accompanying Mr. Mudge through his complaints againft his opponents, particularly againft Dr. Mafkelyne, whom he has accufed of being too partial to his own darling child, the *lunar method*, to do juftice to any method purely mechanical for anfwering the fame important purpofe; a ferious complaint this, which is corroborated by an affertion, that Meffrs. Harrifon and Arnold fenior, made fimilar complaints: but be this as it may, it is a fact that the younger Mudge has only fold *eleven* time-keepers of his father's conftruction at the time his book was publifhed in 1799, though he had others finifhed, or nearly fo, and that Barraud and Jamefon, as we are informed, made propofals to the Admiralty for finifhing Mudge's time-keepers at the reduced prices of ninety guineas each, though it is well known that they cannot be afforded for this fum. In juftification of the Aftronomer Royal, we will conclude our account of Mudge's time-keeper with the concluding paffages of his own "Anfwer" to the "Narrative;" "the ufefulnefs of the Board of Longitude is too well known to the public, and acknowledged by all but a difappointed artift, to require my pointing out inftances in which they have materially ferved the public and done honour to the nation. Doubtlefs they deferve commendation in another refpect for having been careful concerning the diftribution of the public money. They might indeed have been properly cenfured, if they had given it away to a perfon not legally entitled to it by the act of parliament, or by a partial preference of the lefs deferving perfon to the more deferving ones."

Chronometer by *Meffrs. John Brockbank and Co.* Among other chronometer makers of reputation we have already had occafion to mention the Brockbanks, of No. 6, Cowper's Court, Cornhill, London, fome of whofe chronometers have performed with a degree of accuracy equal to that of perhaps any other maker, though they never applied for any parliamentary remuneration; the original firm of the houfe was Meffrs. John and Miles Brockbank, the former of whom lately died, and the latter is juft gone out of the bufinefs, and is fucceeded by his nephews, Meffrs. John and William Brockbank, fo that the firm is now Meffrs. John Brockbank and Co. On our applying for permiffion to take one of their chronometers to pieces, in order to give a full defcription of all its parts, the requeft was politely and readily granted. *Plate* XV. contains perfpective views of the different portions of the Brockbanks' chronometer, with the exception of the cafe or box, dial-work, face and hands, guard, fpring-ratchet, and fuch other fubordinate parts as are common to an ordinary watch, which may be feen more particularly under the article Watch-work. *Fig.* 1, exhibits the upper plate of the frame, feen a little obliquely, together with the balance, regulating cylindrical fpring, and the three different cocks for holding refpectively the balance verge, upper pivot, the ftud for the outer end of the balance-fpring and the mechanifm for banking. A, B, C, and D, are four circular holes perforated through the plate, juft large enough to receive the ends of the four pillars, denoted by the fame letters in *fig.* 2; E is a hole fomewhat lefs, to receive the end of the fpring-barrel arbor, and is at the place where the ratchet and click are placed to regulate the main-fpring, and preferve its intenfity when regulated: *a* is the compenfation balance, at prefent feen in the form of an ellipfe, as placed on its verge; but in *fig.* 3 is feen in its true fhape of a circle, where the eye is fuppofed to be perpendicularly over it; *b* is the cylindrical balance fpring, with its coils equal in diameter to the radius of the balance, having ufually from four to nine folds, attached at its lower extremity to the balance verge, by means of a collet and pin, and at its upper extremity to a ftud at the extreme end of cock *d*, which is compofed of two parts, fcrewed together by two fcrews, the heads of which appear near *d*; this cock is then fcrewed to the plane of the upper plate by a fingle fcrew, which fcrew, by the aid of two little fteady pins, faft in the cock near the fcrew hole, one of which is reprefented by a diminutive circle, and inferted into fmall holes in the plate, holds the cock firm in its proper fituation; *c* is the principal cock, the end of which has a jewelled hole that receives the upper pivot of the balance, the correfponding pivot is hid, being fupported by the crank part of the potence, which is reprefented by D E F in *fig.* 6, and is fcrewed to the under fide of the upper plate by a fcrew at E, aided by three fteady pins; the pivot hole in this potence is alfo jewelled. The third cock, *e*, is feen on an enlarged fcale in *fig.* 4, where it will be defcribed by and by. The cock, *c*, alfo appears to be compofed of two pieces joined together by two fcrews above the bend, the heads of which appear near *c*, but *c*, but it is in one piece, and theſe ſcrews fix it more firmly to the plate. The fuſee guard, as in common watches, is placed under this upper plate, and is therefore out of ſight.

Take the upper plate from the frame now, by unſcrewing the four ſcrews that go into the ends of the pillars, a contrivance of Meſſrs. Brockbank's, and *fig.* 2 will be preſented to view, in which are contained the main-ſpring, fuſee, and chain, with the mechaniſm of the perpetual ratchet, ſeen ſeparately in *figs.* 7 and 8, the movement of the piece, and the lower or pillar plate with the four pillars, one of which has indeed been purpoſely left out in the drawing, that it might not intercept the view of the movement. A, C, and D, are the three pillars alluded to in our deſcription of *fig.* 1, and B the place in the lower plate, where the fourth pillar ought to be ſcrewed. or riveted, which we have ſaid is left out of the drawing; E is the ſpring barrel, containing a well tempered main-ſpring, ſtronger than the ſpring of an ordinary watch, becauſe the eſcapement is a detached one, requiring the momentary impulſe given to it to be pretty ſtrong; there is nothing particular in the conſtruction of this barrel, except its ſize, which is proportioned to the ſpring it contains; one of which, for a large box chronometer, has been found equal to ſupport a weight of 11 lbs. or upwards; the chain is alſo of the uſual conſtruction, except that it is ſtronger than is neceſſary in a common watch; it is repreſented as partly wound on the fuſee, and partly on the barrel, which is generally the caſe when a watch or chronometer is going, ſo that, in this ſituation, if ſome obſtacle to motion were not preſented to ſome one of the wheels of the train, before the balance is taken out, the piece would run rapidly down, and be in danger of breaking ſome of the pivots or other delicate parts, on which account a briſtle is uſually put through the croſſes of the third or fourth wheel to prevent ſuch accident, while the balance is taken out, a ſmall obſtacle being ſufficient to arreſt the motion when applied near the top of the train, where the maintaining power is diminiſhed in proportion to the number of wheels and pinions in the train that it has paſſed through; the reaſon of which is more particularly explained under our article Clock Movement, where the obſervations we have made are equally applicable to the movement of a clock, chronometer, or ordinary watch. F is the fuſee grooved in ſuch a way, after being made of the ſhape of the fruſtum of a paraboloid, that the decreaſe of the acting radius is always inverſely proportional to the intenſity of the main-ſpring; by which admirable contrivance the effective power of this ſpring is at all times very nearly alike; the adjuſtment of the varying levers, or points of action, of the fuſee, is made very conveniently by a long lever with a moveable weight, like a ſteel-yard, being inſerted on the ſquare of the fuſee arbor made for the key, as will be explained more particularly in its proper place. (See Fusee and Clock-tools.) The number of turns of the fuſee, it has been already ſaid, depends on the number of hours it is intended to be actuated by the ſpring at one winding up, and this number again depends on the ratio between the great wheel and the centre pinion, as has been mentioned in our deſcriptions of Harriſon's and Mudge's time-keepers. The angular point of the cap, at the ſmaller end of the fuſee, near F, is to catch the ſhoulder of the guard, when the chain has filled all the turns of the ſpiral groove; otherwiſe the chain would wind back again a little way, and the power of the main-ſpring would become too great, or perhaps the ſpring might even break by being over ſtrained. Concentric with the fuſee at the large end, contiguous to the pillar plate, are the great wheel, two ratchets, and a ſecondary ſpring to keep the chronometer going while it is wound up; this idea, and alſo the mechaniſm proper for effecting ſuch purpoſe, originated, as we have ſeen, with James Harriſon; but the preſent application of his principle is much more ſimple than his was, inaſmuch as the ſpring is ſo conſtructed, as not to require a barrel or box to contain it. The particulars will be more minutely detailed when we come to *figs.* 7 and 8. In the pocket chronometer before us, the great wheel, which is moveable round the fuſee arbor in one direction only, like that of a common watch, has 60 teeth: *a* is the centre wheel arbor, on which is a pinion of 12 leaves revolving in an hour; this arbor is ſtronger than any other arbor in the train above, not only becauſe more power is impreſſed on its pinion than on any other pinion higher in the train, but alſo becauſe the minute hand is borne by it, and alſo motion given to the hour hand from it; the centre wheel fixed on this arbor has 64 teeth, which impel the pinion of eight leaves on the ſecond arbor *b*; the ſecond wheel of 60 teeth is faſt alſo to this arbor, and impels the third pinion of eight leaves faſt on the third arbor, *c*, which is the arbor for the ſeconds hand, which hand moves in a circle of 60 out of the centre of the face, therefore cannot be miſtaken for the minute hand, which is a matter of ſome importance in a chronometer: on this arbor of the ſeconds hand, a contrate wheel is uſually placed in a common watch, for the ſole purpoſe of altering the direction of motion, that the balance or crown wheel may have an horizontal arbor, but here the caſe is different, the balance wheel, or more properly ſpeaking the eſcapement wheel, has a vertical arbor like the reſt of the train; the third wheel therefore is here like the reſt in poſition, and has 80 teeth driving its pinion of eight on the fourth arbor, *d*, which alſo carries the eſcapement wheel with 15 teeth. From this account of the movement, we now know that the fuſee revolves in $\frac{60}{12}$ of an hour, or in five hours, and alſo that, as there are $6\frac{1}{4}$ turns in it, the whole period of continued motion, at one winding up, will be 32 hours; alſo by our former method of eſtimating the value of a train exemplified in Harriſon's and Mudge's trains; we know that $\frac{64 \times 60 \times 80 \times 15 \times 2}{8 \times 8 \times 8} = \frac{921600}{512} = 18000$ are the number of vibrations in an hour, or five in a ſecond; but as it will be ſeen preſently that there are only half as many audible beats as vibrations in this detached eſcapement in a ſecond, this circumſtance would induce any perſon, not previouſly acquainted with it, to conclude that the train is a lower or ſlower one than is uſed in an ordinary watch, though the reverſe, in point of fact, is the truth. In ſome of the beſt box chronometers, the pinions are 10, and the train = 14400, owing to the large ſize of the balance. At *e* is a ſlender ſpring ſcrewed to the pillar plate, and preſſing againſt the tail of a lever or detent, fixed to the arbor, *f*, and reſting like a click in the inclined teeth of the large or perpetual ratchet, the edge of which ratchet wheel is juſt viſible above the large wheel under the fuſee, but is ſeen better in *fig.* 7; the little ratchet and its click are not ſeen in this 2d figure, but is ſeen alſo within the perpetual one in *fig.* 7.

Fig. 3 repreſents the balance detached from its verge and regulating-ſpring after being taken from its collet on the verge; there are three radial arms meeting and uniting at the centre, which carry each a third part of a circle; this circle is at firſt turned in a lathe out of a ſolid compound plate of ſteel and braſs, a circular plate of ſteel of the required diameter being covered with braſs by immerſion in a crucible of this metal melted previouſly by heat, after which it is divided into three equal portions, which will, by theſe operations, be of ſimilar dimenſions and weight when nicely divided;

divided; this method of uniting the metals, and of forming the balance in a lathe, was the invention of Mr. J. Brockbank senior, though never before publicly known; at the outer end of each of the three radial bars, which are of steel, are three screws of adjustment for time, and also for position, at *a*, *a*, and *a*, where the three portions of the compound circle are supported by their respective radial bars, or sometimes a little at one side. When the chronometer gains considerably, each of these three screws are screwed back or outwards, to increase the momentum of the balance by enlarging its effective dimensions, but the quantity of adjustment must be precisely the same in each of the three screws, supposing the balance previously in equilibrio in all positions. On the contrary, when there is a considerable loss in the rate, the three screws must be alike screwed in a certain quantity, depending on the quantity of the daily error, which a little practice only will determine; but when one of the three screws is screwed in for position, each of the other two must be screwed half the same quantity out, and *vice versâ*, the taps being the same in all. The convex side of the rim of the balance is brass, and the concave side steel; the superior expansibility of the former, therefore, will occasion the remote ends of each of the three expansion pieces, forming the circle, to approach the centre of the balance in high temperatures, by reason of those ends being at liberty, and the opposite ends being fixed to the radial bars; but in cold weather the contrary will be the case; the brass, being more liable to contract with cold, as well as more liable to elongate with heat, than steel, exerts a natural effort, in low temperatures, to straighten the expansion bar, and therefore makes the remote end, in each of the three, recede from the centre of the balance; again, the same heat that makes the remote end of each expansion piece approach the centre of the balance, makes, at the same time, the radial levers elongate, and consequently removes the fixed end of the same expansion pieces from the centre a certain quantity, and *the compensation* consists in a due balance of the two opposite and contemporary motions of the opposite ends of each of the three expansion bars. It is found from experience that the momentum of the balance is best preserved in an equable state by loading each expansion piece with a metallic weight of similar dimensions, and so contrived that they may slide along the expansion pieces, by adjustment, till the exact point is found such in each, that the equipoise of the whole is not destroyed, and yet that the momentum will remain the same in the opposite extremes of temperature, as well as at a medium. The additional weights are denoted by the letters *b*, *b*, and *b*, which have a groove and a screw each, to fix them to the expansion rims. If the additional weights of compensation, *b*, *b*, *b*, were screwed close to the screws of adjustment for rate and position at *a*, *a*, and *a*, it is evident that, as the radial bars are there elongated by heat, these loads would thereby be carried outwards so as to increase the momentum of the balance sufficiently to make the chronometer retard, being an effect similar to that produced by turning the screws *a*, *a*, and *a*, back from the centre; also if the said weights were fixed at the remote ends of the expansion rims, which ends move inwards with the greatest velocity, while their fixed ends are moving but slowly outwards, it is equally evident that, if the weights are too large, which are thus made to approach the centre with the greatest possible velocity, the momentum of the balance will thereby be diminished too much, and the chronometer will have an accelerated rate; there is, consequently, a certain load, which, being fixed in a certain point between the opposite ends of each of the three expansion rims, will render the momentum of the balance least liable to vary in the different degrees of temperature; for if the weight is comparatively small, it must necessarily be fixed near the end at liberty, but if comparatively large, it must necessarily be fixed at some distance from the said end; but until it has been determined in practice, or by experiment, what diameter is best for a given weight of a compensation-balance, with a given escapement and maintaining power, it is not easy to assign the precise quantity of each weight, and the corresponding point in its expansion piece where it ought to be fixed, in order to produce the best practical effect, i. e. the greatest quantum of invariable momentum with the least possible friction and resistance from the air. Various experiments, no doubt, have been tried in the adjustments of the balance, to effect this purpose in the best manner, taking into consideration, moreover, the relative thickness of the brass and steel of the expansion rims; though scarcely any thing has yet been published on the subject; to aid the views of those who are thus laudably employed, we presume to suggest, that the *shapes* of the loading pieces, and of the adjustment screws at present in use, are calculated to meet with too much resistance from the air; and if clock-makers wish to avoid such resistance, by a proper shape given to their balls or bobs in a pendulum, where the momentum is very great, surely the same object is worthy of the notice of the makers of chronometers. Mr. Brockbank once used weights shaped like a double cone, but laid them aside again, supposing it to be a matter of indifference. How far our suggestion may prove useful may be proved experimentally by trying the variation of rate of any machine, small enough to admit of being put under the receiver of an air-pump, whilst it is kept in a complete vacuum, or nearly so; this experiment, however, should not be attempted where there is not a syphon or other gage, to indicate to the eye the state of exhaustion during the trial. A gentleman who tried this experiment, informs us, that the variation in the rate of one of Brockbank's chronometers, was only about one second per day minus.

In the balance before us there is a pin screwed into the remote end of each expansion-piece, exactly opposite to as many projecting pieces of metal borne by the radial arms at *c*, *c*, and *c*, which additions might appear to have something to do with the compensation, but they are only precautionary contrivances, called guard-pieces, to prevent the bending of the expansion-rims too much inward or outward by any jerk or other accidental cause. In the most modern of Messrs. Brockbanks' chronometers, the load of the expansion-pieces is shaped as at *d*, in *fig.* 3, where a third additional screw is put in the direction of a tangent, to adjust for small errors in temperature, where the screws only are moved without the loads, which otherwise might be moved too much, so as to effect more than the desired quantity. *Fig.* 4, is the cock of the banking, marked *e*, in *fig.* 1, but on an enlarged scale; it is screwed down to the plane of the upper plate by the screw A, and kept immoveable by the steady-pin, denoted by a diminutive circle near the screw: B is a small piece of metal borne by a light arm that has a joint, the centre pin of which is seen represented by a dot on the end of the cock near the screw C; this screw is so placed on a side-piece fastened to the cock, that the end of it bears against the side of the joint-piece, and acts as a rest to prevent the joint from opening further than the adjustment requires: D is a very slender straight piece of balance-spring, not blued, with one end in the piece B, and the other in the cock, so that if any slight force is applied on the side of piece B, this piece will have a motion on its centre towards D, but will return to its original position by the force of the flat spring D. E is an erect pin attached to the radial arm, marked *f* in the balance, as exhibited in *fig.* 1, which pin has a triangular head that remains contiguous to the projecting pin in the piece B, and very nearly touches it in the present position in both figures: now the cylindrical spring of the balance may be so adjusted, that the pin E shall be a quarter of a circle, or any given number of degrees, from the piece B, when this spring is in its quiescent state. Suppose it to be a quarter of a circle; and suppose the balance put into a forward motion by any accidental external force; if this force should be great, the balance would revolve, perhaps, two whole revolutions in its circle without any obstacle to stop it, which would overset it, and endanger the teeth of the escapement wheel, which would hobble on irregularly; to avoid such effect, Mr. J. Brockbank sen., having observed that the coils of his spring enlarge their diameters, particularly near the upper end, when wound up by one entire revolution of the balance, ingeniously hit upon the idea of making this protrusion of the coils of his spring subservient to the purpose of limiting the extent of the vibration of his balance, or of constituting the contrivance called the *detached banking*. In an ordinary watch a pin is put into the rim of the balance, which projects sufficiently to prevent its passing two little studs, placed at equal distances from the point of quiescence of the said pin, which studs, therefore, limit the quantity of the whole arc of vibration: this quantity, consequently, when two studs are used, must necessarily be less than a circle, even if the common escapement would admit of such a long vibration; and if one stud only were placed just a semicircle each way from the pin's quiescent point, the limit would then be an exact circle, after deducting the thickness of the stud; but in a chronometer one entire vibration generally exceeds a circle, when the piece is clean; a circumstance which constitutes one of its excellencies, by augmenting its momentum; hence the contrivance wanted was to allow the balance to vibrate more than an entire circle, and then to stop it at a given part of the second revolution: to effect this purpose, the late Mr. J. Brockbank invented the mechanism already described in *fig.* 4, which acts thus; when the balance first begins to vibrate, the coils of the spring do not alter their shape, and the pin E of the balance passes the piece B attached to the cock untouched, the position of B not having been altered by any external force; but when the balance comes round a second time, the protrusion of the coils becomes great enough to strike against the piece B, placed near the spring; it now yields to the impulse of the protruding part of the spring, and moves towards D, taking its pin along with it; and in this new situation it is that the pin of B is presented to the head of the pin E, carried by the balance, and acts as a banking-stud to prevent the further vibration, or, perhaps, we should say rotation, of the balance; in the contrary motion of the balance it cannot be overturned, by reason of the locking-spring not being moved by the backward motion of the lifting pallet. The contrivance before us is certainly an ingenious one, and, we understand, answers its intended purpose very well. The weight of the pin E is, of course, counterpoised in the adjustment for position.

Figs. 5 and 6 represent the escapement-wheel, pallets, and springs used in the business of alternately locking and unlocking the teeth of the pallet-wheel, on an enlarged scale, and as they would be seen by an eye placed over the principal cock, if the upper plate were transparent; but they are hid by this plate in *fig.* 1; the wheel, however, may be seen on its arbor projected on the fusee in *fig.* 2, and the pallets may easily be conceived to be put under the upper plate, through an aperture in the plate, and to be attached to the lower part of the balance-verge above the lower pivot, which pivot, we have said, rests on the crank part of the potence DEF, beneath the said plate, which potence is also supposed transparent. The shorter, or inner slope of the tooth is directed, not to the centre of the wheel, but to a point in the radius, about $\frac{1}{4}$ from the centre, which mode of shaping is called under-cutting. The same letters of reference apply to both the *figs.* 5 and 6, in which A is the escapement-wheel of 15 teeth, (but of 13 in a box-chronometer,) and B the large pallet of polished steel, first made circular, but afterwards notched, to make way for the teeth in passing, and to receive a piece of finely polished diamond, *c*, at that part of the notch where the end of tooth 1 nearly touches it in *fig.* 5; the little dotted piece *d*, like a bird's head, placed on the balance-verge, concentric with the large pallet, but below it, so as to be covered by it, is the lifting or unlocking-pallet made of steel, set with sapphire: C is a long slender spring, screwed to the under side of the upper plate, carrying a protuberance, *a*, called the locking-pallet, and embracing at its loose end, by a semicircular bend, the verge of the balance, the bent part of which, being hid under the large pallet B, is represented by a curve line of double dots: D is another very slender spring fixed by a pin at *c* into a hole in the end of the bar *c d*, which is elastic, and screwed to the potence at *d*; the screw *c* is tapped into a stud in the potence, and bears against the bar *c d*, and adjusts the length of D, which reaches a little beyond the curved end of the locking-spring, called also sometimes the detent-spring; this slender spring D is denominated the unlocking-spring, because the lifting or unlocking-pallet, hitting it on the end, drives it against the crooked end of the locking-spring, and thereby forcing the pallet *a* from a tooth of the wheel, unlocks the wheel and leaves it under the controul of the maintaining power; lastly, *b* is a screw, which, supported by a little tapped cock, constitutes a rest for the detent-spring, when it has returned, in consequence of its elasticity, from the situation it was driven to by the lifting pallet. The two slender springs C and D point in the same straight line through the centre of the balance-verge; and the action of the escapement-mechanism is this: suppose the balance to be at rest in the first place, and the respective positions of the parts as in *fig.* 6, the circular side of the large pallet nearly in contact with tooth 1, and the tooth preceding it; the lifting pallet must be as in *fig.* 5, a little short of the end of the unlocking-spring D, and tooth 2 resting on the locking pallet *a*; while every thing remains in this state, the maintaining power is suspended by the tooth 2 being detained by the locking-pallet *a*, and the machine will not have power to put itself into motion; but let some external force be applied to put the balance in motion, by turning the chronometer suddenly round horizontally, or otherwise, and, supposing the motion impressed to be in a direction from B towards the lifting-spring D, the angular point of the lifting-pallet, moving along with the balance and large pallet B, strikes the extreme end of the locking-spring D, and drives it, and also the bent end of the locking-spring C, against which the other rests, far enough to disengage the locking-pallet *a* from tooth 2 of the escapement-wheel; which wheel, therefore, instantly runs on by the impulse through the train, in a direction towards *b*; but in the mean time the sapphire face of the pallet, moving with the balance, has got before tooth 1; this tooth, therefore, now strikes the said face of the large pallet and urges it on, we will suppose, till it arrives at the line joining the centre of the wheel and great pallet, as is represented in *fig.* 5; in this situation, it will be seen, the lifting-pallet has quitted the end of the lifting or unlocking-spring, and the

the locking-pallet *a* is about the mid-way between tooth 2 and tooth 3: during the continuance of this portion of the wheel's impulfe on the face of the large pallet, the extreme end of tooth 1 has flided forwards along the plane of the pallet's face, which we have faid is fapphire, and, therefore, produces but little friction; but now, as the tooth 1 advances in its revolution beyond the line joining the centres of the wheel and large pallet, it proportionably returns along the face of the fapphire, till, at length, it completely efcapes the pallet, in which fituation it would run on violently, but by this time the locking-fpring has returned to the end of fcrew *b*, and has prefented its locking-pallet to receive tooth 3, which has juft arrived at this pallet, when tooth 1 drops from the large pallet; the train, confequently, is again detained, and the balance proceeds in its vibration, together with the large and lifting pallets, in a ftate completely detached from every obftacle, except the balance-fpring, which fpring, by being wound up, oppofes its free motion, and, at length ftops it; the ftation, however, is but of fhort duration, as the balance-fpring conftantly exerts its power to bring back again the balance; it returns; the back or curved part of the lifting-pallet ftrikes the end of the lifting fpring D at the inner fide, which being very flender gives way, and the locking fpring, not being difturbed, remains in *ftatu quo*. The returning force of the flight fpring, D, is exhaufted at the inftant of its arrival at its point of former quiefcence, and the balance proceeds in its retrograde vibration, by the accelerated force it has acquired on its arrival at this quiefcent point, until the oppofition of its fpring renders it again ftationary for an imperceptible moment, after which the original procefs, which has been defcribed, is refumed, and an alternation of backward and forward vibrations is perpetuated by means of one little impulfe, given by each fucceffive tooth of the wheel, as long as the maintaining power continues in a ftate of fufficient intenfity. With a given maintaining power and a given efcapement-wheel, the momentary impulfe given to the balance, in any chronometer of this conftruction, has its intenfity meafured directly by the effective length of the large pallet, in any fituation of the acting tooth; whence the intenfity of the impulfe would be a minimum in the fituation exhibited in *fig*. 5, in a point lying in the line of the centres, if this fituation were not the moft favourable to the tranfmiffion of the impulfe; but as the wheel here impels the pallet in the direction of a tangent from its point of action, and as this tangent is alfo perpendicular to the face of the pallet, the effect on the balance is here the greateft, independently of the force from the accelerated velocity. The lifting-pallet makes its ftroke at that part of the balance's vibration, when it has come within 20° of its original point of quiefcence, and as the fcale of forces may be confidered as changing foon after this point from an increafing to a decreafing one, there will here be very little difturbance produced in that fcale; befides, the continuance of the faid ftroke will be fmall as well as its force great by being near the point where the velocity is a maximum.

Again, in any chronometer of this conftruction, the arc of continuance of the wheel's action on the great pallet is inverfely proportional to the diameter of it, compared with that of the efcapement-wheel; therefore the larger the pallet the fmaller is the arc of action, and *vice verfâ*; but then, we have faid, that the impulfe is proportionably larger or more intenfe; it is probable, therefore, that there is a medium between a large impulfe given in a fmall arc of action and a fmall impulfe continuing during a larger arc of action, which medium may produce an effect moft fteady and moft in concert with the varying fcale of momentum in the different parts of the total vibration. Mr. Earnfhaw has laid much ftrefs on the circumftance of his large pallet being of half the diameter of the efcapement-wheel; but the inference does not appear to have been the refult of any nice calculations or varied experiments of his; for before him his mafter, the fenior Mr. Brockbank, ufed a pallet in his pocket chronometer, exactly fimilar, though it was a trifle lefs in his box one: but Mr. Arnold's large pallet, in general, is much fmaller, though fome of his chronometers have had as large pallets as thofe of either of the other two. Mr. Miles Brockbank informs us, that his brother and he found from experience, that a fmall pallet does not produce fo large a vibration as a large one with the fame maintaining power.

Fig. 7 exhibits a view of the great wheel, and two ratchets with their clicks fitted to the large end of the fufee, and conftituting, with it, what is called the *going fufee*; the conftruction is more fimple than that of Harrifon's, which we endeavoured to defcribe without a drawing, and anfwers its purpofe equally well. The ratchet, *a*, or fmall ratchet, is fixed by two fcrews or pins to an excavation in the large end of the fufee, the central part being left perforated for the fufee-arbor to pafs through, and its plane lying in the plane of the end of the fufee; its click and fpring, *b*, are fcrewed to the plane of the large or perpetual ratchet, *c*, which has its teeth inclined in a direction contrary to thofe of the fmall ratchet, *a*, and are bedded in a groove turned in the end of the fufee, between the fmall ratchet and great wheel; we have fhewn but one click for the fmall ratchet, but generally there are two, one at each fide of it; the click-fpring of the perpetual ratchet is fcrewed to the upper plane of the pillar plate, as feen at *e* in *fig*. 2, where it will be feen that the click turns on an arbor, and acts as a detent; *e* (*fig*. 7.) is the great wheel, and *fig*. 8 is a horfe-fhoe fpring, bedded between the perpetual ratchet and the great wheel, a circular groove being turned in the plane of the large wheel, or it might be in that of the large ratchet, or partially in both, to form a bed for this fecondary fpring; the pin, *a*, at one end of the fpring, is inferted into a correfponding hole in the bed of the wheel, and the other pin, *b*, into a fimilar hole perforated through the perpetual ratchet at *f*; this fpring, thus connected with both the great wheel and perpetual ratchet, would produce no other effect than to attach them together, and make them like one wheel, if the horfe-fhoe piece were not elaftic, in which cafe the large ratchet would be fuperfluous, and the effect produced would be that of an ordinary fimple ratchet; but the piece in *fig*. 8 is of a fpring temper, and its elafticity fmall enough to be acted upon by the main-fpring, fo as to make the two pins, *a* and *b*, at the ends approach each other; and in this fituation it is that the fecondary fpring is faid to be wound up, and in which it continues whenever the chronometer is going. When the key is applied to the fufee-arbor to wind up the piece, the click, *b*, will flide over the ferrated teeth of the fmall ratchet, *a*, which revolves with the fufee, and the large ratchet, *c*, would alfo revolve a little way with it, to let down the intenfity of the fecondary-fpring, which now exerts its force to remove its ends apart from each other to their natural ftate as they are feen in *fig*. 8.; but the click or detent, held to its teeth by the fpring *d*, prevents this little motion from *b* towards *a*, which otherwife would have taken place from the pulling of the pin *b* inferted into its little hole; in confequence of this oppofition to the great ratchet's temporary motion by the action of its detent, the pin, *a*, at the other end of the fecondary-fpring pulls at its hole in the great wheel, and draws it towards *b*, or, in other words, draws the great wheel round in a contrary direction, and with a force equal for a time to that of the original maintaining power by which the two pins were made to approach each other. The reafon of pin *b*, in *fig*. 8, being made to project both ways acrofs the end of the fecondary

condary ſpring, is, that the remote end beyond b may move in a circular little aperture made through the plane of the great wheel behind f in *fig.* 7, which aperture allows the two ends of the ſpring to approach and recede ſteadily, and the length of the aperture is determined by the quantity that pin b is drawn by the main-ſpring towards pin a before there is an equipoiſe in their intenſities.

Some years ago Mr. Ed. Troughton contrived a jambol or gimbol for preſerving the horizontal poſition of a pocket chronometer at ſea, which is loaded with a weight, turning on the point of a pin, like the card of a compaſs, and continues to be made by Meſſrs. Brockbank and Co. with conſiderable advantage to the going of the chronometer. The order of the adjuſtments is this: firſt the adjuſtment for temperature is made in heat of from 90° to 120° of Fahrenheit, and alſo in as great a degree of cold as can be obtained; ſecondly, the chronometer is cleaned anew, and has freſh oil put on; thirdly, the adjuſtment for rate and poſitions is made; and, laſtly, the rate is taken. There are, beſides the three pallet-faces of ſapphire, eight jewelled holes in the beſt chronometers; viz. two at the balance verge pivots in the cock and potence, two at the pivots of the eſcapement-wheel, and two for each of the two next wheel pivots, called the fourth and third wheels of the movement, beginning with the great wheel as firſt, but the third and ſecond of the train, if we count from the centre or hour-wheel. The pivots are tapering, in the form of a cone, and bear on their ends in action, which ſhape gives ſtrength, without adding to the friction.

It cannot be expected that the beſt chronometers will ever be manufactured at ſo low a price as watches without the compenſation and detached eſcapement; but when, as many different hands are employed in making their ſeveral parts, as are employed in the making and finiſhing of an ordinary watch, we may expect that the price will be proportionably reduced; the loweſt price that we have been informed of, as the price of any good maker for a pocket chronometer, is forty guineas, but in general they cannot be afforded for ſo little when all the adjuſtments are well made, which take up much time as well as patience. At preſent the *movement*, that is, the frame containing the barrel, fuſee, wheels, and pinions, all but the eſcapement-wheel, is made, like the movement of a watch, by the different workmen employed for this purpoſe in Lancaſhire; the motion or dial-work is next added by a workman in London, who has the main-ſpring, chain, face, and hands, from the reſpective makers in town; then the eſcapement-maker and the jeweller are employed to finiſh their departments; and, laſtly, the *maker*, as he is called, finiſhes the adjuſtments, and puts the works into the box, or caſe, or both, as may be required. In the progreſs of theſe different ſtages, or even after the adjuſtments are begun, it is frequently neceſſary to alter, and many times to change certain parts, as the ſprings, compenſation-rims, adjuſtable weights, &c. which neceſſarily enhance the price the chronometer might otherwiſe be afforded for.

The teſtimonies, both public and private, of the accuracy of ſome of Meſſrs. Brockbanks' chronometers in meaſuring time, are ſufficiently numerous to eſtabliſh their credit. Several letters from naval officers and rates were delivered to the Board of Longitude during the time of Mr. Earnſhaw's application for remuneration, which cannot be reſtored without an order from the Board; otherwiſe it would have been in our power to have laid ſome of them before the public. Governor Hunter, in his publication, has given a teſtimony ſo extraordinary, that we cannot, in juſtice, with-hold it; he has aſſerted, that, from the time of his ſetting out from Port Jackſon in New Holland, on a twelve months voyage round a great part of the globe, in the courſe of which he remained ſome time at the Cape of Good Hope, to the time of his return to the ſame port, a time-keeper or chronometer by the Brockbanks was found to have gone ſo well, that the error, at the end of the voyage, did not exceed *one ſecond* of time. This, however, will be conſidered rather as an extraordinary coincidence of the ſtate of the watch at the beginning and end of the voyage, than as a proof that its accuracy was thus great at all the intermediate parts of the voyage. Mr. Gavin Lowe, of Iſlington, has a pocket chronometer, the rate of which was given to Sir Joſeph Banks to be laid before the Board of Longitude, which, we have heard, exceeds, in accuracy, the rate of any other pocket chronometer that has been made, inaſmuch as that the rate in it is not ſenſibly affected by cleaning in the courſe of many years wear. But, as we have ſaid, it is not our intention to preſs upon the public attention the merits of any individual maker excluſively, we ſhall ſatisfy ourſelves with copying only one additional teſtimony in favour of our preſent maker, from the report of lord Hugh Seymour, who tried three of Mr. Mudge's time-keepers againſt one of Mr. Earnſhaw's and one of Meſſrs. Brockbanks' chronometers, in a cruiſe from the 18th of May, 1796, to the 19th of Auguſt following.—The report was this: viz.

"At noon, May 31ſt, the town of St. Mary, on the iſland of that name, bore N. 10° W. diſtance 30 miles. The longitude of the ſhip, at that time, taken from the requiſite tables and corrected by the above bearings, gave 25° 3′ 15″ W. Mr. Mudge's watch, called No. 4, gave 1′ 45″ W. Mr. Mudge's watch, called *green*, gave 1′ 45″ E. Mr. Mudge's watch, called *blue*, gave 9′ 15″ E. Theſe watches were taken from the academy at Portſmouth, May 10. A watch made by Mr. Earnſhaw gave 3′ 45″ W. and one made by Mr. Brockbank gave 15′ 45″ E. of the ſhip's place. The mean of all gave 4′ 18″ E. Theſe two laſt watches were too ſhort a time on board at Spithead to obtain their rate exactly, *but were given a new rate this day.*

"At noon, June 4th, the town of Delgada, on the iſland of St. Michael's, bore N. 5 miles. The ſhip in the longitude of 25° 42′ W. No. 4 at that time gave 11′ 15″ W.; *green*, 5′ W.; *blue*, 5′ E.; Earnſhaw, 2′ 15″ E.; and Brockbank, 1′ 45″ E. The mean of all 1′ 30″ W. of the ſhip's place.

"At noon, July 16th, Cape St. Vincent bore N. 81° E. 4 miles. The ſhip in the longitude of 9° 7′ W. No. 4 at that time gave 3′ 15″ E.; *green*, 10′ 30″ W.; *blue*, 13′ 30″ E.; Earnſhaw, 16′ 30″ W.; and Brockbank, 2′ E. The mean of all 1′ 39″ W. of the ſhip's place.

"At four in the afternoon, Auguſt 12th, the light-houſe of St. Agnes was ſeen bearing N. diſtance 19 miles. The longitude of the ſhip at that time was 6° 28′ W. and ſuppoſing Scilly to be in *that* longitude. No. 4 gave 27′ 30″ E.; *green*, 8′ 30″ W.; *blue*, 18′ 15″ E.; Earnſhaw, 56′ 30″ W.; and Brockbank, 6′ 15″ E. The mean of all 2′ 30″ W. of the ſhip's place.

"At noon, Auguſt 13th, the Start bearing N. 28° E. diſtance 19 miles: the longitude of the ſhip was 4° 5′ 15″ W. No. 4 at that time gave 28′ 15″ E.; *green* 9′ 15″ W.; *blue* 17′ 15″ E.; Earnſhaw 59′ 15″ W. and Brockbank 6′ 45″ E. The mean of all 3′ 9″ W. of the ſhip's place.

"At Spithead, Auguſt 18th, the ſhip in the longitude of 1° 7′ 20″ W. No. 4 gave 30′ 20″ E.; *green*, 12′ 10″ W.; *blue*, 15′ 50″ E.; Earnſhaw, 1° 11′ 10″ W.; and Brockbank, 7′ 20″ E. The mean of all, 5′ 55″ W. of the truth."

From this report it is evident, that, after a proper rate was aſſigned, Meſſrs. Brockbanks' chronometer performed with a degree of accuracy which far exceeded any one of the other four, indeed, we may ſay, which has ſeldom been equalled by any other chronometer.

 After

After being apprifed of thefe and other teftimonies, we inquired why the Brockbanks never applied to parliament for a public trial of any of their chronometers, with a view of obtaining the premium under the act of Geo. III., and received for information, that, after having been refufed a private trial at the Royal Obfervatory, and on finding that much trouble was likely to attend the application to the Board and fubfequent public trials, the idea at one time entertained was given up; which circumftance is our reafon for having troubled the reader with lord Hugh Seymour's report at full length.

CHRONOMETER by *Mr. Arnold.* After the minute defcription of all the parts of Meffrs. Brockbanks' chronometer, it would be fuperfluous to repeat here an account of fuch parts as are common in all the modern chronometers; we therefore propofe to omit the drawings of the movement and other portions of the mechanifm contained within the frame of both Mr. Arnold's and Mr. Earnfhaw's chronometers, and beg leave to refer thofe readers who wifh to fee all the individual portions of each of thefe two, to a pamphlet lately publifhed by the Hon. Commiffioners of Longitude, which is charged five fhillings, and in which are contained three plates of each author, together with the defcriptions of the plates, and the queftions put by the Board of Longitude relative to each conftruction, together with the anfwers. This pamphlet is entitled, "Explanations of Time-keepers conftructed by Mr. Thomas Earnfhaw, and the late Mr. John Arnold," Payne and Mackinlay, Strand, 1806. The movements are made with pinions of 8 or 10, according as they are intended for pocket or box-chronometers, to which the correfponding wheels for trains of 14,400 or 18,000, may be had by infpection in our tables under our article CLOCK-MOVEMENT, calculated on purpofe for the workmen who are movement-makers, and who chiefly refide in Lancafhire. It may be neceffary to mention, that Mr. Arnold's box-chronometers have very ftrong main-fprings requiring a deeper barrel than is neceffary for the length of the frame pillars, on which account there is a cap fixed on the plane of the upper plate, to receive the lower pivot of the barrel arbor, and to hold the click and click-fpring of the ftrong ratchet, as placed on the fquare of this projecting arbor; but there is no occafion for fuch addition in the pocket-chronometer. The efcapement-wheel A, fhown in *fig.* 1, of *Plate* XIV. of *Horology*, is Mr. Arnold's, on an enlarged fcale, and, like Meffrs. Brockbanks', is placed near the lower end of its arbor, within the frame, fo as to have only a fmall portion of it feen by an eye placed over the cock, when the piece has its natural pofition reverfed: this wheel is what is called a *funk* one; that is, it has its teeth, like thofe of a cylinder-efcapement-wheel in this refpect, projecting from the plane of the wheel, as feen in *fig.* 2, which reprefents a fide-view of the fame wheel. The fhape alfo of the teeth of the wheel before us differs from that of Meffrs. Brockbanks' and Mr. Earnfhaw's in another refpect: the triangular acting part of each tooth, which is raifed from the plane of the wheel, is bounded by two ftraight lines and a curve; the curved portion, which acts with the jewelled face of the large pallet B, and which Mr. Arnold jun. in his defcription calls a *cycloidal curve*, is defcribed as being generated by the revolution of a fmall circular piece of metal with a tracing-pin in its circumference, while it rolls on the circumference of a larger metallic circle, as a bafe, and is, therefore, properly fpeaking, *epicycloidal*; a cycloid being generated by a circle rolling on a ftraight line: the proportions of the generating circle, and its bafe are ftated to be as the diameter of the large pallet to that of the efcapement-wheel; but, by confulting what we have faid on the proper fhape of acting teeth in an impelling-wheel in our article CLOCK-MOVEMENT, the reader, we prefume, will agree with us, that, to have as little friction as poffible, the fmall circle with the tracing-point, called the generating circle, ought to be equal to the *radius*, not the *diameter*, of the large pallet; which pallet may properly be confidered as a pinion for the fhort time it is impelled by a tooth of the efcapement-wheel; in the fame place, above referred to, it will be feen, indeed, that the difference of the curves, generated by a tracing-piece equal to the diameter, and by a tracing-piece equal to the radius of the fame wheel or pinion, will fcarcely be fenfible till the two curves have been carried on farther than is neceffary for forming a fmall tooth; fo that the diftinction in theory makes no confiderable difference in practice, which we here mention, left an unfavourable opinion fhould be entertained of the teeth in queftion: but, what may feem to fome of our readers a curious circumftance, when the epicycloidal tooth in any wheel is formed by a generating circle of double the fize it ought to be from theory, the friction of the parts in wear will ultimately produce the curve that ought to have been originally formed by a generating circle of a due fize, provided the tooth of the wheel acting with it is of a proper fhape, and of a more durable metal; becaufe, when the teeth of any two wheels that act together are both formed truly from proper generating circles rolling on proper bafes, thefe teeth will roll over one another without, or nearly without friction, and preferve their original figure unimpaired; but if one of the two fhall happen not to have the exact curve, the friction in the action will wear away the fuperfluity of fubftance beyond what ought to have been there to conftitute the true curve; and as a large generating circle gives a fuller tooth than a fmall one, there will neceffarily be that fuperfluity in its fize which we have fuppofed to exift, when the diameter is ufed for radius in the generating circle. Thus a flight deviation from the true epicycloidal fhape of the tooth of any wheel will be rectified by its action with a lefs deftructible body of an exact fhape for true action, and it will be feen, under the article to which we have already referred, that a *ftraight line*, the particular fhape of the jewelled face of the large pallet, is one of the varieties of an interior epicycloid generated by any generating circle revolving on the concave fide of a circle of *twice its diameter* ufed as a bafe of generation.

We made thefe obfervations under an impreffion that Mr. Arnold's tooth *rolls* over the furface of the face of the pallet during the time of its impulfion, in which cafe the friction and deftruction of the parts of contact would have been the *leaft poffible*; but on examining his drawing more minutely, and on adverting to the queftions put to Mr. Arnold, junior, by the Board of Longitude, we find that the tooth of the wheel always continues to act at the extreme point of the pallet's face, over which angular point, probably rounded a little, the curved part of the tooth *flides* inftead of rolling, by reafon of every acting part of the tooth coming in fucceffion to the fame point of the pallet. This mode of action does certainly require that the ratio between the generating circle and its bafe fhould be exactly as ftated by Mr. Arnold; it being that particular cafe where a wheel drives a lantern pinion with fmall fpindles, as may be feen by the reference we have more than once given to CLOCK-MOVEMENT. However, we are ftill perfuaded, that to give an impulfe to the large pallet without friction, would be more defirable than the method before us, if it is equally practicable. An adoption of the mode we have propofed would, we think, on mature confideration, require either the wheel to have more teeth than has been uſual, or the pallet to be larger, to which we ſee no objection, as the arc of action would in either caſe be diminiſhed.

"The ſize of the pallet depends upon the number of teeth in the eſcapement wheel, ſays Mr. Arnold, in his Deſcription of his father's eſcapement. The radius of the pallet ſhould be equal to the diſtance between any two teeth of the wheel, and then their relative motions will be equal. If the wheel has twelve teeth, the radius of the pallet will be thirty degrees, meaſured on the circumference of the wheel, and its diameter ſixty degrees (nearly), meaſured in the ſame manner, which will make it half the ſize of the wheel. If it has thirteen teeth, the pallet will, in diameter, meaſure fifty-five degrees and a half; if fourteen teeth, fifty-one degrees and a half; and if fifteen teeth, which is the number generally applied to pocket time-keepers, it will be forty-eight degrees. The marine (or box) time-keeper is made to beat half-ſeconds, the balance making 240 vibrations both ways in a minute; for if the balance-wheel has 15 teeth, the fourth wheel 80 teeth, and the balance pinion 10 teeth, there will be 120 beats, or half ſeconds, in one minute. It is alſo made with the eſcapement wheel of 12 teeth, the balance pinion having 7, and the fourth wheel 70 (counting from the great wheel); conſequently there will be 120 beats or half ſeconds in one minute, as before. It has been already remarked that the pallet for 12 teeth muſt be half the diameter of the wheel, and for 15 teeth five-twelfths, or fifty degrees.

"The pocket time-keepers, that they may not be diſturbed by motion, have what is called a quicker train, the ſeconds hand making 150 beats upon the dial, or 5 beats in two ſeconds. The eſcapement wheel has 15 teeth, the balance pinion 8 teeth, and the fourth wheel 80; conſequently there will be 150 beats in one minute, the pallet being 50 degrees in diameter, meaſured upon the diameter [ought to be circumference] of the balance-wheel. No mention has been made of the numbers of the teeth in the other wheels and pinions, as they are of little or no importance, and may be varied conſiderably."

We beg leave to differ here from Mr. Arnold, being decidedly of opinion that pinions of 6, 7, and even 8, are by no means ſo well calculated to tranſmit the maintaining power equally, as pinions of 10 and upwards; indeed Camus has demonſtrated in his chapter on the proper ſhape of teeth of "*Cours de Mathematique*," lately tranſlated into Engliſh, that no ſtrong pinion with a number of teeth under 10 will act with a wheel of ordinary ſize, entirely on one ſide of the line joining the centres of the acting wheel and pinion; therefore will not act without much friction; beſides, the more numerous the teeth are in a given wheel, provided the ſtrength of the tooth be ſufficient for its purpoſe, the leſs the teeth take into thoſe of the pinion, and conſequently the leſs the friction, in this ſecond point of view; if pinions of 12 or upwards were to be adopted in watch-movements and clock-movements, the advantage accruing from the adoption would be conſiderable, provided the weight of the wheels, towards the third and fourth wheels, were as little as their requiſite ſtrength will admit.

Mr. Arnold has given four poſitions of his eſcapement wheel in *Plate* III. of his deſcription, delivered to the Board of Longitude; figure one ſhows the wheel locked, and the balance returning in a detached ſtate from its ſecond excurſion; the ſecond figure ſhows the ſituation of the three pallets at the inſtant of unlocking; the third, which is our *fig.* 1, of *Plate* XIV., ſhows the ſituation of the different parts when the impulſe is half given, the jewelled face of the large pallet being in the line that joins the centres of the eſcapement wheel and pallet; and his figure four exhibits the parts at the moment when the impulſe ceaſes to be given by the acting tooth of the wheel. After what we have ſaid of the mode of acting in Meſſrs. Brockbanks' eſcapement, it will eaſily be apprehended what thoſe relative poſitions are from a verbal deſcription; particularly as we have put the ſame letters to the correſponding parts of both eſcapements, to aſſiſt the reader in comparing what we have before ſaid with our preſent deſcription. A is the eſcapement-wheel of Mr. Arnold's marine or box chronometer, made of braſs, and having 12 teeth, with their triangular ends projecting upwards, or rather downwards, when the face is up, from the plane of the wheel; B is the large impelling pallet of ſteel, at firſt made circular, like Meſſrs. Brockbanks', but having its notch terminated by two ſtraight lines pointing to its arbor, in one of which its jewel *c* is fixed; C is the locking ſpring, ſcrewed at its remote end to the under ſurface of the upper plate, and playing in a notch, or ſtraight groove made in the plane of the plate to receive it; its weakeſt part is about C, or between C and the fixing ſcrew, about which point it may be ſaid to turn as on a centre, but having no pivot, it requires no oil; about the middle of this ſpring, C, is a ſecond weaker ſpring, D, attached to it, which, in Meſſrs. Brockbanks', is a detached ſpring lying at the oppoſite ſide of the great pallet, and pointing to its centre; the end of this ſlender ſpring, which is called the unlocking ſpring, comes nearer towards the centre of the large pallet than the ſame end of the ſpring C; the ſaid two ſprings, thus attached together, have a great reſemblance, as they are ſeen in the figure, to a metallic pen in a pocket caſe of inſtruments, when one of the nibs is longer than the other; nearly at one third of the ſpring C, from this interior end, and on the ſide next to the wheel at *a*, is the locking pallet, the acting portion of which is a jewel; this jewelled pallet reſts againſt the heel of the tooth, or neareſt angular point towards the centre of the wheel, and in the act of unlocking is driven *inwards*, to allow the projecting portion to move *behind* it, when the wheel is unlocked; but, leſt the locking ſpring ſhould yield to the preſſure of the wheel when locked at any time, a ſcrew *b*, tapped into a ſtud in the upper plate oppoſite the pallet, *a*, bears againſt the exterior ſide of the locking ſpring, to prevent its falling back beyond a certain limit. In the drawing, the pallet appears to be a continuation of the ſcrew through the ſpring, on account of being placed over, or very nearly over it: the centre of motion of the unlocking ſpring, D, is near the ſcrew we have juſt deſcribed, from which it is free, by being narrower than the locking ſpring, C, and conſequently alſo weaker, when equally thin; the unlocking ſpring, D, therefore, is at liberty to move back towards the ſcrew-head without affecting the poſition of the locking ſpring, C, but when, by an impulſe received, it moves in a contrary direction, it muſt neceſſarily take the locking ſpring along with it, and conſequently the pallet, *a*, attached to this locking ſpring alſo. The lifting, or unlocking pallet in Mr. Arnold's conſtruction, is a ſtraight piece of ſteel, *d*, carrying a jewel, pointing not in a direction nearly oppoſite to the face of the large pallet, as is the caſe in Meſſrs. Brockbanks', but in one vibration follows the face of the large pallet a very little, and in the other precedes it as much: if two lines were drawn along the acting faces of theſe two pallets, which are fixed by friction on the verge of the balance, the angle contained would be very ſmall in the figures given by Mr. Arnold, in conſequence of his locking on the ſecond tooth, but we have not exact data whereby to calculate it, as will be ſeen more particularly in our account of Mr. Earnſhaw's chronometer, which

which follows, becaufe we are not informed by Mr. Arnold where the unlocking pallet refts when the regulating fpring of his balance remains quiefcent. Meffrs. Brockbanks' efcapement wheel, like Mr. Arnold's, locks, as we have feen, at the neareft tooth behind the face of the large pallet, whereas Mr. Earnfhaw locks at the third, counting the tooth of action one, as will be feen by and by; but, unlike all the others that we have feen, Mr. Arnold's locking fpring receives an impulfe *inwards*, to ftrike the locking pallet from the tooth of its wheel: we pretend not to affert, from theory, that this kind of action is either more or lefs favourable to the efcapement than when the locking pallet is driven *outwards*; in either cafe, if the face of the tooth is fuch, that the efcapement wheel has no recoil during the difengagement, the total refiftance will be nearly fimilar; for though that part of the tooth, which is neareft the arbor of the wheel, preffes on the pallet more than the extreme points would do of the *fame wheel*, under the fame circumftances, in confequence of which, the preffure is here greater near the termination of the impulfe given to the locking pallet than at its beginning, yet we do not conceive this to be any difadvantage, becaufe the locking pallet may thus be fuppofed to be unlocked gradually, rather than by a fudden jerk, which muft be partly the cafe, when the preffure of the wheel's tooth againft the pallet is a maximum at the commencement of the impulfe that detaches the locking pallet. When, however, a comparifon of this kind is made between two efcapement wheels, we ought to take into the account their relative diameters, the relative maintaining powers as exerted at thefe wheels, the relative ftrengths of the regulating fprings, as well as of the locking fprings, and alfo the relative points in the arcs of vibration where the unlocking pallets ftrike, compared with the relative points of quiefcence of the balance fprings; all of which are data, involving a complexity of calculations not entered into, we prefume, by the chronometer maker, when he feels difpofed to prefer one conftruction to another, on views more fuperficial.

We have already faid, that in our *fig.* 1., the wheel is at the middle point of its arc of action, confequently, the lifting pallet *d* has let go the contiguous end of the unlocking fpring D, and the pallet *a* has returned to the fcrew point, to be ready to receive the next following tooth 3.; the direction of motion being fuch, that the teeth, 1, 2, 3, &c. follow one another in fucceffion. In this fituation, it appears to us, that the heel of tooth 2, which is now moving, is too near the pallet *a* in the figure; for, when the other half of the impulfe has been given, and the tooth 1 has efcaped the pallet, the tooth 3, which is now nearly two-thirds of a fpace from the pallet *a*, will have one-third drop before it arrives at it, which muft be prejudicial to the fteady motion of the balance. It is eafy to fee, that, during this vibration of the balance from D towards *c*, the unlocking pallet *d* muft have hit the projecting end of D before it paffed it, and alfo muft have carried it and the fpring C, together with the pallet *a*, towards the wheel, until the pallet *d* cleared the extreme end of D; alfo that the impulfe given in paffing muft have been of a continuance depending on the quantity that the end of the fpring D prefents of its length to the paffing pallet *d*; in the returning vibration, there will be the fame continuance of the impulfe given by the pallet *d* to the fame fpring D in a contrary direction, but then the flender fpring is the only one to be moved, and it yields to the flighteft impulfe, thereby occafioning no fenfible derangement in the fcale of forces by which the regulating fpring controuls the balance: hence one impulfe received from the maintaining power through the medium of the train, by the face of the great pallet during the angle of its action, or rather of the efcapement wheel's action on it, is fufficient to overcome all the friction and refiftance the balance meets with, from whatever fource, and to perpetuate its vibrations. From the prefent pofition of the refpective parts of action, it is alfo eafy to fee, that the impulfe given to the end of fpring D muft have taken place a very fhort time before the tooth 1 caught the face *c* of the large pallet, on which time depends the quantity of *drop* of tooth 1, before it comes into action; which drop ought to be very fmall, left an accelerated force fhould impel the large pallet with a jerk, and endanger fome of the finer pivots. Mr. Pennington tells us, that the prefent pofition of pallet *d* is very nearly that in which the balance fpring ought to be quiefcent, in order that the chronometer may be well in beat, a circumftance not noticed in Mr. Arnold's account, but a very effential circumftance to be known, when we judge of the fitnefs of the efcapement for anfwering its purpofe for a long continuance; for, as the momentum of the balance is always a maximum when it paffes the quiefcent point of its regulating fpring, or, in other words, when the force of this fpring ceafes to be accelerated, and begins to be retarded, it is acknowledged, we believe, univerfally, that the nearer this point of greateft momentum the balance is, when the unlocking pallet makes its ftroke, the lefs is the derangement in the uniformity of the balance's motion, which its regulating fpring is intended to produce: but, it has been faid, that the prefent pofition is that of original quiefcence of the regulating fpring; and it will be obferved, that there is an arc of feveral degrees contained between the extreme ends of pallet *d*, and fpring D, if a circle were defcribed to touch them both; whence, it might be concluded, that the pallet *d* ought to touch the end of fpring D, when the regulating fpring is at its quiefcent point, for then the ftroke would be made exactly at the moment of its having the greateft momentum: fuch conclufion might be good in theory, and, indeed, this is the pofition which Mr. Earnfhaw has given in his drawings, when he defcribes his balance as being in a ftate of quiefcence; but we fhall referve what we have to fay further on this important point, till we come to fpeak more particularly of Mr. Earnfhaw's efcapement in our following fection. In the mean time, we will only generally obferve, that, to put a chronometer, with a detached efcapement, *into true beat*, the pallet *d* muft be in the middle of the arc of efcapement, which we fuppofe to be nearly in the pofition of our figure, when the balance-fpring is quiefcent. Any further notice here on the mode of acting in this efcapement, we think unneceffary. *Figs.* 3 and 4, exhibit Mr. Arnold's balance; the former fuppofes the eye placed over the centre, and the latter at one fide in a line paffing through its plane. The circular bar of metal *a*, *b*, carrying three weights of adjuftment for pofition, within the expanfion pieces *c*, *d*, in *fig.* 3, we underftand, were added to the original balance by Mr. Arnold junior; but the generality of his chronometers have not had fuch addition, being capable of the neceffary adjuftment without.

The expanfion rims, which are about the third portion of a circle each, were originally foldered together by an intermediate mixture, and bent into the requifite fhape by a pair of pliers fhaped on purpofe to give the defired curve regularly; and, in fome of the *beft* chronometers, Mr. Arnold informs us himfelf, that he ftill continues this practice, which is greatly reprobated by Mr. Earnfhaw; we will not undertake to decide the practical queftion, which, in theory, we fhould have lefs difficulty to decide; the regularity of weight and fhape enfured by turning in the lathe, which was at firft the fenior Brockbank's practice, and is fince that of

Mr.

Mr. Earnſhaw, who formerly worked under him, ſeems to promiſe fairly for anſwering the purpoſe beſt, particularly when two metals only are united by fuſion; but, it is contended by Mr. Arnold, that the true figure given in the lathe no longer remains when the ring is cut into portions, ſuch as halves or thirds; for he ſays, the ſeparate parts aſſume, by their elaſticity, an inſtantaneous alteration in their figure, generally becoming portions of a circle of ſmaller radius than that of the original ring, and the ſeparate portions do not always undergo a change exactly ſimilar, owing to circumſtances which cannot be eaſily detected. To ſatisfy our doubts reſpecting this objection to turning an expanſion ring in a lathe, we applied to Mr. Pennington, who is allowed to be inferior to none of his contemporaries in practical ſkill, in all the different conſtructions of modern date, and we find it to be his practice, like Mr. Arnold's, not only to bend his expanſion pieces with pliers, but alſo, to ſolder them previouſly, as he formerly did thoſe of Mr. Mudge's; and he is convinced that his balances, though perforated in many places to receive various ſcrews of adjuſtment, are as ſenſibly and regularly obedient to the changes of temperature as thoſe of any other maker: it may be proper to add here, that Mr. Pennington has an excellent regulator, with a compenſation pendulum of a peculiar conſtruction; and that he has lately fitted up a little room with an inſulated brick and ſtone pillar for his tranſit inſtrument; of which he is fully acquainted with the uſe and neceſſary adjuſtments.

The ſcrews *d*, *d*, in *figs.* 3 and 4, are for rate; the cylindrical pieces, *c* and *c*, tapped for the ſcrews at the ends of the expanſion pieces, and having little holes at their exterior ends for a fork ſcrew-driver, are for the adjuſtment for temperature; and the two additional ſcrews, *e* and *e*, are for the adjuſtments for poſition, particularly when the interior ring *a b* is not introduced: theſe laſt ſcrews, *e*, and *e*, when uſed for poſition, will alter the momentum of the balance, and conſequently the rate of going, if one of the two is not juſt as much ſcrewed in as the other is ſcrewed out, when the rate is previouſly adjuſted, unleſs, indeed, there is a difference in their relative dimenſions and weights, which, in this caſe, would interfere with the adjuſtment for temperature.

Mr. Arnold uſes a cylindrical ſpring with his balance, and is very particular in aſcertaining the exact effective length that ſhall produce the ſame rate, whether the arc of vibration be long or ſhort; the trial of this adjuſtment is made by uſing the main-ſpring greatly relaxed, or let down by its ratchet, and again when it is ſet high, or has its intenſity increaſed; which alteration is equivalent to an addition or ſubtraction of weight in the maintaining power of a clock in order to increaſe or diminiſh the arc of vibration in a pendulum. When the chronometer is new, or clean if uſed ſome time, the ſemi-arc of vibration varies according to circumſtances from 180° to 230°, making in the whole vibration from a circle to 460°; but, when the oil grows thick, or when dirt has obtained admiſſion into the upper part of the train, the arc will ſometimes be reduced to 240°; ſo that, if the long and ſhort arcs were not performed in the ſame time preciſely, an alteration would take place in the rate, which might be conſiderable enough to do away all dependence on an accurate meaſurement of time. The balance-ſpring is uſually made by Mr. Arnold of ſteel wire hardened and tempered, though he ſays that wire hard rolled, or wire made of gold with a mixture of from one-eighth to one quarter of copper, will do; but the two latter are leſs permanently elaſtic, and the hard rolled wire will ſometimes require to be tapered, at that end which is next the balance ſtud: the beſt length of a balance-ſpring, which is longer in box than in pocket chronometers, lies between 5 and 20 inches to become iſochronal; but Mr. Arnold does not ſeem to apprehend, that there are various intermediate lengths, as Mr. Pennington aſſerts, which are equally iſochronal. In the box chronometer, which has a heavier balance than the pocket one, and a ſlower train, the weight is taken from the ſupporting pivot of the verge, by an ingenious application of the cylindrical regulating ſpring thus; when the ſpring is wound round a cylinder, to be blued, the coils are put contiguous, which ſhape would be afterwards preſerved from the elaſtic temper then given to it, if no force were to ſeparate them; but when one end of the ſpring is attached to the verge collet, and the other to the ſtud, theſe oppoſite ends are forcibly removed from each other to ſuch a diſtance, that the coils are ſeparated from contact, and the effort, exerted to bring them again into contact by their elaſticity, lifts nearly the whole weight of the balance. Formerly, there was a contrivance for banking in Mr. Arnold's chronometers, but the banking pin or lever rubbing between two coils of the ſpring, was found to be injurious, and was therefore laid aſide; and we do not learn that any other banking has been ſubſtituted. Mr. Arnold lays great ſtreſs on his ſtud being placed ſo as to fix the end of his balance-ſpring at half the diſtance between the centre and circumference of the coils, ſo that the laſt coil, at each end, is made ſo much ſmaller than the reſt, as prevents any protruſion of the large coils, and preſerves the cylindrical ſhape apparently unaltered by the action.

We underſtand, that neither of the two Arnolds ever placed a chronometer for trial at the Royal Obſervatory, for the expreſs purpoſe of applying for parliamentary remuneration; but we have ſeen, under our account of Mr. Mudge's time-keeper, that Nos. 36 and 68 were tried againſt his, and pronounced to be ſuperior, both with reſpect to their accurate going, and alſo in regard to the ſimplicity and practicability of their conſtruction; ſo that 1322 l. were given to Mr. Arnold ſenior by the Board of Longitude at different times by way of encouragement, and 1678 l., its complement to 3000 l., were given in December 1805 to Mr. Arnold junior, being at the ſame time that 2500 l. were given to Mr. Earnſhaw, in addition to the 500 l. which he had previouſly received. When the queſtion was difficult to decide, whether Mr. Arnold's or Mr. Earnſhaw's chronometers were moſt worthy of public reward; the Board of Longitude very properly rewarded the labours of both theſe makers.

Mr. Arnold, like Meſſrs. Brockbanks, was deſired to lay before the Board of Longitude ſome of the rates of chronometers made by his father and himſelf, which have not been returned to him, but the public are in poſſeſſion of the certificates of ſeveral rates which Mr. Arnold publiſhed in the year 1791; which rates are copied into Mr. Dalrymple's publication, together with ſome additional teſtimonies, which are too long for us to introduce here, and which, therefore, we muſt requeſt thoſe readers to refer to, who wiſh to be informed of all the particulars ſtated in the certificates; it is ſufficient, for the purpoſes of the general reader, that we have given him the peculiarities of the conſtruction of the chronometer itſelf, together with an hiſtorical notice of Mr. Arnold's inventions, and an account of the mode of action of the eſcapement; the general merit of chronometers of this conſtruction no diſintereſted perſon, that we know of, has yet denied.

Chronometer by *Mr. Earnſhaw.*—For the ſame reaſon that we have not given the movement and parts of the chronometer contained in the frame of Mr. Arnold, we think it

G not

not necessary particularly to describe all the parts of Mr. Earnshaw's that are common to the other modern chronometers. The peculiarities of the construction are confined to the balance, the balance-spring, the escapement-wheel, and the acting parts of the escapement. To these parts, therefore, we propose to confine our account. Mr. Earnshaw says, that his train is the best possible, viz. 1800 vibrations of the balance in an hour, which, we have seen, has always been the train of the other chronometer-makers, particularly for the pocket ones; his box pieces have 13 teeth each in the escapement-wheel, and his pocket ones 15, like those of Messrs. Brockbanks'; we are not told what pinions are used in the movements; nor is it said, in Mr. Earnshaw's account delivered to the Board of Longitude, that this is a consideration of any moment. *Fig.* 5 of *Plate* XIV. is an exact copy of Mr. Earnshaw's *fig.* 1 of his *Plate* III., which was taken from his model laid before the Board of Longitude on June 7th, 1804, at the same time that Mr. Arnold's model was produced; the plate and cocks, being not necessary for explaining the mode of action, are in our figure omitted. Mr. Earnshaw has given so minute an account of his escapement accompanying the model, that we cannot describe it better than by copying his own words, which are nearly these: viz.

"The small wheel M S K is called the large pallet; it is a cylindrical piece of steel, having a notch or piece cut out of it at *l h r;* against the side of this notch is a square flat piece of ruby, or any hard stone, *h l*, ground and polished very smooth, and fixed fast into the pallet. The cylinder is so placed, with respect to the balance-wheel, that it may not be more than just clear of two adjoining teeth. E F is a long thin spring, which is made fast at one end, by being pinned into a stud, G, and made to bear gently against the head of an adjusting screw, *m:* the other end is bent a little into the form of a hook; to this spring there is fixed another very slender spring at *y*, which projects to a small distance beyond it. This small spring lies on the side of the thick spring nearest to the balance-wheel. The adjusting screw, *m*, takes into a small brass cock, at *a p*, which is screwed fast to the upper plate by a strong screw. Upon the spring E F there is fixed a semi-cylindrical pin, which stands up perpendicular upon it, and of a sufficient length to fall between the teeth of the balance-wheel A B C D. This pin is called the locking-pallet, and is placed on the opposite side of the spring represented to view. Through the centre of the cylindrical pallet M S K, a strong steel axis passes, called the verge; the pallet is made fast to this axis, which also passes through the centre of the balance, and is made fast to it; it has two fine pivots at its extremities, upon which it turns very freely, between two firm supporting pieces of brass, screwed firmly, and made as permanent as possible, by steady pins, to the principal plate. A little above the cylindrical pallet M S K is fixed a small cylindrical piece of steel, *i n*, having a small part projecting out at *i*, through which the verge also passes; this is called the lifting pallet, (and is from $\frac{1}{3}$ to $\frac{1}{2}$ the diameter of the large pallet); it fixes upon the verge like a collar, and is made fast by a twist, so as to be set in any position with respect to the large pallet M S K. The end E G of the long spring E F being made very slender, if a small force be applied at the point *o* to press that end out from the wheel A B C D, it easily yields in that direction, turning, as it were, upon a centre at G; it is also made to slide in a groove made in this stud, in such a manner that the end *o* may be placed at any required distance from the centre of the verge. Having described the several parts as they appear in the figure, we next come to their connection or situation with respect to each other. Let the long spring E F be supposed to be so placed, that the end of the slender spring *y i* may project a little way over the point of the lifting-pallet *i n*, but not so close but that the point of the pallet may pass by the hooked end of the spring E F without touching it; the head of the adjusting-screw *m* is also supposed to bear gently on the inner side of the said spring E F, or that nearest to the wheel, and at the same time the locking-pallet is so placed, that one of the teeth, D, of the balance-wheel may just take hold of it. This pallet is not visible in its proper place in the figure, being covered from sight by the screw *m*, and part of the spring E F; its position is therefore represented by the dot *k*, on the opposite side of the wheel, having the tooth A just bearing up against it. From the above description of the several parts of the escapement, and their connection with each other, it will be easy to see the mode of its action, which is as follows:

"A force being supposed to be applied to the balance-wheel, so as to cause it to move round in the direction of the letters A B C D, one of the teeth, as D, will come against the locking-pallet (as represented at A, and the locking-pallet by *k*). The wheel is then said to be locked, being prevented from moving forward by this pin. Let the balance be now supposed to rest in its quiescent position, and it will have the situation represented in the figure; the lifting-point *i* of the pallet *i n* will be just clear of the projecting end of the slender spring, the face *h l* of the large pallet M S K will fall a little below the point of the tooth B, and the balance having its spiral or helical (meaning cylindrical) spring applied to it remains perfectly at rest in this position. Now, as the balance and the two pallets M S K and *i n* are fixed fast to the verge, it is plain they must all move together; let, therefore, the balance be carried a little way round in the direction of the letters M S K; by this motion the end *i* of the lifting-pallet *i n* will be brought to press up against the projecting end of the slender spring, and as this spring is fixed on the side of the spring E F, nearest to the balance-wheel, the point *i* will press the two springs together out from the balance-wheel; then, as only the point of the tooth D (see its position at *k*) touches the locking-pallet, when the spring E F was at rest against the head of the screw *m*, it will, by the spring being pressed out from the tooth, have slipt off (for the locking-pallet which was before supposed at *k*, will now be at *a*, clear of the tooth A of the balance-wheel); the wheel being now at liberty will move round by the force supposed to be applied to it; but as the point *i* of the lifting-pallet moves on and presses out the spring, the point *l* of the large pallet approaches towards the point of the tooth B of the balance-wheel, so that when the spring E F is sufficiently pushed out to unlock the wheel, the point *l* of the large pallet will be got to *d*, and in this position the point of the tooth B of the balance-wheel will fall upon it, at the same time the point of the tooth D has just dropped off from the locking-pallet *m;* the force of the wheel being by this means applied to the top of the pallet *h l*, gives an increased momentum to the balance, and assists it in its motion in the same direction, and by the continued motion of the large pallet in the direction M S K; the point of the tooth B, which keeps pressing and urging it forward, moves up towards the bottom of the face of the pallet towards *h*, until the plain flat surfaces of the tooth and pallet come into contact; by this time the end, *o*, of the slender spring has dropt off from the point, *i*, of the lifting-pallet, and the two springs have returned again into their quiescent position, the spring, E F, gently bearing against the head of the adjusting screw, *m*, and the locking-pallet in a position to receive the next tooth,

C,

C, of the balance-wheel. When the two furfaces of the tooth and pallet are thus in contact, the greateft force of the wheel is exerted upon the pallet, and of courfe upon the balance moving with it. The tooth ftill preffing againft the face of the pallet, and the pallet moving in the direction MSK, it at laft drops off, leaving the balance at perfect liberty to move on in the fame direction in which it was going. Juft as the point of the tooth B, which has been preffing the large pallet round, is ready to leave it, the next tooth, C, of the wheel is almoft in contact with the locking pallet m, fo that the inftant the tooth B drops off, the wheel is again locked, and the action of that tooth upon the balance is finifhed. As the balance moves with the greateft freedom upon its pivots, the force of the tooth has given it a confiderable velocity, fo that the balance ftill keeps moving on in the fame direction, after the preffure of the tooth is removed by flipping off from the pallet, until the force of the pendulum-fpring (which is not reprefented in the figure) being continually increafed by being wound up, overcomes the momentum of the balance, which, for an inftant of time is then ftationary, but immediately returns by the action of the pendulum-fpring, which exerts a confiderable force upon it in unwinding itfelf. As the balance returns, the point i of the lifting pallet $i\,n$ paffes by the ends of two fprings, EF, γ o, and, in paffing by, pufhes the projecting end, o, of the flender fpring in towards the balance-wheel, until it has paffed it; after this, the projecting end o again returns and applies itfelf clofe to the hooked end of the fpring EF, as before. The fpring $\gamma\, o$ is made fo flender, that it gives but little refiftance to the balance, during the time the point i of the lifting pallet is paffing it, and of courfe caufes but little (if any) decreafe in its momentum. During the time the point i of the lifting pallet is paffing in the fmall fpring $\gamma\, o$, the long fpring EF remains fteadily bearing againft the head of the adjufting fcrew m, as the hooked end at o juft lets the end of the lifting pallet pafs by without touching of it. As the fpring has now been continually acting upon the balance, from the extremity of its vibration in the direction MSK, it has given it the greateft velocity, when the point i of the lifting pallet is paffing the end o of the flender fpring; for at this inftant the fpring which was wound up by the contrary direction of the balance, is now unwound again, or in the fame ftate as it was in its quiefcent pofition at firft, and of courfe has no effect upon the balance at all in either direction; but the balance, having now all the velocity it would acquire from the unwinding of the fpring, goes on in the direction SMK, until the force of this fpring again ftops it and brings it back again, moving in the fame direction as at firft, with a confiderable velocity. By this return of the balance, the point i of the lifting pallet comes up again to the projecting end o of the flender fpring, pufhes back the long fpring EF, and unlocks the wheel; and another tooth falling upon the face of the pallet $h\,l$ gives frefh energy to the balance; and thus the action is carried on as before."

In this quotation we have given the original letters of reference, but as the balance and cocks are left out in our *fig.* 5, the direction of the balance has been indicated by the letters referring to the large pallet, which, being placed on the fame verge, has the fame motion. We have added two dotted lines in the large pallet to fhew that the direction of the lines, bounding the notch in the circumference, is towards a point in the radius of it, equally diftant from its centre and circumference; alfo we have added two fimilar dotted lines from two feparate teeth, to fhew that the undercutting or floping of the interior fide of the tooth is likewife directed to a point equally diftant from the centre and circumference of the wheel, which point is at double the diftance from the centre compared with the point guiding the undercutting flope in Meffrs. Brockbanks' chronometers; for the interfecting dotted lines form tangents to the dotted circle defcribed with half the radius of the wheel. The locking fpring points directly to the balance arbor, but is laid in fuch a way as not to be an exact tangent to a radial line drawn from the centre of the wheel to the locking pallet, the angle formed at the pallet being fomewhat lefs than a right angle, in order, as Mr. Earnfhaw fays, "that the wheel may have a tendency to draw the fpring into it," for fafe locking. The efcapement wheel, balance, balance-fpring, pallets and fprings for locking and unlocking are at the outfide of the upper plate, and are prefented to view when the cock is taken off. We hardly underftand Mr. Earnfhaw's reafoning, when he fays that his fcape wheel "unlocks in a fimilar circle which the wheel makes, which renders it a perfect dead fcape," and that "Mr. Arnold's is locked on the other fide of the wheel, and in the act of unlocking the fpring moves in towards the centre of the wheel, which is a different direction to that which the wheel takes, and produces a recoil." In the firft place we are at a lofs to conceive how the pallet on the detent-fpring and the point of a tooth in the wheel can move in a *fimilar circle*, to fize, or direction of motion, unlefs the radii are alike, and the centres of motion coincident; and in the next place, we fee no reafon to conclude that a pallet carried *directly from* the centre of the wheel's motion fhould be confidered in the fame direction as that of a tooth in the wheel, any more than a pallet carried *directly towards* the centre of the fame, in the act of unlocking; in both cafes, if the detent fpring is a tangent to the tooth of the wheel that holds the pallet, the motion *in* or *out* will be at right angles to the circumference of the wheel, and if the tooth is confiderably undercut there muft neceffarily be a recoil in both cafes. The only correction for this is, to make the angle formed by the detent fpring and radial line of the wheel at the refting pallet, to be as much lefs than a right angle, as the angle of undercutting is; accordingly Mr. Earnfhaw fays he has made this angle a little lefs than a right angle, but then he has undercut his tooth much more than the difference, and therefore, as appears to us, there muft be recoil, or a little backward motion in the fcape wheel, in the act of the detent pallet's efcaping; whereas Mr. Arnold's locking pallet refts againft a ftraight line directed towards the centre, which is alfo the direction of the pallet's motion in unlocking, confequently there can be no fenfible recoil in his efcapement. In our defcription of Mr. Arnold's efcapement the reader may recollect that he was referred to this place for fome further account of the proper *adjuftment for beat* in a chronometer of the modern inftruction, we here refume the fubject with an obfervation of Mr. Earnfhaw himfelf which we have already quoted; "let the balance, fays he, be now fuppofed to reft in its quiefcent pofition, and it will have the fituation reprefented in the figure," alluding to the figure which we have copied: we prefume not, merely upon the ftrength of our theoretical reafoning, to affert, that the adjuftment for beat is improper, if the balance fpring is quiefcent when the face of the lifting pallet i is in contact, or nearly in contact with the end of the unlocking fpring $i\ \gamma$, but we are affured by workmen well qualified to judge, and who give fcientific reafons for the affertion, that the lifting pallet is not only about 24° on one fide of the requifite point of pofition, but is actually at the wrong fide of the unlocking fpring; the reafon given us is this, whenever a chronometer is in *true beat*, the quiefcent point from which the excurfions of the balance commence is is in the *mean point* of the angle of escapement; this is obviously the case in the anchor escapement of a pendulum clock, and requires a necessary adjustment when the clock is at first fixed up; and a little consideration will prove that an attention to this adjustment, though not equally obvious, is equally desirable in a chronometer. What is called the angle of escapement differs from what is called the angle of action, or angle of impulse, in a chronometer; the former is included in the arc comprehended between the point where the unlocking spring lets go or escapes the face of the lifting pallet, and the point where the impelling tooth of the wheel drops off or escapes from the face of the large pallet; but the second, or arc of impulsive action, is comprehended, between the point where the impelling tooth commences, and the point where it terminates its action; this second arc is smaller than the former, and is always contained in it; the two have indeed one common termination, but each has a separate commencement; for the wheel must necessarily be unlocked before its action on the large pallet can begin, and the unlocking takes place previously to the unlocking or lifting pallet's quitting the end of the unlocking-spring: if we suppose that the slender spring *i q* bends back, the space of 4°, more or less, before the unlocking-pallet *n i* quits it, after the wheel is unlocked, this quantity will constitute the difference between the arc of escapement and the arc of the wheel's action, provided there be no drop of the impelling-tooth on the heel of the large pallet after the wheel is unlocked, and before the action commences; but if we suppose the said drop to be also 4°, then will the whole arc of escapement exceed the whole arc of action on the pallet by 8°. Admit now that the escapement-wheel and large pallet have their diameters to each other as 2 : 1, which is the ratio Mr. Earnshaw in general adopts, and that this wheel have 13 teeth, which is the number in his box-chronometer; then $\frac{360°}{13} = 27°.7$ nearly, is the distance between the points of two successive teeth; admit also that there be a second drop of 2° from the tooth to be locked to the locking-pallet after the arc of action is finished; then the sum of the two drops, $4 + 2 = 6°$, that precede and follow the arc of action, being subtracted from 27°.7, or whole distance between the two nearest teeth, leaves 21°.7 measured on the circumference of the wheel for the total arc of action on the pallet; but the wheel is double the diameter of the pallet, therefore, the same quantity is $21°.7 \times 2 = 43°.4$ measured on the circumference of the large pallet, and the arc of escapement exceeds the arc of action, on our supposition, by 8°, consequently, $43°.4 + 8° = 51°.4$ will be the arc of escapement: now it will be seen, on referring to the plate, that Mr. Earnshaw has placed his lifting-pallet in the figure within less than 4° of one of the two extremities of the arc of escapament, and on that side of the unlocking-spring *i y*, towards which this spring bends at the instant of the lifting-pallet's final escape; and yet he says that this is its situation when the balance-spring is in a state of quiescence; let us try what will be the consequence of such a position; the chronometer will measure time very well, and the impulse of the lifting-pallet, we allow, will be given at the most favourable instant, namely, at the instant of the spring's quiescence, or point of the balance's greatest momentum, which, it is evident, was Mr. Earnshaw's reason for fixing his lifting-pallet so; but then, which is our objection, as one excursion of the balance from the point of rest must necessarily be 47°.7 (51°.4 − 4°) before it clears the arc of escapement, and as the excursions must be similar to the right and left, when the balance vibrates freely, the whole arc of vibration can never be diminished to less than 95°.4, in this case, without the chronometer's stopping, which, as the chronometer has not the power of commencing motion of itself, is a very serious objection to the present position of the lifting-pallet; it may, indeed, be said, in reply, that the chronometer must be very dirty before its arc of total vibration becomes so much diminished as to be little more than a quarter of a circle, but this is not the only predicament in which the stoppage will take place; any sudden check, or quick horizontal motion given to the vibrating balance, that makes it return even once before it has exceeded this limit, will bring it to rest; that is, nearly the same effect will be liable to be produced as if the arc of the escapement had been almost double the present quantity with a pallet of ½ the diameter of the wheel, which is Mr. Earnshaw's cogent objection to Mr. Arnold's construction. In making this comparison with a double arc of escapement, we, of course, suppose the point of the lifting-pallet's quiescence to be in the middle point of the arc of escapement, as Mr. Arnold's appears to be in his figure, which we have copied, and which situation we now proceed to show, is most favourable to the continuance of the chronometer's going without interruption with any given pallet. We propose to place the lifting-pallet's face exactly in the middle point of the arc of escapement, which is not a theoretical proposition of ours, but we have examined chronometers adjusted so for beat, and have found that, when the balance is drawn round a trifle beyond either extremity of the escapement-angle, they have the power of commencing motion within a limit very little exceeding the escapement-angle, which, in Mr. Earnshaw's box-chronometer, we have shown, may be about 51°.4. Hence the chance is almost two to one in favour of that chronometer's avoiding stoppage by dirt or accident, which has its quiescent lifting-pallet in the middle of the arc of escapement, compared with that which has the same pallet at one end of the same arc.

The only objection which carries the semblance of argument against our mode of adjustment for beat, an adjustment we believe too generally overlooked, is, that the impulse of the lifting-pallet is not at the moment of the balance's greatest momentum, but about 24° before the momentum is a maximum, allowing the pallet to be quiescent at the middle of the arc of escapement, which we contend for; our reply is, that the momentum is so nearly a maximum at 24° from it that the difference produces no sensible bad effect on the balance, compared with the probable effect from stoppage when the adjustment for beat is nearly as bad as possible. Indeed, Mr. Atwood has calculated, and his calculations seem to have been verified by practice, that when, in the case of Mr. Mudge's time-keeper, the quiescent point of his auxiliary spring is at one side of the quiescent point of his stronger spring, the effect produced is a daily gain or daily loss in the rate, accordingly as the distance from coincidence of the respective points of rest fell on the right or left hand side of the quiescent point of the strong regulating spring, and the daily gain or loss thus to be effected is ingeniously proposed, in our author's excellent paper in the Philosophical Transactions of 1794, to be used as an adjustment for rate, or even as a compensation for want of isochronism in the balance-spring. The deduction from the momentum of the balance, occasioned by the impulse of the lifting-pallet, being somewhat analogous to the want of adjustment in the quiescent point of Mr. Mudge's auxiliary spring, might indeed produce a slight loss in the daily rate, if the screws of adjustment for rate did not compensate such loss; but when it is considered that the impulse from the wheel succeeds the deduction from the momentum almost instantaneously, and that the deduction

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we ſpeak of is preciſely the ſame in each vibration, the uniformity of the going of the chronometer will not be ſenſibly altered thereby.

Let us ſee, in the next place, what will be the arcs of action and of eſcapement in Mr. Earnſhaw's pocket chronometers, in which the eſcapement-wheel has 15 teeth; $\frac{360°}{15} = 24°$ is the diſtance between two contiguous teeth, from which ſubtract, on our former ſuppoſition, 6° as the ſum of the preceding and following drops, and the angle of action will be 18°, or 36° meaſured on the circumference of the large pallet, if it be half the ſize of the wheel; but the angle of eſcapement will be greater than the angle of action by 8°; therefore $36 + 8 = 44°$ is the whole arc of eſcapement, ſuppoſing, as before, the data for the drops to be accurate. This angle of eſcapement turns out to be leſs, on our ſuppoſition, than that with only 13 teeth in the eſcapement by 7°.4, and therefore will admit a lifting-pallet ſmaller than the box chronometer has, in order to have the ſame angle of eſcapement, or the ſame liability to ſtop by dirt or accident; it being ſelf-evident that the ſame ſubtending line, conſidered as a chord, will meaſure more degrees on the periphery of a ſmall circle than on the periphery of a larger. This compariſon of the two arcs of eſcapement ſhews, that the arc in queſtion depends not entirely on the relative diameters of the eſcapement and large pallet, as Mr. Earnſhaw ſuppoſed, when he objected to Mr. Arnold's proportions, but on their relative diameters conjointly with the number of teeth in the wheel, the latter of which has been overlooked by Mr. Earnſhaw, but particularly inſiſted on by Mr. Arnold. However, we agree perfectly with Mr. Earnſhaw, that in any wheel with a given number of teeth, a large pallet for receiving the impulſe of the wheel will require a ſmaller arc of action as well as a ſmaller arc of eſcapement, than a pallet that has a ſmaller diameter, under any given adjuſtment for beat, which is a conſideration worthy of general notice.

On counting the teeth in Mr. Earnſhaw's eſcapement-wheel, which we have copied, we were ſurpriſed to find only 12 teeth in it, particularly as we are informed, in his deſcription, that his numbers are 13 and 15 reſpectively; we can only account for this circumſtance by ſuppoſing that the draftſman miſtook the number; which we here notice, leſt the reader ſhould ſuppoſe the fault to lie in our figure excluſively.

Fig. 6 of *Plate* XIV. repreſents Mr. Earnſhaw's balance, which, like Mr. Arnold's, has only two compenſation pieces, and thoſe much ſhorter than his, being little more than a quadrant each: *a* and *a* are the ſcrews of adjuſtment for rate, ſcrewed in to make the chronometer go faſter, and out to make it go ſlower. The ſliding pieces *b* and *b* have each a circular groove, turned in a lathe or turning-frame, deep enough to form a bed for the expanſion bars, in order that the interior ſide ſcrews *c* and *c* may preſs againſt the edges of the expanſion pieces, and retain the ſliding pieces in any given ſituation. *Fig.* 7 is a lateral view of this balance and verge without the pivots, which Mr. E. ſays ſhould be conical except very near the ends, which ſhould be cylindrical; and ſhould run in a "jewel hole as ſhallow as poſſible, ſo as not to endanger cutting the pivot; and the part of action of the hole ſhould be made quite back, with only a very ſhallow chamfer behind to retain the oil." The ſliding pieces *b* and *b* are the weights of adjuſtment for temperature; in making theſe weights, a braſs ring is firſt made in the lathe, and is then cut through into fourteen equal parts in a clock-engine, by an operation ſimilar to that of cutting a wheel into fourteen teeth, ſo that each piece is the fourteenth part of a circle, after deducting the thickneſs of the cutter, which is not mentioned. One of the weights in a box chronometer, is about twenty grains generally. The expanſion rims are turned out into a ring from a circular compound plate, which is made after the method of Meſſrs. Brockbanks, by fuſing the braſs in a crucible, containing the ſteel circle, held in a horizontal poſition during the time of fuſion. The conſtruction is very ſimple, but, as it appears to us, if the adjuſtments for poſition were made by means of the ſcrews of rate, and weights for temperature only, one adjuſtment would derange another, and that for poſition would be very difficult to make nicely, as there is no tangent ſcrew, or other contrivance, to move the weights *b* and *b* by gradual ſlow motions. As though to get rid of this objection, which was too obvious to be overlooked, Mr. E. conceives that the cauſes of a difference in the rate in different poſitions, are large balance pivots in part, but principally the badneſs of the balance-ſpring; his words reſpecting the latter cauſe, are theſe; "much difficulty has fallen to the lot of watch-makers in the endeavour to make time-keepers go nearly the ſame in the different poſitions: I have had my ſhare of this, but it is now over; by far the greateſt part of this difficulty ariſes from the balance-ſpring not being properly made. But if the ſpring is made as I ſhall deſcribe hereafter, you have only to make the balance of equal weight, and it will go within a few ſeconds per day in all poſitions alike; and if it vibrates not more than one circle and a quarter, by applying a ſmall matter of weight to that part of the balance, which is downward, when in the poſition that it loſes moſt, (it) will correct it with great accuracy."

The Board of Longitude not knowing what this "ſmall matter of weight" implied, nor how it is to be attached to the balance, were induced to put the following queſtion, viz. "When the weight is wanted to adjuſt the watch in the poſitions of 3 and 9, by what means do you obtain that weight, in the manner your balance appears to be made; if you know any thing more that is material concerning the making time-keepers go nearly the ſame in different poſitions, communicate it."

Anſ.—"To adjuſt the watch in the poſitions of 3 and 9, (ſays Mr. E.) I fix on to one of the compenſation-weights that is downwards, when in that poſition that it loſes moſt, a ſmall piece of braſs, not larger in diameter than a common pin-head, and nearly as thin as foolſcap paper. I fix it on with a very ſmall particle of *bees wax*, not larger than the common dot of an *i*: that is, if the watch is gaining on mean time. But if the watch is loſing, I then take out the balance, and with a drill drill out a ſmall matter from that compenſation-weight, that is uppermoſt when in the poſition that the watch loſes moſt; this I have found to correct it without ſo many ſcrews and fans as I have ſeen in ſome time-keepers." After having read the above anſwer, we were almoſt induced to examine whether the balance itſelf might not alſo be fixed to the verge-collet by bees wax inſtead of ſcrews, but we recollected that in the drawing there is a little ſcrew-head at each ſide of the centre of the balance, which appear to be uſed for this purpoſe. Mr. E. we truſt, will pardon the obſervation.

The rule for adjuſting the balance for temperature is this; put the watch into about 85 or 90 degrees of heat by the common thermometer, mark down exactly how much it gains or loſes in 12 hours, then put it into as ſevere a cold as you can get, for 12 hours, and if it gains one minute more in 12 hours in cold than in heat, move the compenſation weights farther from the arm of the balance about $\frac{1}{4}$ of an inch; and if it gains one minute more in 12 hours in heat than

than in cold, move the weights $\frac{1}{8}$ of an inch nearer to the arm of the balance, and ſo on in the like proportion, trying it again and again, till you find the watch go the ſame in whatever change of heat and cold you put it. Of courſe this adjuſtment precedes the adjuſtment for poſition, ſo that moſt probably the poſition, whatever it is, during theſe trials, is always the ſame, a circumſtance not ſpecified. The total vibration at firſt is confined to a circle and a quarter, which quantity, it is ſaid, will produce the moſt ſteady performance; but we are not informed what the banking is that limits the greateſt vibration, nor indeed whether there is any banking at all, which we have been informed there is not in general.

Mr. Earnſhaw's greateſt difficulty in the progreſs of his labours ſeems to have been to find out what he calls the *inviſible properties* of the balance-ſpring, and to render it not exactly iſochronal, but ſo nearly ſo, that its deviation from iſochroniſm may compenſate for a *relaxation* in the ſpring, real or imaginary, ariſing from conſtant uſe, which is *ſuppoſed* to affect the permanency of the rate. After complaining bitterly of much diſappointment in his firſt labours, our author ſays, "I found, in the courſe of reaſoning on bodies, that watch-ſprings *relax* and *tire* like the human frame, when kept conſtantly in motion; and this may be proved by the following experiment: let a watch, that has been going a few months, go down, let it be down for a week or two, or more, then ſet it going, and if it be a good time-keeper, ſo as not to be affected by the weather, it will go ſome ſeconds per day faſter than it did when it was let down, but it will again loſe its quickneſs in a gradual manner, gaining leſs and leſs, till it comes to its former rate. Therefore, finding that iſochronal ſprings would not do, and likewiſe having made ſprings of ſuch ſhape as would render long and ſhort vibrations equal in time, (which) conſtantly loſe (loſt) the longer the watch went; I then made them of ſuch ſhape as to gain in the ſhort vibrations about five or ſix ſeconds per day more than the long ones; this quantity could only be found by long experience; and the way I proved this, was to try the rate of the watch with the balance vibrating about $\frac{1}{3}$ of a circle, then tried its rate when vibrating a circle and a quarter, and if the ſhort vibrations go ſlower than the long ones, that watch will loſe on its rate, and if they are equal, it will likewiſe loſe, but that only from *relaxation;* and if it gains in the ſhort vibrations more than five or ſix ſeconds in 24 hours, it will in the long run gain on its rate, but if not more than that quantity, and if the time-keeper is perfect in heat and cold, and every other part, the above properties will render it deſerving of the name of a perfect time-keeper: and this is a principal cauſe of my time-keepers excelling all others; and this is the principal cauſe of ſome of my time-keepers going better than others; though by me, the ſprings of them being made to accord more exactly to the above proportions; and this is the cauſe which has enabled me to foretel what my time-keepers would do, which Dr. Maſkelyne, Mr. Croſley, and others can teſtify. The above effect is produced as follows: I find the common *relaxation* of balance-ſprings to be about five or ſix ſeconds per day on their rates in the courſe of a year; therefore if the ſhort vibrations are made, by the ſhape of the ſpring, to go about that quantity faſter than the long ones, and as the ſpring relaxes in going by time, ſo the watch accumulates in dirt (dirt accumulates in the watch more properly), and thickening of the oil (takes place), which ſhortens the vibrations, the ſhort ones then being quicker compenſated (compenſates) for the evil of relaxation of the balance-ſpring." (See Mr. Earnſhaw's "Explanation," pages 8 and 9.)

The Board of Longitude having put the following queſtions on this ſubject, "Explain what you mean by this? and how it is performed?" Mr. E. replied: "All watchmakers know how to draw and taper balance-ſprings, though they did not know how much they were to be tapered to that certain degree which could only anſwer the purpoſe of a complete time-keeper. I perform it in the following manner: take a length of balance-ſpring-wire, ſay about twelve inches for box time-keepers, and draw it between two ſmooth potence files, beginning from the end about $\frac{1}{6}$ of its length, make one draw, the next about $\frac{2}{6}$, and ſo on, advancing $\frac{1}{6}$ every draw till you come to the top, preſſing the files juſt ſo hard together as will make them bite or take hold of the ſpring; do the ſame with two oil-ſtones, only give 12 ſtrokes inſtead of 6, which will take off all burrs which the file left on." ("Explanation," p. 29 and 30.) We are further told, that when the ſpring is *tired* with long continuance of work, its vigour may be reſtored by *reſt*.

Theſe ſprings, that have the inviſible properties deſcribed, "are made of ſoft ſteel, rolled hard, and not hardened and tempered with heat and cold, that proceſs not being at all neceſſary." Their length varies in box chronometers from 12 to 20 inches, and in pocket ones from 5 to 7, like Mr. Arnold's, and the ſhape is cylindrical, with the two extreme coils, each about half the diameter of the other coils, agreeably to the ſpecification in one of Mr. Arnold's patents. The thickneſs of the ſteel in the expanſion-pieces of the balance is about $\frac{8}{1000}$ of an inch, and that of the braſs twice, or nearly three times as thick; the diameter of the balance without the weights and ſcrews $1\frac{1}{3}$, and with them $1\frac{3}{5}$ inch; the total weight of it with weights and ſcrews 3 dwts. 10 gr. The mainſpring barrel is $1\frac{3}{16}$ inch, and the depth $\frac{1}{2}$ inch, and the ſpring in it has from $4\frac{1}{2}$ to 5 turns. The weight of each of the two balance ſcrews is from 5 to 6 grains; and the figure which the expanſion pieces aſſume when cut from the original compound ring is ſuffered to remain unaltered, on a ſuppoſition that bending by any mechanical means will injure the regularity of their obedience to the changes of temperature; the locking and unlocking ſprings are made as weak at the bending parts as are practicable to afford the neceſſary reſiſtance, as a detent, to the eſcapement-wheel; they are brought to ſhape by filing, then ſmoothed with a piece of ſteel and oil-ſtone powder, and laſtly hardened and tempered. The pallets, which are of ſteel, have each a jewel ſet in them, and thoſe on the verge of the balance are twiſted round, and ſet to their ſituations reſpectively by the friction of their central holes. In his laſt anſwer to the queſtions of the Commiſſioners of Longitude, when aſked, "How ſhould the lifting and large pallet be placed with reſpect to each other?" Mr Earnſhaw's words were, "the ſmall lifting-pallet muſt be moved round to ſuch poſition that when the wheel is unlocked the face of the large pallet ſhould be juſt within the compaſs of the wheel-tooth which is to act on it;" but, what appears to us remarkable, no queſtion was aſked by the Board, nor any particular notice taken, that we can find, either by Mr. Arnold or Mr. Earnſhaw, reſpecting the relative poſitions of the lifting-pallet and the quieſcent point of the regulating ſpring, excepting in the inſtance of Mr. Earnſhaw, that we have had occaſion to notice; which notice, we truſt, will benefit not only him, but moſt of the other makers of chronometers, with the detached ſpring-detent eſcapement.

The mention of this eſcapement brings to our recollection a patent which was ſaid to have been taken out for the invention of a detent-ſpring in the name of Wright, a Quaker in the Poultry, and which was, till lately, conſidered to be

Mr. Earnfhaw's patent, but which was never actually taken out, as we have been lately informed from good authority; what part of the fpring conftituted the pretended invention, and how it differed from Mr. Arnold's fpecification, we are not informed; the only difference that we are aware of is, that one fpring-detent unlocks inwards, and the other outwards; but Meffrs. Brockbanks' have always unlocked outwards, though they have not the two fprings inferted into one another, as Meffrs. Arnold and Earnfhaw have: neither do we fee any good reafon for preferring one of the three conftructions to either of the other. They have all been found to anfwer the defired purpofe; and the three makers, who have feparately fold each a thoufand chronometers or thereabouts, have turned out of their hands fome machines that have performed but indifferently, as well as others, that have done them great credit, as well as the navy great fervice.

"Two time-keepers, fays Dr. Mafkelyne, in his preface to the "Explanations," publifhed by order of the Commiffioners of Longitude, conftructed by Mr. Thomas Earnfhaw, were tried three feveral times at the Royal Obfervatory, by order of the Commiffioners of Longitude, for a twelvemonth or more at a time between 1798 and 1802, as candidates for fome of the great rewards held out by the act of parliament of the 14th of his prefent Majefty; but were adjudged not to have gone within any of the limits prefcribed by the act, and, therefore, not thought proper to be fent to fea, to undergo the fubfequent trial required by the act. However, as they appeared to have gone with fufficient exactnefs, in the two laft trials, to be of confiderable ufe in navigation, the commiffioners, on the 3d and 17th of March 1803, refolved unanimoufly to grant to Mr. Earnfhaw the fum of 2500 l. in addition to 500 l. which they had given him before." Sir Jofeph Banks baronet, however, entered *a proteft* againft this *unanimous* refolution, to which Dr. Mafkelyne has replied in a private pamphlet; which, therefore, we cannot further notice; but Mr. Earnfhaw, elated, probably, with his fuccefs, publifhed an advertifement in the public papers by no means calculated to conciliate his very refpectable opponent; in reply to which, Mr. Dalrymple, a gentleman well known to the world as a geographer, has recently written a pamphlet for public circulation, which we here notice, as impartial by-ftanders, that we may fet the author right in fome of his obfervations, which we confider as the produce of his zeal for his friend's caufe, rather than of his mature judgment. The pamphlet we allude to, is intituled "Longitude;" the author of which, fpeaking of the effects of heat and cold on the balance-fpring, and the mechanical means ufed by Harrifon and others, fays thus: "Various modes of correction were practifed; but, as *all* thefe were by *conftraint*, checking the natural effects of heat and cold on the fpring, they were found ineffectual. Mr. Arnold, imitating the fimplicity of nature in her operations, fo conftructed *his balance*, that *heat* and *cold* fhould *enlarge* or *diminifh* it, in the *fame degree* as they operate on the *fpring* of a *watch*, fo that the *effect* muft be *uniform*; the balance, by becoming *larger* or *lefs*, exactly counteracting the effect of *heat* and *cold* on the fpring." (page 13 and feq.). What Mr. Dalrymple's term *conftraint* here means, we do not exactly conceive; our opinion of Mr. Harrifon's curb, or kirb, is, that its inward and outward motion alternately affected by changes of temperature, limited the effective portion of the fpring to the *fame dimenfions*, in point of length, under all circumftances; which limit in the length of the fpring *conftrained* it, to be fure, to become an uniform regulator, or very nearly fo: but that the *enlargement* of the balance fhould counteract the effects of *heat*, or the *leffening* of it fhould counteract the effects of *cold*, is to us a new doctrine, juft the reverfe of what we have been in the habit of propagating; we beg leave to repeat, on this occafion, that the expanfion pieces of the balance are intended to preferve the effective diameter of it unchanged by heat or cold; the fame heat which elongates the radial arms brings the expanfion weights nearer to the centre, and preferves the momentum unaltered; which effect produced on the diameter of the balance is a *conftraint*, as much as the alternate lengthening and fhortening of the balance-fpring is, by artificial means, fimilar in principle, and alike in oppofition to the direct effect of natural caufes. Of the fame nature is the following opinion, in p. 80: "Before I quit the fubject, I muft obferve, that the confidential committee, to whom Mr. Mudge's time-piece was explained, reprefented the *efpecial merit* of it to be in "a contrivance for deftroying the *inequalities* of the *maintaining power* derived from the *main-fpring*." Before that time, the late Mr. Arnold had *entirely* deftroyed the *inequalities* proceeding from the *main-fpring*; this was demonftrated by an *experiment*, in prefence of feveral perfons, at Mr. Aubert's houfe in Auftin Friars," &c. The experiment here alluded to, was that of the ifochronal length of the balance-fpring, which made the long and fhort arcs of vibration to be performed in the fame times, or, in other words, which compenfated the great inequalities of the maintaining power where no fufee was ufed; fo that the contrivance did not "entirely deftroy the inequalities" proceeding from the main-fpring, but allowed them to be as great as poffible, and then compenfated thofe *increafed inequalities* by the ifochronifm of the regulating-fpring, as we have before ftated. It appears to us, that the author in queftion, at the time he made thofe feveral obfervations on chronometry, had not given himfelf time to form a diftinct apprehenfion of the difference between caufe and confequence.

Nearly of a fimilar kind does Mr. Earnfhaw's reafoning appear on the tapering of the balance-fpring, where he fays, "if a man is to go four miles in the fame time as he has gone one mile, he cannot do it with the fame power; no, he muft have impelling force to quicken his motion, or he will be four times as long in doing it. Therefore, inftead of the fpring being equal in all its parts, it muft be made to increafe in thicknefs to the outer end," &c. (Page 8, of the "Explanations.") Mr. Earnfhaw feems here to have forgotten, that in every uniform fpring, of whatever fhape, the law of its action, as afcertained long ago by Dr. Hooke, is "ut tenfio fic vis," *i. e.* the impelling force is directly as the tenfion, or diftance from the point of reft; and if he knows any thing of the law of accelerated forces, he will find, on confideration, that there is no occafion to apply two feparate caufes to produce an exact effect, when one of them, fingly, is competent to the purpofe; if, indeed, more than a due effect is to be produced, then an auxiliary caufe may be had recourfe to, but ftill we muft look to the primary caufe, for regularity as well as for the continuance of the effect, particularly as, in the cafe before us, the primary caufe is the natural one, and the auxiliary one only artificial. The fpring of uniform thicknefs will produce a fcale of accelerated velocities fimilar to that produced by the uniform action of gravity alone. Another of Mr. Dalrymple's remarks is this; "The *fpiral fpring* was found to be another fource of irregularity; as, by action, it changed its elafticity, and its *power* was not the *fame* in all parts of the *volute*;" (p. 14, "Longitude"): and he ftrengthens the force of this obfervation by adding Mr. Arnold's well known reply to the committee of the Houfe of Commons, when they afked him,

What

What objections are there to the common ſpiral-ſpring? which reply was, "that it is never a ſpiral but when it is at reſt." Our reply to theſe remarks is this, that no ſpring can act at all without motion, and, conſequently, without change of figure; nor would any ſpring anſwer the purpoſe of a regulating-ſpring, if its power or elaſtic force were the ſame at every degree of tenſion, as both Mr. Earnſhaw and Mr. Dalrymple ſeem to have perſuaded themſelves is uſually the caſe. The beauty of the law of a ſpring's tenſion is, that it does not depend on the ſhape, provided its dimenſions be uniform: indeed Mr. Earnſhaw himſelf has found out from practice, that "the only advantage attending the cylindrical ſhape is, that it is rather eaſier (more eaſily) made; a ſaving of about one hour of time." Mr. Earnſhaw has particularized ſix advantages which his eſcapement has over Mr. Arnold's, in p. 12 of his "Explanations;" but, as the reader will probably think we have detained him too long, we refer him to the original information, in reading which, he will now be able to form an opinion for himſelf as to the real exiſtence of thoſe advantages; indeed, when all reaſoning on the ſubject is at an end, that particular conſtruction of a chronometer will no doubt ultimately prevail in practice, which ſhall be found to perform the beſt, and at the ſmalleſt expence.

We might have added to our article an account of different chronometers by French makers, but, as a chronometer differs from an ordinary watch principally in the *compenſation-balance* and *eſcapement*, their properties and peculiarities of conſtruction deſcribed under theſe two heads will be amply ſufficient, after what we have here ſaid on the ſubject: and, with reſpect to our preſent article, which has grown upon our hands to a greater length than we intended it ſhould, the reader, however he may differ from us in ſome particulars, will at leaſt acknowledge, that we have, in general, taken the liberty of thinking for ourſelves, and have, moreover, freely expreſſed thoſe thoughts, uninfluenced by the authority of names, even of thoſe to whoſe aſſiſtance we are indebted; which we conceive to be the only way of doing juſtice to an intereſting ſubject, that has never before gained general circulation in the Engliſh language.

CHRONOMETER.—*Exemplification of its uſe in determining the longitude of a ſhip or place.* The reader, it is preſumed, has already obtained a general idea of the utility of a chronometer in aſcertaining the relative longitudes of any two places, from what we ſaid on this ſubject in our hiſtory of the improvements in chronometers; but if he is in poſſeſſion of one of thoſe delicate and valuable machines, and wiſhes to avail himſelf of its uſe, either at ſea or on ſhore, in determining practically the longitude of the place he is at, compared with his firſt meridian, he will ſtand in need of further and more particular directions, than we have before given, to enable him to effect the requiſite determination with accuracy. The two moſt eſſential things in uſing a chronometer, are, firſt, to be able to aſcertain its mean daily rate of going, and to apply it to the time indicated at any place and inſtant afterwards; and, ſecondly, to be able to determine by obſervations on ſome of the heavenly bodies the exact hour, minute, and ſecond, at the ſaid place and inſtant of obſervation, becauſe the difference between the corrected time indicated by the chronometer, as the time at the firſt meridian, and the equated time obtained by calculation from the obſervations, will be the exact difference of longitude in time, between the place of obſervation and the firſt meridian, to the time of which the chronometer is ſuppoſed to have been previouſly put. But each of theſe two requiſites may be obtained by various means; and as ſome of thoſe means may be in the poſſeſſion of one reader, and ſome of another, we cannot better acquit ourſelves, than by giving in ſucceſſion ſome of the principal methods, uſed by different eminent men, of effecting the ſame purpoſe, each of which methods may have ſome advantage peculiar to itſelf, which under certain circumſtances may render it moſt deſirable, or, at leaſt, moſt practicable. There are, however, certain preparatory operations which are alike neceſſary to aſſiſt the reader, whom we ſuppoſe to be previouſly unacquainted with them, to perform the calculations he will have to go through. We propoſe, therefore, to ſelect from the various authors, who have recently written on this ſubject, and to arrange in ſucceſſive order, thoſe problems in nautical aſtronomy, which we deem neceſſary in order to render our propoſed exemplification, not only eaſy by the gradation we adopt, but alſo ſufficienrly comprehenſive, by including the different methods, to anſwer the deſired purpoſe of practical application. It would lead us beyond our bounds to enter here into an account of the different inſtruments made uſe of in celeſtial obſervations, together with their various adjuſtments and modes of uſing, which are explained under their reſpective heads in the different parts of this work; we muſt, therefore, beg leave to refer the reader to thoſe heads, accordingly as he finds himſelf at a loſs for the requiſite explanations and directions. There are, however, a few ſmall tables not generally met with in books of navigation, which are neceſſary companions for a tranſit-inſtrument, when the ſtars are obſerved, and which the obſerver, who takes a rate by his tranſit-inſtrument, ſhould always have at hand: we therefore think it deſirable to prefix them here, that the reader may not only apply them in peruſing for his amuſement the ſubſequent problems, but may always have them under his eye whenever he may have occaſion hereafter to conſult our directions in practice.

TABLE I.

(From Professor Vince.)

For converting Sidereal into Mean Solar Time.

Hours	Min. Sec.	Minutes.	Sec.	Seconds.	Sec.
1	0 9.83	1	0.16	1	0.00
2	0 19.66	2	0.33	2	0.01
3	0 29.49	3	0.49	3	0.01
4	0 39.32	4	0.66	4	0.01
5	0 49.15	5	0.82	5	0.01
6	0 58.98	6	0.98	6	0.02
7	1 8.81	7	1.15	7	0.02
8	1 18.64	8	1.31	8	0.02
9	1 28.47	9	1.47	9	0.02
10	1 38.30	10	1.64	10	0.03
11	1 48.13	11	1.80	11	0.03
12	1 57.96	12	1.97	12	0.03
13	2 7.78	13	2.13	13	0.04
14	2 17.61	14	2.29	14	0.04
15	2 27.44	15	2.46	15	0.04
16	2 37.27	16	2.62	16	0.04
17	2 47.10	17	2.78	17	0.05
18	2 56.93	18	2.95	18	0.05
19	3 6.76	19	3.11	19	0.05
20	3 16.59	20	3.28	20	0.05
21	3 26.42	30	4.91	30	0.08
22	3 36.25	40	6.55	40	0.11
23	3 46.08	50	8.19	50	0.14
24	3 55.91	60	9.83	60	0.16

TABLE II.

(From Professor Vince.)

For converting Mean Solar into Sidereal Time.

Hours	Min. Sec.	Minutes.	Sec.	Seconds.	Sec.
1	0 9.86	1	0.16	1	0.00
2	0 19.71	2	0.33	2	0.01
3	0 29.57	3	0.49	3	0.01
4	0 39.43	4	0.66	4	0.01
5	0 49.28	5	0.82	5	0.01
6	0 59.14	6	0.99	6	0.02
7	1 8.99	7	1.15	7	0.02
8	1 18.85	8	1.31	8	0.02
9	1 28.71	9	1.48	9	0.02
10	1 38.56	10	1.64	10	0.03
11	1 48.42	11	1.82	11	0.03
12	1 58.28	12	1.97	12	0.03
13	2 8.13	13	2.14	13	0.04
14	2 17.99	14	2.30	14	0.04
15	2 27.85	15	2.46	15	0.04
16	2 37.70	16	2.63	16	0.04
17	2 47.56	17	2.79	17	0.05
18	2 57.42	18	2.96	18	0.05
19	3 7.27	19	3.12	19	0.05
20	3 17.13	20	3.28	20	0.05
21	3 26.98	30	4.93	30	0.08
22	3 36.84	40	6.57	40	0.11
23	3 46.70	50	8.21	50	0.14
24	3 56.55	60	9.86	60	0.16

TABLE III.

Dr. Maſkelyne's Thirty-ſix Stars.

1806.	Mag.	Mean R. A. in Sidereal Time.	Annual Variation.	Mean Declination.	Annual Variation.	Mean Refraction.
		h m s	s +	° ′ ″	s	′ ″
γ Pegaſi	2	0 3 15.40	3.069	14 6 24.90	+ 20.20	0 44
α Arietis *	2 3	1 56 15.66	3.347	22 32 24.98	+ 17.47	0 32
α Ceti	2	2 52 8.88	3.115	3 19 22.40	+ 14.75	1 4
Aldebaran *	1	4 24 48.00	3.426	16 6 31.40	+ 8.00	0 40
Capella	1	5 2 22.62	4.415	45 47 5.88	+ 4.57	0 6
Rigel	1	5 55 13.11	2.876	8 25 59.32 S.	— 4.92	1 38
β Tauri	2	5 14 2.17	3.781	28 25 52.56	+ 3.91	0 24
α Orionis	1	5 44 40.23	3.243	7 21 38.16	+ 1.49	0 55
Sirius	1	6 36 36.06	2.653	16 27 21.54 S.	+ 4.21	2 20
Caſtor	2	7 22 11.92	3.853	32 18 3.76	— 7.06	0 20
Procyon	1 2	7 29 8.17	3.142	5 42 51.48	— 8.53	0 58
Pollux *	2	7 33 25.43	3.688	28 29 2.58	— 7.93	0 24
α Hydræ	2	9 18 3.08	2.946	7 49 19.70 S.	+ 15.10	1 36
Regulus *	1	9 58 1.65	3.212	12 54 41.74	— 17.19	0 45
β Leonis	1 2	11 39 9.14	3.067	15 39 25.24	— 20.04	0 41
β Virginis	3	11 40 35.27	3.125	2 51 32.42	— 20.22	1 4
α Virginis *	1	13 14 59.29	3.147	10 8 29.80 S.	+ 18.80	1 45
Arcturus	1	14 6 48.83	2.728	20 11 59.41	— 18.79	0 35
1 α Libræ	6	14 39 58.66	3.296	15 10 42.66 S.	+ 15.19	2 11
2 α Libræ	2	14 40 9.99	3.297	15 12 26.84 S.	+ 15.21	2 11
α Coronæ	2 3	15 26 28.63	2.545	27 22 34.54	— 12.49	0 25
α Serpentis	2	15 34 43.17	2.945	7 2 48.60	— 11.70	0 56
Antares *	1	16 17 32.06	3.658	25 59 4.92 S.	+ 8.43	4 11
α Herculis	2 3	17 5 48.33	2.731	14 37 26.48	— 4.48	0 43
α Ophiuchi	2	17 25 55.91	2.776	12 42 47.88	— 3.03	0 46
α Lyræ	1	18 30 22.08	2.027	38 36 36.34	+ 2.91	0 12
præcedens α Aquilæ *	3	19 37 1.91	2.846	10 9 6.72	+ 8.38	0 50
α Aquilæ *	1 2	19 41 18.83	2.925	8 22 2.64	+ 9.11	0 53
β Aquilæ	3 4	19 45 46.85	2.944	5 56 1.28	+ 8.57	0 58
1 α Capricorni	4	20 6 53.03	3.336	13 5 39.70 S.	— 10.80	2 0
2 α Capricorni	3	20 7 16.83	3.339	13 7 58.36 S.	— 10.81	2 0
α Cygni	1 2	20 34 49.06	2.038	44 35 33.84	+ 12.56	0 7
α Aquarii	3	21 55 48.75	3.081	1 15 15.66 S.	— 17.36	1 15
Fomalhaut *	1 2	22 46 54.18	3.343	30 38 26.30 S.	— 19.10	6 38
α Pegaſi *	2	22 55 6.12	2.973	14 9 59.32	+ 19.43	0 43
α Andromedæ	2	23 58 22.89	3.070	27 58 34.24	+ 19.99	0 25

Note. In the column of declination, S. means ſouth, and where there is no S. the declinations are all north; alſo, that the ſtars marked with aſteriſks are thoſe from which the lunar diſtances are computed in the Nautical Almanac.

TABLE IV.

For reducing the Sun's Longitude, as given in the Nautical Almanac for Noon at Greenwich, to any other Time, or to Noon under any other Meridian.—Taken from W. Wales, F.R.S.

2d Arg. Time from Noon.		1ft Arg. Hourly Motion of the Sun.											2d Arg. Degrees of Long.
		′ ″ 2 23	′ ″ 2 24	′ ″ 2 25	′ ″ 2 26	′ ″ 2 27	′ ″ 2 28	′ ″ 2 29	′ ″ 2 30	′ ″ 2 31	′ ″ 2 32	′ ″ 2 33	
h	′	′	′	′	′	′	′	′	′	′	′	′	°
0	20	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	5
0	40	1.6	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.7	1.7	10
1	00	2.4	2.4	2.4	2.4	2.5	2.5	2.5	2.5	2.5	2.5	2.5	15
1	20	3.2	3.2	3.2	3.2	3.3	3.3	3.3	3.3	3.4	3.4	3.4	20
1	40	4.0	4.0	4.0	4.0	4.1	4.1	4.1	4.2	4.2	4.2	4.2	25
2	00	4.8	4.8	4.8	4.8	4.9	4.9	5.0	5.0	5.0	5.1	5.1	30
2	20	5.6	5.6	5.6	5.6	5.7	5.7	5.8	5.8	5.9	5.9	5.9	35
2	40	6.4	6.4	6.4	6.4	6.5	6.6	6.6	6.7	6.7	6.7	6.8	40
3	00	7.2	7.2	7.2	7.3	7.4	7.4	7.5	7.5	7.6	7.6	7.6	45
3	20	8.0	8.0	8.1	8.1	8.2	8.2	8.3	8.3	8.4	8.4	8.5	50
3	40	8.8	8.8	8.9	8.9	9.0	9.0	9.1	9.2	9.2	9.3	9.3	55
4	00	9.6	9.6	9.7	9.7	9.8	9.9	9.9	10.0	10.1	10.1	10.2	60
4	20	10.4	10.4	10.5	10.5	10.6	10.7	10.8	10.8	10.9	11.0	11.0	65
4	40	11.2	11.2	11.3	11.3	11.4	11.5	11.6	11.7	11.7	11.8	11.9	70
5	00	12.0	12.0	12.1	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.7	75
5	20	12.8	12.8	12.9	12.9	13.1	13.2	13.2	13.3	13.4	13.5	13.6	80
5	40	13.6	13.6	13.7	13.8	13.9	14.0	14.1	14.2	14.3	14.4	14.4	85
6	00	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	90
6	20	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	95
6	40	15.9	16.0	16.1	16.2	16.3	16.4	16.5	16.7	16.8	16.9	17.0	100
7	00	16.7	16.8	16.9	17.0	17.2	17.3	17.4	17.5	17.6	17.7	17.8	105
7	20	17.5	17.6	17.7	17.8	18.0	18.1	18.2	18.3	18.5	18.6	18.7	110
7	40	18.3	18.4	18.5	18.6	18.8	18.9	19.0	19.2	19.3	19.4	19.5	115
8	00	19.1	19.2	19.3	19.4	19.6	19.7	19.8	20.0	20.1	20.3	20.4	120
8	20	19.9	20.0	20.1	20.2	20.4	20.5	20.7	20.8	21.0	21.1	21.2	125
8	40	20.7	20.8	20.9	21.0	21.2	21.4	21.5	21.7	21.8	21.9	22.1	130
9	00	21.5	21.6	21.7	21.8	22.1	22.2	22.3	22.5	22.6	22.8	22.9	135
9	20	22.3	22.4	22.5	22.7	22.9	23.0	23.2	23.3	23.5	23.6	23.8	140
9	40	23.1	23.2	23.3	23.5	23.7	23.8	24.0	24.2	24.3	24.5	24.6	145
10	00	23.9	24.0	24.1	24.3	24.5	24.7	24.8	25.0	25.2	25.3	25.5	150
10	20	24.7	24.8	24.9	25.1	25.3	25.5	25.7	25.8	26.0	26.2	26.3	155
10	40	25.5	25.6	25.8	25.9	26.1	26.3	26.5	26.7	26.8	27.0	27.2	160
11	00	26.3	26.4	26.6	26.7	27.0	27.1	27.3	27.5	27.7	27.9	28.0	165
11	20	27.1	27.2	27.4	27.5	27.8	27.9	28.1	28.3	28.5	28.7	28.9	170
11	40	27.9	28.0	28.2	28.3	28.6	28.8	29.0	29.2	29.4	29.6	29.7	175
12	00	28.6	28.8	29.0	29.2	29.4	29.6	29.8	30.0	30.2	30.4	30.6	180

We have not met with this ufeful little Table in any other Book but in Mr. Wales's Pamphlet, entitled, "The Method of finding the Longitude at Sea by Time-keepers." London, 1800.

PROBLEM

Problem I.

To reduce apparent to mean time.

Rule, (from W. Wales, F.R.S.) If the time at Greenwich be not given, turn the longitude of the place into time; and add it to the time at the given place, if the longitude be weſt, but ſubtract from that time, if the longitude be eaſt, and it will give the time at Greenwich.

Take the equation of time from page II. of the Nautical Almanac, for the noon preceding the time when it is wanted, and alſo the difference between it and the equation for the day following; and ſay, as 24^h is to this difference, ſo is the time at Greenwich to a fourth number; which muſt be added to, or ſubtracted from, the equation for the preceding noon, accordingly as the equation is increaſing or decreaſing.

Note. In every operation, where one time is to be taken from another, add 24 hours to the time you ſubtract from, if the time which is to be taken from it be the greater, and the remainder muſt be reckoned from the noon of the preceding day. When one time is added to another, if the ſum exceed 24 hours, take 24 hours from it, and the remainder muſt be reckoned from the noon of the following day.

Example 1, (from Mr. Kelly.) What is the equation of time at noon at Bombay, on the 16th Nov. 1805, the longitude of Bombay in time being $4^h\ 50^m\ 32^s$?

Equation of time for noon, at Greenwich ſub.	$15^m\ 1^s.9$
24^h is to $4^h\ 50^m\ 32^s$ as 10.8 (daily diff.) is to	+ 2.2
Equation of time for noon, at Bombay	$15^m\ 4^s.1$

Example 2, (from Mr. Kelly.) What is the equation of time at Port Royal, on July 11, 1805, at $20^h\ 23^m$?

Time at Port Royal - - -	$20^h\ 23^m\ 0^s$
Longitude of Port Royal in time	5 7.2
Time at Greenwich, July 12th -	1 30.2
Equation of time, July 12th, at noon add	$5'$ 5.6
24^h is to $7^s.5$ (daily diff.) as $1^h\ 30^m\ 2^s$ is to	+ 0.5
The equation of time ſought	5. 6.1

If it be required to convert mean time to apparent, a contrary proceſs muſt be uſed; that is, the equation of time muſt be applied with a contrary ſign: but in order to perform this problem with perfect accuracy, an allowance muſt be made for the proportion of the equation itſelf, as the table is computed for apparent noon.

Problem II.

To find the ſun's longitude for any given time and place from the Nautical Almanac.

Rule, (from W. Wales, F.R.S.) Take the ſun's longitude for noon at Greenwich from page II. of the Nautical Almanac for the given day, and its hourly motion from page III.

Enter Table IV. with the ſun's hourly motion at the top, and the longitude of the given place in time in the left-hand-ſide column, or in the right-hand column if given in degrees, and take out the correction which ſtands under the former and oppoſite the latter: this correction being added to the ſun's longitude for noon at Greenwich, if the longitude of the place be weſt, or ſubtracted from it, if the longitude be eaſt, will give the ſun's longitude for noon at the given place.

Example 1. What was the ſun's longitude at noon on the 15th of October, 1793, at Lima in Peru?

Sun's longitude for noon at Greenwich	$6^s\ 22^\circ\ 34'.8$
Hourly mot. $2'\ 29''$ and long. 77° W. give +	12.7
Sun's long. for noon at Lima	6 22 47.5

Example 2. What was the ſun's longitude at noon on the 27th of November, 1793, at Calcutta?

Sun's longitude for noon at Greenwich	$8^s\ 5^\circ\ 46'.6$
Hourly motion $2'\ 32''$ and long. 88° E. give −	14.9
Sun's longitude for noon at Calcutta	8 5 31.7

When the time is for any hour before or after noon, a ſecond ſimilar reduction will be neceſſary in addition to the reduction for longitude, which will be additive if the time be after noon, but ſubtractive if it be before.

Example 3. What was the ſun's longitude at Port Royal on May 4th, 1794, at $5^h\ 30^m$?

Sun's long. for noon at Greenwich -	$1^s\ 14^\circ\ 9'.9$
Hourly mot. $2^m\ 25^s.1$ & long. W. $5^h\ 7^m\ 2^s$ +	12.4
Hourly mot. $2^m\ 25^s.1$ and $5^h\ 30^m$ P.M. +	13.3
Sun's long. at Port Royal at $5^h\ 30^m$	1 14 35.6

Problem III.

To find the ſun's declination for any given time and place from the Nautical Almanac.

Rule, (from W. Wales, F.R.S.) Take the ſun's declination out of the Nautical Almanac for noon at Greenwich on the given day, if the given time be leſs than twelve hours, but for the day following if it be more.

Enter Table VI. of the *Requiſite Tables* with the time from the neareſt noon at the top, and the day of the month in one of the ſide columns: under the former, and oppoſite to the latter ſtands the correction of the ſun's declination on account of the time.

If the ſun's declination be wanted for noon at any other place than Greenwich, enter the table with the longitude of the given place at the top, and the day of the month in one of the ſide columns, againſt which, and under the longitude, ſtands the correction of the ſun's declination on that account.

If the declination be wanted at any other place than Greenwich, and at any other time but noon, both corrections muſt be applied; and they muſt be added to, or ſubtracted from, the declination for noon at Greenwich, according to the directions which ſtand at the top of the column, where the day of the month is found.

Example 1. Find the ſun's declination for $21^h\ 17^m$ apparent time at Greenwich, May 4, 1793?

May 4th at $21^h\ 17^m$ is $2^h\ 43^m$ before noon on the 5th.	
Sun's declination for noon, May 5th	$16^\circ\ 27'\ 34''$ N.
$2^h\ 43^m$ before noon gives - -	− 1 59
Sun's declination, May 4th, at $21^h\ 17^m$ =	16 25 35 N.

Example 2. What was the ſun's declination on the 14th of October, 1793, at $7^h\ 43^m$ in longitude 83° eaſt?

Sun's declination, October 14th, at noon	$8^\circ\ 25'\ 26''$ S.
$7^h\ 34^m$ after noon in Table VI. give	+ 6 54
83° Eaſt longitude in Table VI. give	− 5 3
Sun's declination at $7^h\ 34^m$ in long. 83° eaſt	8 27 17 S.

PROBLEM IV.

To convert sidereal into mean solar time, and the contrary.

Rule. Collect the numbers expressing the acceleration of sidereal on mean solar time out of our Table I. when sidereal time is given to be changed, but the numbers out of Table II. when mean solar time is given; then in the former case subtract the amount from the time given, but in the latter add the said amount, and the difference or sum, as the case may be, will be the time converted into that of a different name.

Example 1. Let it be required to convert $10^h\ 16^m\ 30^s$ of sidereal time into a corresponding quantity of mean solar time?

The work is this:

From Tab. I. 10^h——1^m	$38^s.30$	acceleration of sidereal on mean solar time.
16^m——0	2.62	
30^s——0	0.08	
Amount 1	41.00	

then $10^h\ 16^m\ 30^s - 1^m\ 41^s = 10^h\ 14^m\ 49^s$ the corresponding quantity of mean solar time.

Example 2. Let it again be required to convert $10^h\ 14^m\ 49^s$ of mean solar time into a corresponding quantity of sidereal time?

The operation is thus:

From Tab. II. 10^h——1^m	$38^s.56$	retardation of solar compared with sidereal time.
14^m——0	2.30	
49^s——0	0.14	
Amount 1	41.0	

Then, $10^h\ 14^m\ 49^s + 1^m\ 41^s = 10^h\ 16^m\ 30^s$ which is the corresponding quantity of sidereal time agreeably to Example 1, to which this is the converse.

PROBLEM V.

To compute the sun's right ascension for a given hour at any given place.

Rule, (according to the Requisite Tables.) Take the sun's right ascension in time from page II. of the Nautical Almanac for the given day, and see how much it differs from that of either the preceding or following day, which call the *daily variation* in right ascension in time; with this as an argument, enter Table XXIII. at the top, and with the *time from noon,* or the *difference of longitude,* or both separately and successively, as a second argument for the side of the page, enter the same Table, and the intersection or intersections will give the quantity or quantities to be added to the right ascension for noon at Greenwich, if the time be after noon, or the longitude west, but to be subtracted if the time be before noon, or the longitude east.

Example 1. Required the right ascension of the sun at Bombay, on the 1st of January 1794, at $3^h\ 36^m$?

Sun's Right Asc. Jan. 1, 1794, at Greenwich, per Nautical Almanac	-	18^h	49^m	38^s
Ditto, on Jan. 2	-	18	54	2.8
Daily variation	-		4	24.8
Then ☉'s R. Asc. at noon at Greenwich being	-	18	49	38
Reduction for $3^h\ 36^m$ with $4^m\ 24^s.8$	+		0	40
Reduction for long. of Bombay $4^h\ 30^m\ 32^s$ E.	—		0	50
Right Asc. required	-	18	49	28

Example 2. Let it be required to ascertain the sun's right ascension at 7 o'clock, civil time, in a ship, the longitude of which is 8° 30′ or 34^m E., on April the 20th, 1794?

☉'s R. Asc. on April 19, 1794	-	1^h	50^m	6.2^s
Ditto, — on Do. 20, 1794	-	1	53	49.6
Daily variation	-		3	43.4
Then R. Asc. on April 20, 1794		1	53	49.6
Reduction for 5 hours before noon	—		0	46.5
Reduction for 34^m E.	—		0	5.7
Right Ascension required	-	1	52	57.4

Instead of Table XXIII. of the Requisite Tables, published by the Board of Longitude, Table XVIII. of Dr. Mackay may be used in the solution of this problem.

PROBLEM VI.

To ascertain mean solar time by a sidereal clock or watch: and also sidereal time, from a solar clock or chronometer, on any given day in the year.

Prefatory Remark. A sidereal clock or watch goes faster than a solar one by $3^m\ 55^s.91$ of solar time, and consequently shows one day in the year more than a solar clock or chronometer does, the sidereal day being measured by the earth's absolute rotation as it is referred to a fixed star, and the solar by the earth's synodic rotation, as it relates to the sun in motion. But the right ascensions, or angular distances from the first point of Aries, of all the heavenly bodies, when they are given in time instead of degrees, are given in sidereal time; therefore a clock so regulated as to gain $3^m\ 55^s.91$ per day, if it does not vary in its rate, will always show the right ascension of any star, as it passes the middle wire or hair of a transit instrument, well fixed in the meridian, and levelled, provided the hands of the clock be put to $24^h\ 0^m\ 0^s$ at the instant that the point $12^s\ 0°\ 0'\ 0''$ of the equator, or first point of Aries, is passing the said wire or hair. Hence a sidereal clock, as Mr. Kelly has observed in his Appendix to his "Nautical Astronomy," may with propriety be called a *right ascension clock,* and is that which is usually fixed in observatories, and known by the appellation of an *astronomical clock.* The writer of the present article is in possession of a chronometer, by the late Mr. Margetts, which indicates both mean solar and sidereal time, and consequently the sun's mean right ascension, which is their difference on any day; the manner in which both these kinds of times are indicated by the same machine will be explained under the article DIAL-*work.*

Rule. When sidereal time is given on any day to find the corresponding solar, take the sun's right ascension for the noon of that day and place, by the last problem, and subtract it from the sidereal time given, after borrowing 24^h if necessary, and the remainder will be the sidereal time elapsed since the last apparent noon; to this remainder apply the acceleration of sidereal on mean solar time, from Table I. as already directed in Problem IV., and then the sidereal time will be converted into mean solar time that has passed since apparent noon, to which apply the equation of time *at noon,* and then there will be the mean time elapsed since mean noon, that

that is, there will be the mean solar time. On the contrary, when mean solar time is given, the correspondng sidereal time is found by reversing this operation.

Example 1, (from Mr. Kelly.) Required the mean time on the 8th of September, 1805, when the sidereal clock was at $15^h\ 20^m\ 7^s$?

Time per sid. clock - -		15^h	20^m	7^s
$\odot$'s R. Asc. at noon -		11	5	59 .6
Sid. time elapsed since ap. noon		4	14	7 .4
Accel. of sid. on sol. time from Tab. I.	—	0		41.63
Mean time elap. since ap. noon		4	13	25.77
Equation of time at noon -	—		2	24 .0
Mean solar time -		4	11	1.77

Operation reversed. Example 2, (from Mr. Kelly.) Required the time by a sidereal clock at $4^h\ 11^m\ 1^s.77$ of mean solar time, on the 8th of September, 1805?

Mean solar time given -		4^h	11^m	$1^s.77$
Equation of time at noon, add here	+		2	22
Mean solar time since appar. noon		4	13	25.77
Retardation of solar compared with sidereal time from Table II. -	+			41.63
Sidereal time since apparent noon		4	14	7 .4
Sun's right asc. at apparent noon		11	5	59 .6
Time by sidereal clock -		15	20	7

These examples suppose the clock to be at Greenwich, but if the sidereal time or solar time given is for any other meridian, the sun's right ascension, and also the equation of time, as given in the Nautical Almanac, must be previously reduced to the noon of that meridian, by the respective foregoing problems.

Problem VII.

To take the transit of a celestial object.

Rule. Place the transit instrument in the meridian, and see that all the adjustments are properly made, then when the object to be observed approaches the meridian, elevate the telescope to the required altitude by means of the graduated circle and spirit level at the end of the axis. The sun or star will soon appear in the field of view, apparently moving from the west to the east, when the telescope inverts the object. If there are five wires, or cobweb hairs, which are better, in the focus of the eye-glass, which is usual, mark the time of the transit over each separate wire or hair, as in the subjoined examples, and use a coloured glass over or under the eye-glass if the sun be the object, and the day clear; but if there is but one wire or hair, a simple transit can only be obtained.

Example 1, (from Mr. Kelly's Appendix to his "Nautical Astronomy.") On the 8th of September, 1805, the following transit of the sun was taken at the observatory in Finsbury Square, with a transit instrument of five wires, and a sidereal clock; to find the error of the clock.

1 Wire.	2 Wire.	Mer. Wire.	4 Wire.	5 Wir.	
m. s.	m. s.	h. m. s.	m. s.	m. s.	
3 53.	4 22.5	11 4 52	5 20.5	5 50	$\odot$'s 1st limb.
7 58.5	7 30	11 7 00	6 31.5	6 2	$\odot$'s 2d limb.
					*
11 51.5	11 52.5	22 11 52	11 52	11 52	
		† 51.5			
		52.5			
		52			
		52			
		5 | 260.0			
2		22 11 52			
		11 5 56 mean of the whole.			

* The order of this row of figures is reversed, by which the mean of each column is most readily obtained.

† The hours are inserted in the middle column only, and the other columns may be supposed to contain them.

Hence the $\odot$'s centre passed the meridian at -	11^h	5^m	56^s	per clock.
And per Naut. Alm. $\odot$'s R.A.	11	5	59.6	
Clock slow	0	0	3.6	

The observation might have been made with the middle wire only, by adding the *time of the sun's semi-diameter passing the meridian* (p. 3, Naut. Alm.) to the time when the $\odot$'s first limb passed the third wire; or, by subtracting it from the time of the $\odot$'s second limb passing it; thus,

$\odot$'s 1st limb passed mer. wire	11^h	4^m	52^s	per observation
Times of $\odot$'s semi-diameter passing mer. -		1	4	per Naut. Alm.
	11	5	56	

Or, if $1^m\ 4^s$ be taken from $11^h\ 7^m$, the time of the second limb's passing the meridian wire, the result will be as before.

Example 2. On the evening of the same day, the transit of α Lyræ was thus observed:

First wire	18^h	29^m	7^s	per sidereal clock.
2d ditto		29	43	
Mer. ditto		30	19	
4th ditto		30	55	
5th ditto		31	31	
	5 |	151	35	
Star passed mer. wire	18	30	19	App. R. A. per clock.
Mean R. A. of α Lyræ	18	30	20.05	per Table III.
Corr. for precession and aberra.			+ 2.04	per Tables in the Greenwich observations.
Ditto for nutation, &c.			+ 0.66	
	18	30	22.75	App. R. A. per Tables.
Clock slow	0	0	3.75	

Problem VIII.

To find the rate which a watch goes at by observations of the sun's, or of a star's transit over the meridian.

Rule, (by W. Wales, F.R.S.) *for the sun*. Observe, with a transit-instrument, properly adjusted, the time when the sun passes the meridian of the place every day at noon, (as in the last problem) or as often as opportunities offer. The equation of time must then be taken from the Nautical Almanac, (as in Prob. I.) and, if it be marked additive, it will be the same as the time by the watch when the sun's centre was observed to pass the meridian, if the watch be right. If they differ, that difference is what the watch is too fast, or too slow for mean time: and it is too fast, if the time by the watch be greater than the equation of time; and too slow, if the time by the watch be less. If the equation of time be subtractive, take it from twenty-four hours, compare the observed time when the sun's centre was on the meridian with the remainder, and the difference between them will be what the watch is too fast, or too slow; accordingly, as the time by the watch is the greater or the less. These observations, when the voyage is expected to be of a considerable length, ought to be continued for a month at least: indeed, the longer they are continued, in all cases, the better; but in this the observer must be governed by circumstances. They must always, however, be continued as near as possible to the time when the ship is expected to sail, that there may be as little chance as possible left for the watch to alter its rate of going after the observations are closed.

The times by the watch, when the sun's centre was observed on the meridian, must be written one under another, in column two, against the days of the month when they were observed in column one; and it is the day that began at the instant when the sun's centre was on the meridian, which is to be set before the observed time, and not the day which ended then, as is the custom with seamen. The equation of time, or its supplement to 24 hours, according as it is additive or subtractive, must be set in a third column, against the observed times of noon, and the difference between them in a fourth, with the sign + or —, according as the watch is too fast or too slow for mean time; which difference is had by taking the third column from the second, after borrowing 24, if necessary. This is all that is necessary to be done till all the observations are made.

When the ship is ready to sail, add a fifth column to your paper, take the difference between what the watch was too fast or too slow on the first day of observation, and what it was too fast or too slow on the second, and put it in the fifth column, opposite the space which is between the two numbers of which it is the difference. Take also the difference between what the watch was too fast or too slow on the second day, and what it was too fast or too slow on the third; between what it was too fast or too slow on the third, and what it was too fast or too slow on the fourth, and so on. Place these differences also in the fifth column, opposite the spaces which are between the two numbers of which they are, respectively, the difference. Those differences will be the gain or loss of the watch in the 24 hours, which they respectively stand against. And it must be observed, that the watch is gaining if it be too fast for mean time, and the numbers in the third column increase; or, if it be too slow, and the numbers in the third column decrease; but the watch is losing if it be too fast for mean time, and the numbers in the third column decrease; or if it be too slow, and the numbers in the third column increase.

Remark. By making daily observations in the manner here recommended, it will be seen whether the watch alters its rate of going while it is under trial, which is absolutely necessary to be known; because, if it does, all those observations must be rejected which were made before the alteration happened, and those only retained which were made afterwards.

If no material alteration happened in the rate of the watch's going, during the time of trial, take the difference between what the watch was too fast or too slow on the first day of observation, and what it was too fast or too slow on the last, if they be of the same kind, that is, both too fast, or both too slow; but add them together, if the watch was too fast in one instance, and too slow in the other; this difference, or sum, must be divided by the number of days which elapsed between the first and last day's observations, and the quotient will be the number of seconds and decimal parts that the watch gains or loses in a day. And it is manifest, that if the watch be faster at the end of the trial, than it was at the beginning, it is gaining, and if it be slower, it is losing.

If any considerable alteration happened in the rate which the watch went at, instead of taking the difference between what the watch was too fast or too slow, on the first and last days, take the difference between what the watch was too fast or too slow on the day after that, when the alteration in its rate happened, and what it was too fast or too slow on the day when the last observation was made, and divide by the number of days which elapsed between them. The following examples will make this very plain.

Example 1. Suppose the observed times when the sun's centre passed the meridian of Barbadoes, in the month of December, 1793, were as follow; what was the loss or gain of the watch on mean time?

Note. The days of the week are here denoted, as in the original, by the planetary characters, where ☉ is Sunday, ☽ Monday, ♂ Tuesday, and fo on.

1793.	Obf. Times of ☉'s Tranf.	Mean Time of app. noon.	Watch too faft.	Daily gain.
	h. m. s.	h. m. s.	h. m. s.	s.
☉ Dec. 1	3 50 34.0	23 49 41.7	+ 4 0 52.3	+ 4.4
☽ — 2	3 51 2.1	23 50 5.4	+ 4 0 56.7	+ 4.2
♂ — 3	3 51 30.6	23 50 29.7	+ 4 1 0.9	+ 3.7
☿ — 4	3 51 59.2	23 50 54.6	+ 4 1 4.6	+ 1.5
♃ — 5	3 52 26.2	23 51 20.1	+ 4 1 6.1	+ 1.8
♀ — 6	3 52 54.0	23 51 46.1	+ 4 1 7.9	+ 1.4
♄ — 7	3 53 21.9	23 52 12.6	+ 4 1 9.3	+ 1.5
☉ — 8	3 53 50.3	23 52 39.5	+ 4 1 10.8	+ 1.2
☽ — 9	3 54 18.9	23 53 6.9	+ 4 1 12.0	+ 1.1
♂ — 10	3 54 47.7	23 53 34.6	+ 4 1 13.1	+ 0.7
☿ — 11	3 55 16.4	23 54 2.6	+ 4 1 13.8	+ 1.9
♃ — 12	3 55 46.7	23 54 31.0	+ 4 1 15.7	+ 2.2
♄ — 14	3 56 48.7	23 55 28.6	+ 4 1 20.1	+ 2.0
☉ — 15	3 57 19.8	23 55 57.7	+ 4 1 22.1	+ 2.2
☽ — 16	3 57 51.3	23 56 27.0	+ 4 1 24.3	+ 1.4
♂ — 17	3 58 22.2	23 56 56.5	+ 4 1 25.7	+ 1.5
☿ — 18	3 58 53.4	23 57 26.2	+ 4 1 27.2	+ 1.3
♃ — 19	3 59 24.6	23 57 56.1	+ 4 1 28.5	+ 1.8
♀ — 20	3 59 56.3	23 58 26.0	+ 4 1 30.3	+ 1.6
♄ — 21	4 0 27.9	23 58 56.0	+ 4 1 31.9	+ 1.8
♂ — 24	4 2 3.4	0 0 26.1	+ 4 1 37.3	+ 0.3
☿ — 25	4 2 33.6	0 0 56.0	+ 4 1 37.6	+ 1.6
♃ — 26	4 3 5.0	0 1 25.8	+ 4 1 39.2	+ 1.5
♀ — 27	4 3 36.1	0 1 55.4	+ 4 1 40.7	+ 2.4
♄ — 28	4 4 08.0	0 2 24.9	+ 4 1 43.1	+ 2.9
☉ — 29	4 4 40.2	0 2 54.2	+ 4 1 46.0	+ 2.2
☽ — 30	4 5 11.5	0 3 23.3	+ 4 1 48.2	+ 1.5
♂ — 31	4 5 41.9	0 3 52.2	+ 4 1 49.7	

Here it appears that the watch went confiderably fafter the firft three days than it did afterwards; I therefore reject thefe three days, fays Mr. Wales, and take the difference between $4^h\ 1^m\ 4^s.6$, what the watch was too faft on the fourth, and $4^h\ 1^m\ 49^s.7$ what it was too faft on the 31ft, and find it $45^s.1$, which I divide by 27, the number of days elapfed, and the quotient, $1^s.6704$, is the *daily rate*, or quantity which the watch gained on mean time in one day. If the inftrument be not pretty exactly in the meridian, the obferver will, however, by this method, not only get the abfolute quantity of time, which the watch is too faft, or too flow, wrong; but will, if there be any confiderable change in the fun's declination, while the watch is under trial, determine the rate of its going erroneoufly alfo. On this account it will be better to find the rate of the watch by obferving the tranfits of a fixed ftar; the computations being ftill more fimple than they are when the fun is made ufe of, as will be feen in the annexed example.

Example 2. Suppofe the times by a chronometer when the ftar Aldebaran paffed a tranfit-inftrument placed nearly in the meridian of Madras, were as follow: it is required to find how much the watch gained or loft on mean time?

Rule for a ftar. In column one put down the days of obfervation; in column two the obferved times of the tranfit; in column three the differences of each pair of fucceeding times contained in column two; in column four $3^m\ 55^s.91$, the difference between a mean folar and fidereal day; and in column five the differences between the numbers contained in column three and column four with the proper figns, which will be the daily errors in folar time; and laftly, the amount of thefe errors divided by the number of days elapfed will give the mean rate.

The operation according to the Rule.

1794	Obf. Times of the ✳'s Tranf.	Difference.	Diff. bet. m.fol. and fid. day.	Watch gains or lofes on mean Time.	Remarks.
	h. m. s.	m. s.	m. s.	s.	
♀ Jan. 3	9 22 17.42				
♄ — 4	9 18 20.73	3 56.69	3 55.91	−0.78	
☉ — 5	9 14 24.36	3 56.37	3 55.91	−0.46	
☽ — 6	9 10 28.05	3 56.31	3 55.91	−0.40	
♂ — 7	9 6 31.48	3 56.57	3 55.91	−0.66	
☿ — 8	9 2 33.87	3 57.61	3 55.91	−1.70	
♃ — 9	8 58 36.53	3 57.34	3 55.91	−1.43	
♄ — 11	8 50 45.07	7 51.46	7 51.82	+0.36	In 2 days
☉ — 12	8 46 49.46	3 55.61	3 55.91	+0.30	
☿ — 15	8 35 0.17	11 49.29	11 47.73	−1.56	In 3 days
♃ — 16	8 31 4.62	3 55.55	3 55.91	+0.36	
♀ — 17	8 27 8.21	3 56.41	3 55.91	−0.50	

Here it may be obferved, that the fum of all the chronometer's gainings is $4^s.50$, and the fum of all its lofings is $2^s.01$; the difference between them is $2^s.49$, which being divided by 14, the number of days the chronometer was under trial, will give $0''.178$ for the rate or daily gain of the watch.

The rate which a watch goes at is obtained this way with much lefs trouble than by any other; but the *abfolute time* is not given by it, nor, of courfe, how much the watch is too faft or too flow, for mean time, at the meridian it is tried under, which may be found by fome of the following problems.

Problem IX.

To find the rate of a chronometer by comparifon with a good folar or fidereal clock, the rate of which is known, and occafionally corrected.

Prefatory Remark. Though the rate of a chronometer, as afcertained from a fucceffion of tranfits of a heavenly body, be moft to be depended upon, yet it will not always happen particularly in a changeable climate, that a fufficient number of obfervations can be gotten within the limited time allowed for fixing a rate; it will, therefore, be very convenient to compare the going of the chronometer with that of either a folar or fidereal clock, that has a compenfation pendulum and good efcapement, and to afcertain in the mean time the rate of the clock itfelf by occafional obfervations of the fun or ftar, it being generally allowed that a good clock is more fteady in its rate than any chronometer which has yet been made, provided its adjuftments be perfect. It may be advifeable to try the chronometer, in the firft place, in different pofitions, by fhort comparifons of 12 hours each with the clock; and if any confiderable change of rate takes place during fuch fhort comparifons, it muft neceffarily be put into gimbols, or otherwife be fent back again to the maker for new adjuftment for the different pofitions.

Rule

Rule for a solar clock.—Place the chronometer in the position it is likely to preserve in a voyage, and put its hands with thofe of the clock, and have a fheet of paper ruled into as many columns as the comparifon will require; for a solar clock feven columns will anfwer the purpofe, but for a fidereal clock there will be more required. Put titles to the different columns, and, after an interval of each 24 hours, make the requifite comparifons, and enter them as they ftand in the fubjoined example, referving columns four and five to be filled up afterwards; then after as many days' comparifon as the time will allow, complete the calculations in thefe two referved columns thus; take a mean of the obferved differences between the time of the clock and mean time determined occafionally by a tranfit inftrument, which will be the clock's mean daily rate, particularly if the obfervations are taken after equal intervals; then add or fubtract, as the cafe may be, the clock's daily rate to or from the refpective numbers in column three, and fill up column four with the fum or differences, or both, if the cafe fhould fo be; in the next place, take the differences between each couple of the fucceeding lines of column four, and fill up therewith column five, annexing — or +, as the difference may be; laftly, take the difference between the plus and minus amounts, or the fum, if there is but one kind, and divide it by the number of days elapfed on trial, and the quotient will be the daily error, — or +, which error is denominated the *rate*.

Example. Let it be required to affign a rate to a chronometer from the comparifons made in the columns 1, 2, and 3, of the annexed table?

Days of Trial.	Clock after mean Time.	Chrono. diff. from Clock in 24 h.	Do. from mean Time in 24 h.	Daily Rate of Chron.	Mean State of Thermometer.	Mean State of Barometer.
	s	s	s		o	
1	— 6.5	+ 8.5	+ 2.2		54	29.8
2		+ 8.8	+ 2.5	+ 0.3	55	30.0
3		+ 9.4	+ 3.1	+ 0.6	57	30.2
4		+ 7.5	+ 1.2	— 1.9	56	30.4
5		+ 9.0	+ 2.7	+ 1.5	53	29.6
6		+10.4	+ 4.1	+ 1.4	53	29.4
7		+10.5	+ 4.2	+ 0.1	54	29.6
8	— 8.0	+11.3	+ 5.0	+ 0.8	55	29.7
9		+11.5	+ 5.2	+ 0.2	54	29.8
10		+10.4	+ 4.1	— 1.1	56	30.0
11		+10.0	+ 3.7	— 0.4	57	30.4
12		+ 8.4	+ 2.1	— 1.6	58	30.4
13		+ 7.6	+ 1.3	— 0.8	57	30.6
14		+ 7.4	+ 1.1	— 0.2	56	30.5
15	— 4.5	+ 7.2	+ 0.9	— 0.2	57	30.4

$3|\underline{10^{s}}$

Rate of clock $-6^{s}.3$ on an average of 15 days.

— 6.2 Total lofs.
+ 4.9 Total gains.

— 1.3 Diff. in 15 days.

Then $\frac{-1^{s}.3}{15} = 0^{s}.087$ minus is the daily rate of the chronometer taken from a comparifon with the clock for 15 fucceffive days, which rate muft be added to the time fhown by the chronometer on any fucceeding day, after it has been multiplied by the number of days elapfed fince the laft day of the comparifon. This rate might fuffice for a fhort voyage, immediately undertaken, if the chronometer had been tried and approved previoufly; but if not previoufly approved on a voyage, it ought to have a longer trial. If a chronometer could be made fo perfectly as to meafure time precifely alike under all circumftances, a very few days would at any time fuffice for affigning to it its rate. Had not the rate of the clock in this example been taken at equal intervals, it would have been more accurate to have taken a mean between — $6^{s}.5$ and — 8^{s} for the mean rate to be applied for the firft portion, and a mean between 8^{s} and $4^{s}.5$ to be applied to the fecond portion of the trial; particularly as there is a confiderable variation in the rate of the clock. The fame refult might otherwife have been obtained by affigning a daily rate to the clock by interpolation for each feparate day firft, and then by applying each feparate day's rate to each feparate comparifon in column three, to obtain column four, and from that the daily rates of the chronometer in column five; but this method is attended with more trouble, and is only neceffary when the clock's rate is taken at unequal intervals, and is found to vary confiderably. Whenever it happens that the comparifon is not made exactly at the inftant of the 24^{h} being elapfed, the interval, whatever it is, muft be reduced to 24^{h} by proportioning the difference in the going of the two machines correfponding to the faid interval. By the prefent rule alfo the going of one clock may have its rate affigned by a comparifon with that of another.

Rule for a fidereal clock.—When the clock fhows fidereal time, and the chronometer folar, their difference in 24^{h} of folar time ought to be $3^{m}\ 55^{s}.91$ of folar time, but in 24^{h} of fidereal time, $3^{m}\ 56^{s}.55$, provided the machines performed with perfect truth; one or other of thefe two ftandard numbers, therefore, muft be ufed as the meafure of the daily error, accordingly as the interval is a folar or a fidereal day. In making the comparifons previoufly to the calculations being entered upon, it is not neceffary to have more than five columns; one for *the day of the month*, a fecond for *time per watch*, a third for *the time per clock*, a fourth for the *barometer*, and a fifth for the *thermometer;* which form being fo fimple requires no fac fimile. But the calculations, grounded on the data in the faid five columns, require many more columns, for which we fhall not give any previous directions, but infert Dr. Mafkelyne's two methods of arrangement, extracted from "The original Obfervations of the Going of Mr. Harrifon's Watch from day to day," as publifhed by the Board of Longitude; which methods will be better underftood from the forms of his tables, than from any verbal rules of ours, which muft neceffarily be complex.

Example, (from "The original Obfervations"). Let it be required, from the data contained in columns 1, 2, and 3, of the fubjoined tables, to determine the rate of Mr. Harrifon's time-keeper, taken on an average of the 11 days trial contained in the table?

First

First Method.—Calculations of the going of Mr. Harrison's Watch from Day to Day.

	Interval of Comparisons.	Watch loses of Clock.	Watch loses of Clock, in 24^h of Watch.	Clock varies from sidereal Time per Day.	Watch loses of sidereal Time of 24^h. of Watch.	Watch gets on mean Time per Day.	Mean state of Thermometer.	Mean state of Barometer.
	The watch in a horizontal position, with the face upwards.							
1766.	h. m.	m. s.	m. s.	s.	m. s.	s.	Deg.	Inch.
May 6 to 7	23 30	3 33	3 37.53	+1.34	3 38.9	17 .6	54	29.9
7 8	24 4	3 37	3 36 .4	+1.22	3 37.6	18 .9	57	29.7
8 9	23 52	3 34	3 37 .2	+1.17	3 36.4	20 .1	55	29.5
9 10	24 4	3 36	3 35 .4	+1.13	3 36.5	20 .0	54	29.3
10 11	23 57	3 36	3 36 .4	+1.16	3 37.6	18 .9	49	29.5
11 12	24 1	3 36	3 35 .9	+1.12	3 37.0	19 .5	50	29.6
12 13	24 9	3 37	3 35 .6	+1.05	3 36.6	19 .9	51	29.6
13 14	23 49	3 33	3 34.76	+1.02	3 35.8	20 .7	52	29.8
14 15	24 8	3 37	3 35.79	+1.02	3 36.8	19 .7	52	30.1
15 16	24 2	3 36	3 35.70	+0.80	3 36.5	20 .0	54	30.2
16 17	24 9	3 38	3 36.64	+0.58	3 37.2	19 .3	56	30.1
						11)209 .56		
						19.509		

By a mean of 11 days' comparisons, from May 6th to May 17th, the watch being in a horizontal position with the face upwards, gets at the rate of $19^s.509$ per day upon mean time.

Dr. Maskelyne's explanation. "The first column shews the days of the month; the second, the interval of time, according to the watch, between the attested comparisons of the watch each day with the transit clock; the third column contains the quantity of minutes and seconds which the watch loses of the clock in the said interval; the fourth column shews how much the watch should lose of the clock in 24 hours of the watch, according to the proportion expressed in the second and third columns; the fifth column gives the daily gaining or losing of the transit clock with respect to sidereal time, as deduced from the observed transits of the fixed stars over the meridian, the sign + being set down in case of the clock's losing, and — in the case of its getting. This correction, applied to the numbers of the fourth column, produces the sixth column, or the losing of the watch from day to day; with respect to sidereal time, in 24 hours of the watch. The seventh column gives the daily gaining of the watch upon mean time, and is found by taking the difference of the preceding column and $3^m\ 56^s.5$ sidereal time, gaining so much upon mean solar time in 24 hours of mean time; or rather more exactly, in 24 hours of the watch, which generally corresponds to less than 24 hours of mean time by near 20 seconds. The eighth column contains the mean state of the thermometer for the day; and the ninth and last column shews the mean state of the barometer." ("The Original Observations," p. xxvii. and xxviii.)

Second Method.—Comparisons of Mr. Harrison's Watch with Mean Time.

	Observed Transit of Sun per Clock.	Time per Clock at comparison with Watch.	Apparent Time.	Equation of Time.	Mean Time.	Time per Harrison's Watch at comparison with Clock.	Harrison's Watch fast for Mean Time.
1766.	h. m. s.	h. m. s.	h. m. s.	m. s.	h. m. s.	h. m. s.	m. s.
♂ May 6	2 53 30.27	3 39 1	0 45 23.60	3 39 .8	0 41 43.8	0 42 0	0 16.2
☿ 7	2 57 20.50	3 12 34	0 15 11.10	3 45 .0	0 11 26.1	0 12 0	0 33.9
☽ 12	3 16 43.71	3 28 33	0 11 47.38	3 59.32	0 7 48.0	0 10 0	2 12.0
♃ 15	3 28 28.77	3 45 20	0 16 48.47	4 1.10	0 12 47.4	0 16 0	3 12.6
♄ 17	3 36 21.83	4 3 34	0 27 7.68	3 59.47	0 23 8.2	0 27 0	3 51.8

If we include here both the 6th and 17th, there will be 12 days in this calculation, during which the watch gained in the whole $3^m\ 51^s.8$ or $231^s.8$, therefore $\frac{231.8}{12} = 19^s.32$ is the rate on this mode of comparison, which agrees very well with the preceding one calculated on the same period.

Explanation, by Dr. Maskelyne. According to the arrangement in this last Table "the first column contains the day of the month; the second, the observed transit of the sun's centre over the meridian, according to the time of the transit clock; the third column shews the time by the clock, when compared with Mr. Harrison's watch; the fourth, the apparent time at the same comparison; the fifth, the equation of time, which, applied to the numbers in the preceding column,

lumn, gives the mean time contained in the fixth column; the feventh column gives the time fhewn by Mr. Harrifon's watch, when compared with the clock; laftly, the eighth column fhews how much the watch is too faft for mean time each day." ("The Original Obfervations," p. xxxix.)

Problem X.

To find the equation of equal altitudes.

Rule, (by A. Mackay, LL.D. F.R.S. Edin. &c.) Enter Table XXIII. (contained in his "Theory and Practice of finding the Longitude," vol. ii.) with the *interval of time* between the obfervations at the *top*, and the *latitude of the place* of obfervation in the *fide* column, and take out the correfpondent number; take out the number from Table XXIV. anfwering to the *interval of time* and the *fun's declination*; fubtract it from the former, if the latitude and declination are of the fame name, otherwife add them, and find the log. correfponding to the remainder or fum, which fubtracted from the pro. log. of the daily variation of the fun's declination, increafed by 5, the remainder will be the pro. log. of the equation of equal altitudes.

Example. Let the latitude of the place of obfervation be 57° 9′ N.; the interval of time between the obfervations 5^h 17^m; fun's declination 17° 48′ S., and change of declination 16′ 19″½.

Required the equation of correfponding altitude?

No. from Table XXIII. to interval and lat.	= 1782	
No. from Table XXIV. to inter. and declin.	= 284	
Sum - - -	2066 log. fub.	3.3151
Daily variation of declination	16′ 19″.5 p. log. + 5 =	6.0424
Equation of equal altitudes	= 20ˢ.2 p. log. -	2.7273

In the Tables I. and II. of Mr. Wales, and in Tab. XLIII. of Mr. Vince, the arguments at top and fide are "half the interval between the obfervations," and "☉'s longitude."

Problem XI.

To find the errors and rate of a chronometer by equal altitudes of the fun.

Rule, (by A. Mackay, LL.D. F.R.S. Edin. &c.) In the morning, when the fun is more than two hours diftant from the meridian, in thefe latitudes, let a fet of obfervations be taken, confifting, for the fake of greater accuracy, of at leaft three altitudes; which, together with the correfponding times per watch, are to be written down regularly, the time of each obfervation being previoufly increafed by 12 hours. In the afternoon obferve the inftants when the fun comes to the fame altitudes, and write down each oppofite to its refpective altitude. Now, half the fum of any two times, anfwering to the fame altitude, will be the time of noon per watch uncorrected; find the mean of all the times of noon, thus deduced from each correfponding pair of obfervations, to which the equation of equal altitudes is to be applied, by addition or fubtraction, according as the fun is receding from, or approaching to, the elevated pole; the fum or difference will be the time per watch of apparent noon, or the inftant when the fun's centre was on the meridian, the difference between which and noon is the error of the watch for apparent time, and the watch will be faft or flow, accordingly as the time of noon thereby is more or lefs than 12 hours.

If the watch be regulated to mean folar time, it is obvious, that the time of noon found as above, fhould agree with that found by applying the equation of time to noon, according to its fign in the Nautical Almanac. If thefe times do not agree, their difference will be the error of the watch for mean folar time. Inftead of applying the equation of time to twelve hours, it perhaps will be found more convenient to apply it with a contrary fign to the time per watch of apparent noon; and the difference between this time and 12 hours will be the error of the watch.

Example 1. January 29, 1786, in lat. 57° 9′ N. the following equal altitudes of the fun were obferved. Required the error of the chronometer?

Time.	A.M.		P.M.
Alt. = 8° 5′	21^h 35^m 8^s		2^h 55^m 43^s
8 10	- 36 8	- - -	54 42
8 20	- 38 9	- . -	52 41.2
8 25	- 39 12⅓	- - -	51 38

	21^h 35^m 8^s	21^h 36 8	21^h 38^m 9^s	21^h 39 12.5
	2 55 43	2 54 42	2 52 41.2	2 51 38
Sum	24 30 51	24 30 50	24 30 50.2	24 30 50.5
M.	12 15 25.5	12 15 25	12 15 25.1	12 15 25.2
				25.1
				25.0
				25.5

Sum - - - - - - - - - -	.8
Time of noon per chronometer uncorrected	12 15 25.2
Equation of equal altitudes, by Prob. X.	20.2
Time per chronometer of apparent noon	12 15 5.0
Chronometer faft for apparent time -	15 5
Time per watch of apparent noon -	12 15 5.0
Equation of time - - - - -	13 29.8
Time per chronometer of mean noon -	12 1 35.2
Chronometer faft for mean time - -	1 35.2

In obferving equal altitudes, it will be found convenient to put the index of the inftrument to a certain divifion, and to wait till either limb of the fun attains that altitude. If the fucceffive altitudes of the fame fet are equidiftant from each other, the mean of the morning obfervations may be compared with the mean of thofe obferved in the afternoon, in order to find the time of noon.

Example 2. April 20th, 1786, in latitude 57° 9′ N. the following obfervations were made, in order to afcertain the error of the chronometer.

		A.M.	P.M.
Alt. = 35° 40′	time p.chr.	21^h 20^m 27^s .5	2^h 37^m 29^s .5
35 45	- -	21 16 .0	36 41 .0
35 50	- -	22 4 .5	35 52 .5
35 55	- -	22 53 .0	35 4 .0
36 0	- -	23 41 .3	34 15 .6
		10 22 .3	29 22 .6
Mean -	-	21 22 4.46	2 35 52.52
		2 35 52.52	
Chronometer	-	23 57 56.98	
Carried over		11 58 58.49	

6

Time

Time per chron. of noon uncorrected	11 58 58.49		
Equation of equal alt.	— 19.53		
Time p. chr. of app. noon	11 58 38.96		11 58 38.96
Chron. slow for app. time	1 21.04	eq.ti. +	1 16.20
Time per chron. of mean noon	-		11 59 55.16
Chron. slow for mean time	- -	-	4.84

Hence, the observations of the two preceding examples being supposed to be made at the times specified, by the same chronometer, its daily rate may be established upon the supposition of an uniform motion, as follows:

January 29th, clock fast at noon		$= 1^m\ 35''.3$
April 20th, clock slow at noon	-	4.8
Interval, 81 days.	Difference	- 1 40.1

Now $1^m\ 40'.1$, div. by 81, gives $1'.236$ for the daily error or rate of the chronometer.

Second method of operation.

Example 3, (extracted from W. Wales, F.R.S.) Admit that on the 25th of August, 1793, the following observations of equal altitudes were made at Quebec, as in the annexed scheme.

Observation.

Thermometer.	Morning.	Afternoon.	Dou. Alt.	Thermometer.	
°	h. m. s.	h. m. s.	° ′	°	
56	19 26 53.9	4 35 43.3	45 00	67	Upper Limb.
	19 30 2.3	4 32 35.7			Lower Limb.
58	20 4 25.6	3 58 14.6	57 30	68	Upper Limb.
	20 7 36.0	3 55 5.0			Lower Limb.

Operation.

Upper Limbs.	Lower Limbs.	Upper Limbs.	Lower Limbs.	
h. m. s.	h. m. s.	h. m. s.	h. m. s.	
28 35 43.3	28 32 35.7	27 58 14.6	27 55 5.0	Afternoon observ.
19 26 53.9	19 30 2.3	20 4 25.6	20 7 36.0	Morning observ.
9 8 49.4	9 2 33.4	7 53 49.0	7 47 29.0	Interval.
4 34 24.7	4 31 16.7	3 56 54.5	3 53 44.5	Half interval.
0 1 18.6	0 1 19.0	0 1 20.1	0 1 20.5	Noon nearly.
+ 18.3	+ 18.2	+ 17.1	+ 17.0	Equa. Tab. I.
— 1.1	— 1.2	— 1.5	— 1.5	Equa. Tab. II. (by Wales).
0 1 35.8	0 1 36.6	0 1 35.7	0 1 36.0	True time of noon by the watch.
			35.7	
			36.0	
			35.8	
			4)143.5	

Time of noon by the chronometer	- -	$0^h\ 1^m\ 35^s.6$
Mean time of apparent noon (Naut. Alm. p. II.)	-	0 1 35 .3
Chronometer too fast for mean time	- -	00 .6

In any case of necessity, the observations of the equal altitudes may be taken in the forenoon of any day, and in the afternoon of the following day, and then the error of the chronometer may be ascertained by a similar process, as it was at the instant of the intermediate midnight. In this example Mr. Wales has added 24 hours to the time of the afternoon observation, and subtracted therefrom the time of the morning observation, the difference being the interval between the observations. We thought it not necessary to give Mr. Wales's rule, as it is very similar to Dr. Mackay's, and as the operation

ration will be sufficiently underſtood from the arrangement of the figures in the table.

Third Method.

Rule, (by Joſeph de Mendoza Rios, Eſq. F. R. S.) The equation (in Table XXXIII. of Mr. Mendoza's "Collection of Tables for Navigation and Nautical Altronomy,") is divided into two parts, and both have for arguments the ſun's longitude, (which muſt be previouſly found by Problem II.) and the interval, or time elapſed, between the obſervations; the firſt part is, beſides, to be multiplied by the tangent of the latitude, or, which comes to the ſame, by the ſine and ſecant, of the place of obſervation. The ſigns at the top of each ſection mark whether ſuch a part muſt be added to, or ſubtracted from the middle-time, in order to have the time of true noon; but the ſigns of the firſt part muſt be changed, if the place of obſervation is in the ſouthern hemiſphere.

Example 4. September 17th, 1789, (civil time) the following obſervations were made by Count de Bruhl, at his obſervatory at Harefield, ſituated in lat. 51° 36′ 9″.

Altitude of ☉'s upper limb.	Times by the Chronometer. Morning.	Times by the Chronometer. Afternoon.
67° 40′	21 42ᵐ 21ˢ.4	2h 0ᵐ 3ˢ.0
68 0	21 44 5.0	1 58 22.0
68 20	21 45 45.5	1 56 39.0
68 40	21 47 29.0	1 54 55.4
69 0	21 49 12.4	1 53 11.0
69 20	21 52 46.4	1 49 41.0
69 40	21 54 31.6	1 47 52.0
70 0	21 58 15.6	1 44 11.2

Sums - -	174 34 26.9	15 4 54.6
Means (div. by 8)	21 49 18.4	1 53 6.8
	25 53 6.8	Interv. (differ.) $4^h\,3^m\,48^s.4$ or 4 4
Sum - -	47 42 25.2	
Middle time (half)	23 51 12.6	

The ſun's longitude was then 5 ſigns 25°: conſequently

	First Part.	Second Part.
For 5 ſigns 25°, and $\begin{cases} 4^h\ 0^m \\ 4\ \ 20 \end{cases}$	$+15^s.53$ $+15.66$	-0.46 -0.45
Differences - - -	0.13	0.01

$$20^m : 0^s.13 :: 4^m : x \left(= \frac{4' \times 0.13}{20} = 0.03\right) \qquad 20^m : 0^s.01 :: 4^m : x \left(= \frac{4' \times 0.01}{20} = 0.00\right)$$

For ſix ſigns 0°, and $\begin{cases} 4^h\ 0^m \\ 4\ \ 20 \end{cases}$	$+15.63$ $+15.76$	0.00 0.00
Difference - - -	0.13	

$$20^m : 0.13 :: 4^m : x \left(= \frac{4' \times 0.13}{20} = 0.03\right)$$

Therefore,

For $\begin{matrix} 5^s & 25^\circ \\ 6 & 0 \end{matrix}$ and $4^h\ 4^m$	$+15.56$ $+15.66$	-0.46 0.00
Differences - - -	0.10	0.46

$$5^\circ : 0^s.10 :: 1^\circ : x\ (= 0.02) \qquad 5^\circ : 0.46 :: 1^\circ : x\ (= 0.09)$$

	First Part.		Second Part.
Thus, for five ſigns 26°, and $4^h\ 4^m$ -	$+15^s.58$	- - -	$-0^s.37$
Log. firſt part - - - -	1.19257		
Log. ſine latitude - - - -	9.89417		
Log. ſecant latitude - - - -	0.20684		
Log. firſt part corrected (ſum) - -	1.29358	- - -	$+19.66$
Equation - - - - - - - - -			$+19.29$
Middle time - - - - - - - -			$23^h\ 51^m\ 12.60$
Time of true noon - - - - - - -			23 51 31.89

To the time of true noon by the chronometer, thus obtained, it is only neceſſary to apply the equation of time, in order to compare the chronometer with equated, or mean time. The equation of time, in the preſent example, is $5^m\ 49^s.5$, ſo that at true noon the mean time is $23^h\ 54^m\ 10^s.5$; and rom hence it reſults, that the chronometer deviated $-2^m\ 38^s.61$ from mean time.

In theſe four examples, the obſerver is ſuppoſed to be in a ſtationary ſituation.

Problem XII.

To find the error of the chronometer by equal altitudes of the ſun, the ſhip being under way.

Rule, (by A. Mackay, LL.D. F.R.S. Edin. &c.) Let ſeveral

several sets of equal altitudes be observed in the morning and afternoon, and from thence find the corrected time of noon, as before, in Prob. XI.; also, let the sun's azimuth be observed, by which, the variation of the compass being applied, the true azimuth at the time of observation will be obtained.

Now, to the constant log. 9.2219 add the proportional log. of the interval of time between the equal altitudes, the hours and minutes being considered as minutes and seconds; the prop. log. of the hourly rate of sailing, the log. co-sine of the ship's latitude, the log. secant of the course, and the log. tangent of the sun's azimuth; the sum, rejecting tens in the index, will be the prop. log. of the correction answering to the change of latitude; and to the sum of the first four logs. add the log. co-secant of the course; the sum, rejecting tens in the index, will be the prop. log. of the change of longitude. The first correction is to be added to, or subtracted from, the time of noon before found, accordingly as the ship's latitude is increasing or diminishing; and the second correction is additive or subtractive, accordingly as the ship's course has been in the eastern or western hemisphere. The result thus deduced will be the time per watch of apparent noon, under the meridian of the first place of observation.

If the two last corrections be applied with a contrary sign, the time of apparent noon, under the meridian of the second place of observation, will be obtained.

The first correction vanishes, if the course made good between the observations is either due east or west; and the second, if the ship sails on a meridian.

Example. August 7th, 1804, equal altitudes of the sun's lower limb were observed, whereof the means were $9^h\ 14^m\ 52^s$ A.M., and $2^h\ 48^m\ 18^s$ P.M. respectively, the corrected azimuth of the sun from the south was $69\frac{3}{4}°$, the ship's course during the elapsed time S.W. by W. at the rate of 8.6 knots per hour, and the ship's latitude and longitude at noon were 39° 18′ N. and 31°24′ W. respectively. Required the error of the watch for apparent noon, under the meridian of the place where the first set of observations was made?

Constant logarithm	9.2219		
Int. of time $= 5^h\ 33^m$ or $5^m\ 33^s$ p. log.	$=$ 1.5110		
Hourly rate of sailing $8^h\ 6^m$ or $8^m\ 36^s$ p. log.	$=$ 1.3208		
Latitude 39° 18′, co-sine	9.8886		
	1.9423	- -	1.9423
Course 3 points, secant	0.0801	co-secant -	0.2553
Azimuth 69° 45′, tangent	0.4331	sec. cor. $1^m\ 9^s$ P.L.	2.1976
First correction $0^m\ 38^s$ p. log.	2.4555		

Mean of morning set - -		$9^h\ 14^m\ 52^s$
——— afternoon set - -		2 48 18
Uncorrect time of noon - -		12 1 35
Equation of equal altitudes	+	7
Equation of latitude - -	—	38
Equation of longitude -	—	1 9
Time p. watch of apparent noon, under meridian of first place of observation -		11 59 55
Watch slow for apparent time		5
Equation of time - -		5 23
Watch slow for mean time -		5 28

The problem may otherwise be performed, by estimating how many minutes the sun is higher or lower, in consequence of the change of latitude in the elapsed time, at the instant it will attain the corresponding altitude in the afternoon, and setting the index of the quadrant accordingly. This quantity may be found with sufficient accuracy from a traverse table.

Problem XIII.

To find the error of a chronometer, by equal altitudes of a fixed star.

Rule, (by A. Mackay, LL.D. F.R.S. Edin. &c.) Let several altitudes, and the corresponding times per watch, of a known star, be observed when in the eastern hemisphere; and when the star is in the western hemisphere, observe the instants when it comes to each of the former altitudes.

Take the mean of each corresponding pair of times, and the mean of these will be the apparent time per watch of the star's transit over the meridian.

From the apparent right ascension of the star, taken from the table, subtract the sun's right ascension, and the remainder will be the approximate time of the star's transit; from which subtract the equation corresponding thereto, and the sun's right ascension obtained by Prob. V., or from Table XVIII. (of Dr. Mackay), and from the same table take the equation answering to the ship's longitude, which must be added, if the longitude is east, but subtracted, if west. Hence the apparent time of the passage of the star over the meridian will be obtained.

Now, the difference between the observed and computed times of the star's transit, will be the error of the watch for apparent time, and which is fast or slow, accordingly as the time by observation is later or earlier than the computed time of the star's transit.

Example. July 4th, 1804, in latitude 35° 48′ S. and longitude 23° 26′ E. the following equal altitudes of Atair were observed. Required the error of the chronometer for apparent time?

	Time per Chronometer.		Altitude.		Time per Chronometer.
	$8^h\ 17^m\ 0^s$	-	27° 23′		$14^h\ 35^m\ 57^s$
	19 16	-	27 40		33 42
	20 12	-	27 55		32 44
	21 54	-	28 12		31 5
	23 16	-	28 30		29 41
	8 25 55	-	28 52		14 27 1
Sum	7 33	-	-	-	10 10
Mean	8 21 15.5	-		-	14 31 41.6
					8 21 15.5
					22 52 57.1
Observed time of transit		-		-	11 26 28.6
Atair's right ascension		-		-	19 41 18
Sun's right ascension at noon, p. N. Al.					8 14 5
Approximate time of Atair's transit					11 27 13
Equation to $8^h\ 14^m$ and $11^h\ 27^m$ Tab. XVIII. —					1 53
Equation to $8^h\ 14^m$ and 23° 26′ Tab. XVIII. +					16
Apparent time of star's transit		-			11 25 36
Apparent time of transit per watch		-			11 26 29
Watch fast		-	-	-	0 0 53^s

In this problem, the observer is supposed to continue in the place during the interval between the corresponding observations, but if the observations are taken on board of a ship under

under way, the equations muſt be applied ariſing from the ſhip's run, according to the directions given and exemplified in the laſt problem, to reduce the time of the tranſit to either of the two places of obſervation; then the difference between this time and the time indicated by the chronometer, when all allowances are made for rate, &c. will be the longitude of the ſaid place. It may be proper to add here, that when the courſe and diſtance made good between the obſervations are given, inſtead of the obſerved interval of time and hourly rate of ſailing, the conſtant log. 1.4771 (= 9.2219 + pr. log. of one minute) is to be uſed inſtead of 9.2219 which is uſed in Prob. XII.

Problem XIV.

To find the apparent time on any given day in a known latitude by one obſerved altitude of the ſun.

Rule, (according to the Requiſite Tables.) From the obſerved altitude ſubtract the dip of the horizon, and the refraction; and to the remainder add the ſun's ſemi-diameter; the ſum will be the true altitude of the ſun's centre. Subtract the natural ſine of the altitude thus corrected, from the natural ſine of the calculated meridional altitude, and to the logarithm of the remainder add the log. ſecant of the ſhip's latitude, and the log. ſecant of the ſun's declination; their ſum, rejecting 20 from the index, muſt be ſought for in Tab. XVI. under log. riſing, and the time correſponding to it is the apparent time from the neareſt noon, when the ſun's altitude was obſerved. Conſequently, if the obſervation be made in the forenoon, the time, thus found muſt be taken from 24 hours, and the remainder will be the apparent time from noon of the preceding day. The parallax in altitude is here diſregarded, as being too trifling to deſerve notice.

Example. July 9th, 1775, about 8 A.M. in latitude 34° 55′ N. longitude 40° W. the altitude of the ſun's lower limb was obſerved to be 36° 49′½; the obſerver's eye being 21 feet above the ſurface of the ſea; what was the apparent time when this obſervation was made?

Refr. (Tab. I.)	1′ 16″	Sun's declin. Naut. Al.	22° 23′ 15″ N	Tab. VI. of Req. Tab.		
Dip. (Tab. II.)	4 22	Ship's long. gives -	— 52			
		Time for noon gives	+ 1 18			
Sum - -	5 38					
Sun's ſemi-dia.	15 47	Sun's declination -	22 23 41	N. log. ſec. - -		10.03407
		Co. latitude -	55 5 0	N. log. co-ſec. - -		10.08619
Cor. ☉'s alt.	10 9					
Alt. ☉'s l. l.	36 49 30	Meridional alt. -	77 28 41	Nat. ſine -	97623	
☉'s true alt.	36 59 39	- - - - -		Nat. ſine -	60181	
					37442	Log. 4.57336

Time from noon on the 9th •	$3^h\ 58^m\ 22^s$	- - - - Log. riſing - - -	4.69362
	24 0 0		
Apparent time on the 8th -	20 1 38	which was required.	

Second Method.

Rule, (by Joſeph de Mendoza Rios, Eſq. F.R.S.) With the ſhip's longitude and the eſtimated apparent time, find, by the Nautical Almanac, the ſun's declination for the moment of the obſervation. (Problem III.)

From the obſerved altitude of the limb, deduce the true altitude of the centre.

From the ſun's declination, conclude the polar diſtance, and add it together with the ſhip's latitude and the altitude; take half the ſum, and the difference between the half ſum and the altitude.

Take the logarithmic co-ſecant of the polar diſtance, the logarithmic ſecant of the latitude, the logarithmic co-ſine of the half ſum, and the logarithmic ſine of the difference. The ſum (with the index reduced to the units) will be the logarithmic verſed ſine of the time from noon (or the ſun's horary angle), when the altitude was obſerved.

The time from noon is itſelf the apparent time, if the altitude was obſerved to the weſt, or in the afternoon; but, if it was obſerved to the eaſt, or in the forenoon, the time from noon muſt be taken from 24^h, in order to have the apparent time of the preceding day.

Example. February 11th, 1792, in latitude 23° 20′ S. and longitude 27° 27′ W., the altitude of the ſun's lower limb was obſerved (to the eaſt) to be 45° 10′ 10″, the obſerver's eye being 14 feet above the ſurface of the ſea. The eſtimated time was then $20^h\ 57^m\ 30^s$ ($8^h\ 57^m\ 30^s$ in the morning by the watch). What is the apparent time at the ſhip, at the moment of the obſervation?

Eſtimated time at the ſhip, Feb. 11th -	$20^h\ 57^m\ 30^s$
Longitude W. 27° 27′ = - - - -	+ 1 49 48
Time at Greenwich - - - - -	22 47 18
The true altitude will be found to be -	45° 21′ 53″

☉'s declin. (by Naut. Almanac) S -	13° 41′ 36″		
Polar diſtance -	76 18 24	L. co-ſec.	0.01252
Latitude -	23 20 0	L. ſec. -	0.03706
Altitude -	45 21 53		
Sum - -	145 0 17		
Half-ſum -	72 30 8	L. co-ſine	9.47804
Half-ſum-alt -	27 8 15	L. ſine -	9.65609
Time from noon	$3^h\ 4^m\ 40^s$	L. verſ. (ſum)	9.18671
Apparent time required - -	20 55 20		

Third Method.

Rule, (by A. Mackay, LL.D. F.R.S. Edin. &c. and others.) Correct the obſerved altitude of the ſun's limb, and reduce the declination to the time and place of obſervation, which, ſubtracted from, or added to 90°, according as the declination and latitude are of the ſame or of contrary names, the remainder or ſum will be the ſun's *polar diſtance.*

Now,

Now, add together the ſun's corrected altitude and polar diſtance, and the latitude of the place of obſervation, and call the difference between half the ſum of theſe and the altitude, the *remainder*.

Then, to the log. co-ſecant of the polar diſtance, add the log. ſecant of the latitude, the log. co-ſine of the half ſum, and the log. ſine of the remainder; half the ſum of theſe will be the log. ſine of an arch; which, being multiplied by 8, will be ſun's diſtance from the meridian in apparent time. Hence, the apparent time of obſervation, and the error of the chronometer will be known.

Example. March 4th, 1804, in latitude 45° 37′ N. and longitude 19° 19′ W. the following altitudes of the ſun's lower limb were obſerved, the height of the eye being 16 feet above the ſurface of the ſea. Required the apparent time of obſervation, and the error of the watch?

Time per watch.	Alt. ⊙'s l. limb.		
$2^h\ 53^m\ 32^s$	24° 59′	⊙'s dec. at noon, p. N. A.	= 6° 23′.4
54 30	52	Eq. tab. XIII. to dec. and 2^h 55^m P. M.	= − 2.8
55 36	54		
56 47	35	Do. to dec. and 19° 19′ W.	= − 1.2
20 25	190	Reduced declin.	6 19.4
Mean 2 55 6	24 47.5	Polar diſtance	96 19.4

Semi-diameter -	+ 16.2		
Dip. - -	− 3.8		
Correction - -	− 1.9		
Cor. alt. ⊙'s centre =	24 58.0		
Sun's polar diſt. =	96 19.4	Co-ſecant -	0.00265
Ship's latitude =	45 37.0	Secant. -	0.15524
Sum - -	166 54.4		
Half - -	83 27.2	Co-ſine -	9.05695
Remainder - -	58 29.2	Sine - -	9.93071
			19.14555
Arc - -	21 57.4	Sine - -	9.57277
	8		
Apparent time -	2 55 39		
Time per chronom.	2 55 6		
Chronometer ſlow -	33^s		

Fourth Method.

Rule, (from A. Mackay, LL.D. F.R.S. Edin. &c.) Enter Tab. XXVII. (of Dr. Mackay) with the declination of the object at the top, and the latitude of the place of obſervation in the ſide column; take out the correſponding number, to which prefix the index 4, and add to it the log. ſine of the corrected altitude; find the natural number anſwering thereto, to which apply the number from Tab. XXVIII. by ſubtraction or addition, according as the latitude and declination are of the ſame or of contrary names. Now, find the above difference or ſum in Table XXIX. and the correſponding time will be the diſtance of the object from the meridian.

Example. May 7th, 1803, in latitude 56° 4′ N. and longitude 7° 30′ W. at $4^h\ 37^m\ 4^s$ P.M. per chronometer, the altitude of the ſun's lower limb was 25° 6′ 1″, and height of the eye 18 feet. Required the error of the chronometer for apparent time?

Alt. ⊙'s l. l.	25° 6′.1	⊙'s dec. p. N. Al. =	16° 37.5′ N.
Semi-diam.	+ 15.9	Eq. to $4^h\ 37^m$ P.M.	+ 3.2
Dip. -	− 4.1	do. to 7° 30′ W.	+ .3
Correction	− 1.9	Reduced declination	16 41.0 N.
Cor. alt. ⊙'s c.	25 16.0		

To latitude 56° 4′, and declination 16° 41′, the number from

Table XXVII. =	4.2719	Table XXVIII. =	4455
Alt. 25° 16′ ſine -	9.6303		
Sum - -	3.9022	Natural number -	7984
Apparent time -	$4^h\ 37^m\ 20^s$	per Table XXIX.	3529
Time per chron.	4 37 4		
Chronom. ſlow -	16		

Fifth Method. By Spherical Trigonometry.

If in any ſpherical triangle, P ⊙ Z, P repreſent the pole, ⊙ the ſun, and Z the zenith of the place, then we ſhall have that caſe in ſpherical trigonometry, in which the three ſides of the triangle are given to find the horary angle at P.

Example. Suppoſe the co-latitude, Z P, of London to be 38″ 28′, the co-alt. or zen. diſtance Z ⊙ corrected 43° 40′, and the co-declination or polar diſtance, ⊙ P, reduced to be 66° 52′ 9″, on June 21, 1795, required the horary angle ⊙PZ, and the mean time correſponding?

The work is thus; viz.

Co. lat. -	38° 28′		
Zenith diſtance	43 40		
Polar diſtance	66 32 9″		
2)	148 40 9		
½ ſum	74 20 4½		
½ ſum − Z P =	35 52 4½	ſine -	9.7678374
½ ſum − ⊙ P =	7 47 55½	ſine -	9.1325553
		Co-ar. s. 38° 28′	0.2061683
		Co-ar. s. 66 32 9″	0.0374842
		2)	19.14[illegible]045
		Sine 21° 55′ 5″ =	9.5720226
		2	

43 50 10 = the angle from noon, which converted to time is $2^h\ 55^m\ 20^s$ of apparent time from noon; to which add the equation at the time, which is $1^m\ 25^s.6$, and the ſum $2^h\ 56^m\ 45^s.6$ will be the mean time from noon, which may be either before or after it.

PROBLEM XV.

To find the apparent time at a given place, on any night, by an obſerved altitude of a ſtar.

Rule, (according to the Requiſite Tables.) Subtract the dip of the horizon and the refraction from the obſerved altitude of the ſtar, and let its right aſcenſion and declination for the given year be taken out of the tables; compute its meridian altitude, from the natural ſine of which take the natural ſine of its corrected altitude, and find the logarithm of the remainder. To this logarithm add the logarithmic ſecant of the

the latitude of the ſhip or place, and the logarithmic ſecant of the ſtar's declination; their ſum, rejecting 20 from the index, muſt be ſought for in Table XVI. under *log. riſing*, and the time correſponding to it will be the diſtance of the ſtar from the meridian; which being added to the ſtar's right aſcenſion in time, if the ſtar was weſt of the meridian at the time of obſervation, or ſubtracted from it, if the ſtar was then eaſt of the meridian, will give the right aſcenſion of the mid-heaven. Find the ſun's right aſcenſion in time by Prob. V. for noon at the given place, and ſubtract it from the right aſcenſion of the mid-heaven; the remainder is the eſtimate time.

Enter Table XXIII. again, as in Prob. V. with the eſtimate time and daily variation of the ſun's right aſcenſion, and ſubtract the minutes and ſeconds, thus found, from the eſtimate time; the remainder is the apparent time when the altitude of the ſtar was obſerved.

Example. April 14th, 1780, latitude 48° 56′, N. longitude 66°, W. the obſerved altitude of Aldebaran, weſt of the meridian, was 22° 24½′; the height of the obſerver's eye, above the ſurface of the ſea, 21 feet; what was the apparent time when that obſervation was made?

Sun's A.R. for n. at Greenw.	1 31ᵐ 1	Refract. Tab. I.	2ᵐ 18ˢ
Long. 66°, W. Tab. XXIII. giv.	+ 41	Dip, Table II.	4 22
⊙'s A.R. at n. given place	1 31 42	Correction	6 40
		Obſ. alt. ſtar	22° 24 30
Star's dec. Tab. VII.	16 3 N.		
Co-latitude	41 4 N.	True alt. ſtar	22 17 50

Star's merid. alt.	57 7	Nat. ſine 83978		
True alt. ſtar	22 18	Nat. ſine 37946		
Difference of the nat. ſines		46032	log.	4.66306
Latitude of the ſhip	48° 56′ 0″		log. ſecant	10.18248
Star's declination	16 3 0		log. ſecant	10.01727
Star weſt of the meridian	4ʰ 57 8		log. riſing	4.86281
Star's right aſ. Tab. VII.	4 23 20			
Right aſcen. mid heaven	9 20 28			
Sun's right aſcen. at noon	1 31 42			
Eſtimate time	7 48 46			
Num. from Tab. XXIII. ſubt.	0 1 12			
Apparent time	7 47 34			

Second Method.

Rule, (by A. Mackay, LL.D. F.R.S. Edin. &c.) Correct the obſerved altitude of the ſtar, and let its declination and right aſcenſion be reduced to the time of obſervation.

With the latitude of the place, the true altitude, and apparent declination of the ſtar, compute its horary diſtance from the meridian, by any of the methods given in the laſt problem; which being added to or ſubtracted from its right aſcenſion, according as it was obſerved in the weſtern or eaſtern hemiſphere; the ſum or remainder will be the right aſcenſion of the meridian.

From the right aſcenſion of the meridian, increaſed by 24 hours if neceſſary, ſubtract the ſun's right aſcenſion, as given in the Nautical Almanac for the noon of the propoſed day; the remainder will be the *approximate time* of obſervation; from which ſubtract the equation anſwering thereto, and the ſun's right aſcenſion, from Table XVIII. and let the equation from the ſame table, correſponding to the longitude, be added or ſubtracted, accordingly as the ſhip is to the eaſt or weſt of Greenwich, and the reſult will be the apparent time of obſervation. Hence the error of the watch will be known.

Example. December 13, 1804, in latitude 37° 46′ N. longitude 21° 15′ E. a certain phenomenon was obſerved, and at the ſame inſtant the altitude of Arcturus, eaſt of the meridian, was obſerved to be 34° 6′.4; the height of the eye 10 feet. Required the apparent time of obſervation?

Obſ. alt. of Arcturus	= 34° 6′.4		
Dip	— 3 .0		
Refraction	— 1 .4		
True alt. of Arcturus	= 34 2 .0		
Polar-diſtance	69 47 .8	co-ſecant	0.02758
Latitude	37 46 .0	ſecant	0.10209
Sum	141 35 .8		
Half	70 47 .9	co-ſine	9.51706
Remainder	36 45 .9	ſine	9.77709
			19.42382
Arch	31 0 .3		
	8		
Arcturus E. of mer.	= 4ʰ 8ᵐ 2ˢ		
Arcturus right aſcen.	= 14 6 46		
Right aſc. of mer.	= 9 58 44		
Sun's right aſcenſion	17 22 24		
Approximate time	16 36 20		
Eq. to long. Tab. XVIII.	+ 16		
Eq. to approx. time	— 3 2		
App. time of obſ.	16 33 34		

In order to attain the greateſt accuracy from obſervations of this kind, ſeveral ſtars ſhould be obſerved, and the error of the watch deduced from each ſtar ſeparately. If an equal number of ſtars be obſerved on each ſide of the meridian, and nearly equidiſtant therefrom, thoſe errors which ariſe from the inſtrument, the ſpheroidal figure of the earth, &c. will by this means be rendered almoſt inſenſible. If the ſhip is under way, during the interval between the obſervations of the different ſtars, and if that interval is conſiderable, it will be neceſſary to reduce the error to the ſame meridian, by allowing for the difference of longitude made good between the obſervations, as in Prob. XII.

Third Method.

Rule, (from Mr. Mendoza's Tables.) Find the right aſcenſion and declination of the ſtar for the given time by the catalogue.

Reduce the obſerved altitude to the true.

With the ſtar's declination and true altitude, and the ſhip's latitude, compute the ſtar's horary angle (or diſtance from the meridian,) when the altitude was obſerved to the weſt, take the ſum of the horary angle and the ſtar's right aſcenſion; when it was obſerved to the eaſt, ſubtract the horary

horary angle from the right aſcenſion, increaſing this by 24^h, if neceſſary; the ſum (deducting 24^h if greater than this quantity) or remainder, will be the right aſcenſion of mid-heaven.

Take out of the Nautical Almanac, the right aſcenſion for noon of the given day; and its variation during the 24 hours which comprehend the time of obſervation.

If the apparent time at Greenwich, at the moment of the obſervation is accurately known, find the ſun's right aſcenſion for that moment; and ſubtract it from the right aſcenſion of mid-heaven (increaſed by 24^h, if neceſſary) and the remainder will be the apparent time at the ſhip required.

If the apparent time at the ſhip is not well known, it will be neceſſary to proceed according to the following rules:

Subtract the ſun's right aſcenſion for noon, from the right aſcenſion of mid-heaven (increaſed by 24 hours if neceſſary); and the remainder will be the approximated apparent time at the ſhip.

With the difference of longitude, find the correſponding time at Greenwich; and take the interval between it and the noon before. Find the proportional part of the variation of the right aſcenſion to this interval; and add it to, or ſubtract it from the approximated time at the ſhip, accordingly as the correſponding time at Greenwich is before or after the ſaid noon; the ſum, or difference will be the time required.

Example. March 1, 1792, at $9^h\ 32^m\ 9^s$, time eſtimated by means of the watch, latitude 28° 7′ north, and longitude 36° 6′ weſt, the altitude of Aldebaran was obſerved (to the weſt) to be 32° 11′ 45″, the obſerver's eye being 16 feet above the ſurface of the ſea: What is the apparent time at the ſhip when the obſervation was made?

The right aſcenſion of Aldebaran for March 1, is (by Table XXV.)			$4^h\ 24^m\ 0^s.6$
The declination of the ſame - -			16° 4′ 40″ N.
The true altitude will be found to be -			32 6 18
✱'s Polar diſt.	73° 55′ 20″	L. co-ſec. 0.01733	
Ship's lat.	28 7 0	L. ſec. 0.05454	
Altitude	32 6 18		
Sum -	134 8 38		
Half-ſum	67 4 9	L. co-ſine 9.59061	
Half-ſum alt.	34 58 1	L. ſine 9.75823	
✱'s horary ang. W.		L. verſ. (ſum) 9.42071	4 7 4
✱'s right aſcenſion - - -			4 24 0.6
Right aſcenſion of mid heaven - (ſum)			8 31 4.6
⊙'s right aſcen. March 1, at noon, at Greenw.			22 52 25.0
(Variation of R. A. in 24^h following $3^m\ 43^s.8$)			
Approximated app. time at the ſhip (diff.)			9 38 39.6
Longitude W. 36° 6′ = - -			2 24 24
Approximated apparent time at Greenwich			12 3 3.6
Propor^l. part of $3^m\ 44^s$ to $12^h\ 3^m$ — $1^m\ 52^s\ 28^t$ - - .			= −0 1 52.5
Approximated apparent time at the ſhip			9 38 39.6
Apparent time at the ſhip required -			9 36 47.1

PROBLEM XVI.

To find the longitude at ſea by a chronometer.

Rule, (by W. Wales, F.R.S., &c.) Obſerve the altitude of the ſun's limb, either in the morning or evening, when it is, at leaſt, three points of the compaſs from the meridian, and note the time when it was obſerved by the time-keeper.

Multiply the daily rate of the watch by the number of days which have elapſed ſince that on which the laſt obſervation was made for finding it, and add the product to the time ſhewn by the watch when the ſun's altitude was obſerved, if the watch be loſing, but ſubtract it from that time if the watch be gaining. To the ſum, or remainder, add what the watch was too ſlow, or ſubtract from it what the watch was too faſt for mean time at the place where its rate was found, on the day when the laſt obſervation was made for finding it, and the reſult will be the mean time at the place when the ſun's altitude was obſerved. To this time add the longitude of the place in time, where the rate of the watch was found, if it be weſt; or ſubtract the longitude in time from it, if it be eaſt, and the ſum or remainder will be the mean time at Greenwich.

To this time find the ſun's declination by Problem III. and correct the obſerved altitude of the ſun's limb for the dip of the horizon, refraction, parallax, and ſemi-diameter, with which, the latitude of the ſhip, and the ſun's declination, find the mean time at the ſhip, (by Problem XIV.)

Take the difference between the mean time at the ſhip, and the mean time at Greenwich, and it will be the longitude of the ſhip in time; eaſt, if the time at the ſhip be greater than the time at Greenwich, but weſt if it be leſs.

Example 1. After having found the rate of a chronometer to be gaining $1^s.67$, (as in Example 1 of Prob. VII.) and that it was too faſt for mean time at Barbadoes, on the 31ſt of December, 1793, by $4^h\ 1^m\ 49^s.7$, let us ſuppoſe that on the 4th of February, 1794, in the afternoon, latitude 44° 26′ N. the following obſervations were taken: what was the longitude of the ſhip; the height of the obſerver's eye above the ſurface of the ſea being 21 feet?

Times by the watch	Alt. of the ⊙'s L.L.		
		Chr. too faſt, Dec. 31, 1793,	$4^h\ 1^m\ 49^s.7$
		Gain to Feb. 4, 1794, = $1^s.67 \times 35^d$ -	+ 58.5
		Time-keep. too faſt, Feb. 4,	4 2 48.2
$5^h\ 2^m\ 51^s$	9° 17′ 15″		
3 44	9 8 45	Sun's ſemi-diameter -	16′ 16″
4 40	8 59 30	Sun's horizontal parallax -	9
5 49	8 50 00		16 25
4)17 4	36 15 30	Dip of the horizon 4′ 22″; Refraction - 5 48	10 10
5 4 16	9 3 52		
4 2 48	+ 6 15	Correction of the ſun's alt.	6 15
1 1 28	9 10 7	True altitude	
3 58 45	-	Longitude of Barbadoes, W.	
5 0 13	-	Mean time at Greenwich	

Sun's declination for noon at Greenwich			16° 3′ 24″ S.
Correction for time at Greenwich -			− 3 31
Sun's correct declination - -			15 59 53 S.
	90° 00′		
Ship's latitude	44 26 N.	ſecant -	10.14626
Co-latitude	45 34		
Sun's declin.	16 00 S.	ſecant -	10.01715

Meric.

Merid. altitude	29 34 N.S. 49344	} 33413 log. 4.52393	
Sun's obs. alt.	9 10 N.S. 15931		
Apparent time at the ship	$3^h\ 56^m\ 29^s$	Log rising 4.68734	
Equation of time, add	14 26		
Mean time at the ship	4 10 55		
Mean time at Green.	5 0 13		
Longitude in time	0 49 18 = 12° 19′½ W.		

Example 2. March 29th, 1794, latitude 55° 9½′ N. the following obfervations were made to determine the longitude by the fame chronometer :

Time by the Watch.	Alt. of the ☉'s L.L.		
		Chr. too faft Dec. 31, 1793,	$4^h\ 1^m\ 49^s.7$
		Gain to Mar. 29, 1794, } = $1^s.67 \times 88\frac{1}{2}^d$	+ 2 27.8
$18^h\ 8^m\ 30^s$	11°27′15″	Chr. too faft March 29,	4 4 17.5
9 28	34 45		
10 26	42 00	Sun's femi-diameter -	16′ 3″
11 27	49 30	Sun's parallax in altitude	9
12 32	58 00		
5)52 23	5)211 30	Dip of the horizon 4′ 22″ } Refraction - 4 31	8 53
18 10 28.6	11 42 18		
+ 4 17.5	+ 7 19	Correction of the fun's alt.	7 19
14 6 11	11 49 37	True altitude.	
3 58 45	-	Longitude of Barbadoes, W.	
18 4 56	-	Mean time at Greenwich.	

Sun's declination for noon at Greenwich			3° 58′ 00″ N.
Correction for time at Greenwich -			− 5 49
Sun's correct declination - -			3 52 11 N.
	90° 00′		
Ship's lat.	55 9½	N. fecant	10.24313
Co lat.	34 50½		
Sun's declin.	3 52⅙	N. fecant	10.00099
Merid. alt.	38 42⅔	Nat. S. 62539 }	42043 log. 4.62369
Sun's obf. alt.	11 49⅔	Nat. S. 20496 }	
	$4^h\ 59^m\ 9^s$		Log rifing 4.86781
	24		
Appar. time at the fhip	19 0 51		
Equation of time	+ 4 32		
Mean time at the fhip	19 5 23		
Mean time at Greenw.	18 4 56		
Longitude in time	1 0 27 = 15° 6′¾ eaft.		

Same Problem.

Rule, (by A. Mackay, LL.D. F.R.S. Edin. &c.) Let feveral altitudes of the fun, or of any fixed ftars to be obferved ; and correct the mean altitude as ufual ; with which, the fhip's latitude, and heavenly object's declination, compute the apparent time of obfervation, to which apply the equation of time, reduced to the time and place of obfervation, according to its title in the Nautical Almanac, and hence the mean time of obfervation will be known.

To the mean of the times of obfervation, as fhewn by the chronometer, apply its error and accumulated rate. Hence, the mean time, under the meridian of the place where the error and rate were eftablifhed, will be known : to which apply the difference of longitude in time between the given place and Greenwich, and the mean time of obfervation under the meridian of Greenwich will be obtained. Now, the difference between the time at the place of obfervation and that of Greenwich will be the longitude of the place in time ; and which is eaft or weft, accordingly as the time by obfervation is later or earlier than the Greenwich time.

Example 3. February 3, 1804, being in latitude 15° 48′ N. the mean of feveral altitudes of Spica Virginis, eaft of the meridian was 53° 24′, and that of the correfponding times, $15^h\ 18^m\ 22^s$ per chronometer, which had been fet to mean folar time at Rio Janeiro, December 5th, 1803, and was then gaining $23^s.8$ daily, on mean time. The height of the eye was 16 feet. Required the longitude of the fhip?

Daily rate - - - -			$53^s.8$
No. of Days between Dec. 5, 1803, & Feb. 3, 1804,			60
Gain in 60 days - - -			$53^m\ 48^s$
Now, $15^h\ 18^m - 54^m = 14^h\ 24^m$, in which time it gains			32
Accumulated rate - - -		54	20
Time per watch of obfervation -	15^h	18	22
Mean time of obfervation at Rio Janeiro	14	24	2
Longitude of Rio Janeiro in time	2	50	55 W.
Mean time at Greenwich - -	17	14	57
Equation of time - -	—	14	12
Apparent time at Greenwich -	17	0	45

Mean of ob. alt. = 53°24′.0		Sun's R.A. at noon	$21^h\ 4^m\ 3^s$
Dip and refraction —	4.5	Equa. tab. XVIII. of Dr. Mackay }	+ 2 53
Alt. corrected	53 19.5	Reduced R. afcen.	21 6 56

To lat. 15° 48′ N. and reduced declin. 10° 8′ S. the number from

Dr. Mackay's Table XXVII. }	= 4.0236	Dr. Mackay's Ta. XXVIII. }	= 0506
Alt. 53° 19½ fine	9.9042		
	3.9278	Natural number	8468
Mer. dift. Spica Virg.	$1^h\ 44^m\ 43^s$	Dr. Mackay's Tab. XXIX. }	8974
Right afc. Spica Virg.	13 14 53		
Right afcen. merid.	11 30 10		
Sun's right afcenfion	21 6 56		
Apparent time	14 23 14		
App. ti. at Greenw.	17 0 45		
Longitude in time	2 37 31 = 39° 29¾′ W.		

Example 4. Auguft 16, 1804, in latitude 38° 19′ S. the mean of feveral altitudes of Antares, weft of the meridian, was 14° 28′.9, the height of the eye being 12 feet, and the mean of the times per watch $11^h\ 41^m\ 38^s$ P. M. which had been compared with mean time at the Cape of Good Hope, June 22d, and was found to be $1^h\ 10^m\ 28^s$ flow, and gained $3^s.54$ daily ; required the fhip's longitude ?

6 Daily

Daily gain - - -	$3^s.54$
Number of days between 22d June and 16th August	55
Gain in 55 days - - -	$3^m\ 14^s.7$
The Green. time of obs. is about $11^h 35^m$, and cor. gain	1 .7
Accumulated rate - -	3 16
Error, 22d June - -	1^h 10 28
Watch slow at time of observation -	1 7 12
Time per watch of observation -	11 41 38
Mean time of obs. at Cape of Good Hope	12 48 50
Longitude of Cape of Good Hope -	1 13 33E.
Mean time at Greenwich - -	11 35 17
Equation of time - -	— 3 52
Apparent time at Greenwich - -	11 31 25

Obs. alt. of Antares =	14° 28′.9	Sun's R.A. at noon	9 42 40
Dip and refraction	— 6.9	Equa. Tab. XVIII.	+ 1 44
Corrected altitude	14 22	Red. right ascen.	9 44 24
Polar distance	64 1	Co-secant -	0.04628
Latitude -	38 19	Secant -	0.10535
Sum -	116 42		
Half - -	58 21	Co-sine -	9.71993
Difference -	43 59	Sine -	9.84164
			19.71320
Arch - -	45 $57\frac{1}{4}$ 8	Sine -	9.85660

Mer. dist. of Ant.	$6^h\ 7^m\ 38^s$
R. A. of Antares	16 17 27
R. A. meridian	22 25 5
Sun's right ascen.	9 44 24
Apparent time	12 40 41
Ap. time at Green.	11 31 25
Long. in time	1 9 16 = 17° 19′ E.

In practice, it will be found very convenient to have a table constructed, shewing the error of the chronometer at the noon of every day for several weeks, or during the estimated time of the run to a place where its error and rate can be again settled. To this table a column should be added, containing its hourly rate continued up to 24 hours.

Thus, supposing the daily rate of a chronometer, deduced from a series of observations, was — $4^s.72$, and its error for mean time, May 9, 1820, at noon was $3^m\ 58^s.6$ slow; then we shall have the subjoined table; viz.

Error of Chronometer at Mean Noon.	Hourly Rate.
♂ May 9 Error = $3^m\ 58^s.6$	1 hour = $0^s.2$
☿ — 10 — = 4 3.3	2 — = 0.4
♃ — 11 — = 4 8.0	3 — = 0.6
♀ — 12 — = 4 12.8	4 — = 0.8
♄ — 13 — = 4 17.5	5 — = 1.0
☉ — 14 — = 4 22.2	6 — = 1.2
☽ — 15 — = 4 26.9	7 — = 1.4
♂ — 16 — = 4 31.6	8 — = 1.6
☿ — 17 — = 4 36.4	9 — = 1.8
♃ — 18 — = 4 41.1	10 — = 2.0
♀ — 19 — = 4 45.8	11 — = 2.2
♄ — 20 — = 4 50.5	12 — = 2.4

In the last three problem, and indeed in all calculations, where the time is ascertained from an observation of the sun's, or of a star's altitude taken at a distance from the meridian, the accuracy of the result will entirely depend on the accuracy of the observation which furnished the data; it is, therefore, of the utmost importance, that the heavenly body should be in a situation, or azimuth line, in which its change of altitude is the greatest possible in a given time; this precise situation in the diurnal or nocturnal arc of any body, depends partly on the latitude of the place of observation, and partly on the object's declination; but, in all the heavenly objects, the situation alluded to, is when they are in the prime vertical; i. e. when they are either due east or due west of the observer; therefore, the nearer the observed object is to the prime vertical, provided it be not too near the horizon, so as to be too much affected by refraction, the more likely will the determined time be to be accurate. Dr. Mackay, in Table XXV. of his "Theory and Practice of finding the Longitude," p. 56, vol. ii., has given us "the altitude to be observed, in order to ascertain the apparent time with the greatest accuracy," which table is very convenient for determining very nearly when any heavenly object is due east or west: his arguments are, at the top "Declination of the sun or star," and at the side "Latitude:"—and since him, Joseph de Mendoza Rios, Esq. has given not only the requisite altitudes, but also the corresponding distances from noon in time in a parallel column, with the same arguments and mode of arrangement, in Table XXVIII. of his valuable and very cheap volume. This volume contains a complete collection of tables for navigation and nautical astronomy, that no navigator should be without. Indeed the commissioners of the Board of Longitude, and the court of directors of the East India company, with a liberality characteristic of the English nation, have enabled the author (who as liberally gives up his right to the benefits of his labours) to give, for we can hardly say sell, to the world the work in question for one third of its real value, as an encouragement to nautical science.

In the sixteen problems, which we have here exemplified, we have confined ourselves to observations of the sun and stars, though we might have extended our examples to the moon and planets also, if we had deemed it necessary; but the results derived from observations of these bodies, moving as they do in eccentric orbits, would have been less certain, as well as the calculations more complex than those we have given, which are our reasons for having omitted them.

Chronometer. A generical term for an instrument to measure time in *Music*. Accordingly a clock, a watch, or a sun-dial, is a *Chronometer*. See the preceding article. There are, however, chronometers constructed purposely to regulate the bars and measures of music; one in particular invented by M. Sauveur, described in his "Principles of Acoustics." It was a pendulum of a particular kind, which he exclusively applied to ascertain the time in the performance of musical compositions. L'Affilard, in his "Principles dedicated to Religious Ladies," placed at the head of all his airs, figures which expressed the number of vibrations of the pendulum, during the performance of each bar.

Rousseau said in his dictionary, 34 years ago, that it was then 30 years since a similar instrument appeared under the title of chronometer, which beat the time itself; but neither the one nor the other has succeeded. Many, however, continues Rousseau, have pretended that it is very much to be wished that such an instrument was completed in order to fix with precision the time of each bar in a piece of music; as, as, by that means, the true original meafure of each compofition would be recorded, without which expedient, it lofes its character; and after the death of the author, it is only by a kind of tradition, very likely to vary and be loft, that the time is known. Old people already complain that the time of many airs is loft; and it is believed that they are performed too flow. This may have come on by degrees, from the characters in prefent ufe, which look much quicker than thofe of a hundred, or indeed of fifty years ago, when demi-femiquavers were feldom ufed, and where there are now only minims, there ufed to be femi-breves, as in *alla breve* time. We are certain from our own memory, that the time of Handel's mufic is often miftaken, and performed fometimes quicker and fometimes flower than under his own direction.

The Encyclopedifts of the prefent time difpute Rouffeau's opinions about fuch an inftrument to regulate the meafure of each bar throughout a piece, which would be too mechanical, and trench on the authority of the leader. It has long been obferved that mufic on a barrel is ftiff, and without that flexibility, feeling, and expreffion, that are given to it by the human hand or voice, though the accuracy of clock-work is proverbial. But though we are equally difturbed by the abufe and bungling ufe of *rallentando;* yet there is a retardation as well as acceleration of time, which is almoft imperceptible, in the execution of particular paffages of *pathos* and of *fpirit* by a great mufician, which fenfibility alone can produce or underftand.

If a chronometer were to beat the time aloud, it would carry us back to mufical infancy; or if the pendulum were to be watched in its ofcillations, it would take the performer's eye from the book, and too much divide his attention. We can therefore only recommend with fincerity, the conftruction of a fmall machine, which might be an appendage to a piano-forte, to afcertain by the vibration of a pendulum the original time in which every movement of a compofition was conceived, as indicated by numerical figns at the beginning of each ftrain, by the compofer himfelf.

CHRONOSCOPE, formed of χρονος, *time*, and σκεπτομαι, *I confider*, a word fometimes ufed for a pendulum, or machine to meafure time. See PENDULUM and CHRONOMETER.

CHRONUS, or CHRONOS, in *Ancient Geography*, a river placed by Ptolemy in European Sarmatia.

CHROSTASIMA, in *Natural Hiftory*, a name ufed by Dr. Hill for all pellucid gems, which have one fimple and permanent appearance in all lights.

Of this kind are the diamond, the carbuncle, the amethyft, the fapphire, the beryl, the emerald, and the topaz.

CHROUET, WARNER, in *Biography*, a phyfician of eminence, in Brabant in Flanders, flourifhed towards the end of the 17th and beginning of the 18th centuries. The work by which he principally diftinguifhed himfelf is his differtation "De trium Oculi Humorum, aliarumque ejus Partium Origine, et Formatione explicata, Leodii, 1688, 8vo." He fhews that the veffels which Nuck fuppofed he had difcovered, and which he called ducts, for conveying the aqueous humour, were branches of the carotid arteries. His experiments, Haller obferves, were made on the eyes of brutes, but the human eye is found to be fimilarly conftructed. He fpeaks but obfcurely of the *membrana pupillaris*, which he fays is wanting in the dog. He defcribes, very well, the cellular ftructure of the vitreous humour, and gives chymical analyfes of the cryftalline and other humours. The work was reprinted in 1691, with ftrictures on the anfwer to it by Nuck. We have alfo by him, "La Connoiffance des Eaux Minérales d'Aix-la-Chapelle, de Chaud Fontaine, et de Spa, par leurs véritables Principes," Leyde, 1714, 12mo. He fhews himfelf, by the analyfes of thefe waters, to have been well fkilled in practical chymiftry. Haller, Elov. Dict. Hift.

CHRUDIM, in *Geography*, a town of Bohemia, and capital of a circle of the fame name, fituated on a river called "Chrudimka;" which circle contains 33 towns. It is chiefly remarkable for a great number of fifh-ponds, and an excellent breed of horfes; 100 miles S.E. of Drefden, and 50 E. of Prague.

CHRUTUNGI, in *Ancient Geography*, the name of a people which formed a part of the Scythians.

CHRYSI, a town of Afia Minor, in the Æolide. Pliny.—Alfo, the name of a fmall ifland, near that of Crete, on the coaft of the Peloponnefus. Pliny.—Alfo, a place in the Troade, called *Sminthium.*

CHRYSÆ-FANUM, a place of Sicily, near the road that paffed from Afforus to Enna.

CHRYSALIS, in *Entomology*, a technical expreffion among the writers on infects during the laft century that has the fame meaning as the more obfolete word aurelia, and is intended to imply what the Linnæan phrafeology denominates the pupa, or middle ftate in which all lepidopterous and moft other infects remain for fome time between the larva or caterpillar form, and the period of their appearance as perfect infects. The word chryfalis is employed by the beft writers, with the exception of Linnæus. Like the term aurelia, it alludes however to the metallic or golden fplendour of the cafe in which the creature is contained while in the pupa ftate, and is confequently applicable only to the pupæ of certain fpecies of the papilio or butterfly tribe, which in this ftate exhibits fuch a fplendid afpect. The term pupa adopted by Linnæus is more generally expreffive, as it implies that the infect like an infant yet remains enveloped in its fwaddling clothes. See AURELIA, ENTOMOLOGY, and PUPA.

CHRYSANTHEMOIDES, in *Botany*, *Ofteofpermum*, Comm. Hort. See OSTEOSPERMUM-*Spinofum*, Linn. *Spinefcens*, Willd.

CHRYSANTHEMOIDES-*Afrum*, Dill. Elth. See OSTEOSPERMUM *moniliferum*.

CHRYSANTHEMUM, (Χρυσανθεμον, Diofcor.) from χρυσὸς, *gold*, and ανθος, *a flower*.) Linn. Gen. 966. Schreb. 1307. Juff. 183. Vent. 2. 546. Gært. 990. (Leucanthemum and chryfanthemum, Tourn.) Clafs and order, *fyngenefia polygamia fuperflua*. Nat. ord. *Compofitæ difcoideæ*, Linn. *Corymbiferæ*, Juff.

Gen. Ch. *Calyx common*, hemifpherical, imbricated; interior fcales larger by degrees; innermoft membranous. *Corol. compound*, radiated; florets of the ray female, ftrap-fhaped; of the difc hermaphrodite, funnel-fhaped, fpreading, the length of the calyx. *Stam.* five, capillary very fhort; anthers forming a hollow cylinder. *Pift.* germ egg-fhaped; ftyle filiform, longer than the ftamens; ftigmas two, obtufe, revolute. *Seed* one to each floret, oblong, not crowned with a marginal rim. *Recep.* naked, dotted, convex.

Eff. Ch. Receptacle naked. Seed without a marginal ring. Calyx hemifpherical, imbricated; fcales dilated at the margin, membranous.

* *Ray white.*

Leucanthema of Tournefort.

Sp. 1. C. *pinnatifidum*, Linn. jun. Sup. 377. Willd. 1. Ait. Kew. iii. 231. (*Matricaria pinnatifida*, Lam. Defrouffeaux in Encyc. 7.) "Stem fhrubby; leaves fmooth, attenuated at the bafe, pinnatifid; fegments gafhed." A fhrub, two feet high. *Root* perennial. *Stem* fhort, rather thick, woody, naked; branches numerous, cylindrical, with a thick a thick foliage above, naked near the bottom, but marked with the scars of fallen leaves. *Leaves* about seven inches long, and three broad, thickly and irregularly set, oval-oblong, narrowing into a petiole at their base, green, smooth, and glossy on both sides. *Flowers* in a loose corymb, furnished at its divisions with slender bractes, smaller than those of C. *leucanthemum*. A native of the island of Madeira. Desroussseaux mentions a variety, C. *lacerum* of some authors, which he thinks may be a distinct species. It is two or three feet high, and forms a less bushy head than the preceding. Its leaves are less, more deeply pinnatifid, with the segments more deeply but less frequently gashed. *Flowers* on long petioles, less numerous on each branch. 2. C. *paludosum*, Willd. 2. Desf. Atl. tab. 238. Poiret. Itin. ii. 241. "Leaves all oblong-wedge-shaped, obtusely serrated; stem diffusely branched." *Root* annual. *Leaves* smooth, deeply serrated; upper ones only three toothed at the tip. *Flowers* resembling those of C. *leucanthemum* solitary, terminating the branches. A native of moist places in the kingdom of Tunis. 3. C. *atratum*, Linn. Sp. 5, excluding Var. β. Mart. 3. Willd. 3. (Bellis alpina major folio rigido, Bauh. Pin.) "Leaves all oblong-wedge-shaped, acutely serrated; stem simple, one-flowered, erect." Willd. *Root* perennial. *Root-leaves* lobed at the tip. *Calyx* with a black margin. Haller judges it not specifically different from C. *leucanthemum*. 4. C. *heterophyllum*, Willd. "Leaves sessile; lower ones linear-lanceolate, serrated; upper ones spatula-shaped." *Stem* ascending, a foot high, erect, simple, one-flowered. *Flowers* resembling those of C. *leucanthemum*, from which, according to Willdenow, who described it from a dried specimen, it differs in the shape of its leaves, and especially in the extreme minuteness of its upper ones. A native of Piedmont. 5. C. *leucanthemum*, great white ox-eye, or ox-eye daisy, Linn. Sp. Pl. 4. Mart. 5. Willd. 5. Eng. Bot. 601. (Matricaria, Lam.) "Leaves embracing the stem, lanceolate, serrated, gash-toothed at the base; stem erect, branched." Willd. "Leaves embracing the stem, oblong, obtuse, gashed, pinnatifid at the base; root-ones inversely egg-shaped, petioled." Dr. Smith. *Root* perennial, somewhat woody, fibrous. *Stems* two feet high, furrowed with red angles, somewhat hairy. *Leaves* deep green, glossy, smooth; upper ones alternate. *Flowers* shewy, large, solitary, terminal; calyx hemispherico-depressed, smooth; scales numerous, imbricated, scarous at the edges; inner ones dilated into a membrane at the tip; florets of the ray three times the length of the calyx, numerous, spreading, elliptic oblong, bitten at the tip, toothed. *Seeds* cylindrical, entirely destitute of a marginal rim, furrowed, black, with white ribs. *Receptacle* convex. A native of dry pastures and meadows in most parts of Europe. It varies much in different situations; hence the discordance of authors with respect to its varieties and kindred species. 6. C. *montanum*, Linn. Sp. Pl. 6. Mart. 6. Willd. 6. (Matricaria montana, Lam. Leucanthemum montanum minus, Tourn. Bellis montana minor, Bauh. Hist.) "Lower leaves petioled, spatula-shaped, serrated; upper ones linear-lanceolate, serrated; stem generally one-flowered." *Root* perennial. Probably only a variety of the preceding. A native of the south of France, Silesia, and other parts of Europe. 7. C. *rotundifolium*, Willd. 7. Waldst. and Kitaib. Pl. Rar. Hung. "Leaves petioled, serrated; lower ones roundish; upper ones egg-shaped; stem one-flowered." A native of the Carpathian mountains. 8. C. *ceratophylloides*, Willd. 8. Allion. Ped. 686. tab. 37. fig. 1. "Leaves pinnatid; pinnæ linear, acute; stem erect, one-flowered." *Root* perennial. *Leaves* alternate, unequally pinnated; pinnæ quite entire. *Flowers* resembling those of C. *leucanthemum*, scales sphacelated. A native of the mountains of Piedmont. 9. C. *graminifolium*, Linn. Sp. Plant. 7. Mart. 7. Willd. 9. Jacq. Obs. 4. tab. 92. (Matricaria graminifolia, Lam. "Leucanthemum gramineo folio, Tourn. Inst. 493. Bellis montana gramineis foliis, Mag. Monsp. 291. Hort. 31. tab. 31.) "Leaves linear, generally quite entire; stem quite simple." *Root* perennial. *Stems* from six to eight inches high, nearly erect, slender, striated, smooth, destitute of leaves near the top. *Leaves* slightly villous; root-ones often a little toothed near the summit. *Flowers* terminal, rather large, solitary; scales of the calyx egg-shaped, elongated, scarious, and blackish at the edges. A native of mountains in the south of France. 10. C. *tanacetifolium*, Willd. 11. (Matricaria tanacetifolia. Lam. Buphthalmum orientale tanaceti minoris folio, Tourn. Cor. 37.) "Leaves pinnated, hairy; pinnæ pectinate-serrated; calyx tomentous. *Root* perennial. *Stem* about two feet high, furrowed, pubescent, especially toward the base. *Leaves* sessile. *Flowers* small; calyx white, with down. A native of the Levant. 11. C. *monspeliense*, Linn. Sp. Pl. 9. Mart. 8. Willd. 12. (Matricaria monspeliensis, Lam. Leucanthemum montanum foliis chrysanthemi, Tourn. Inst. 492.) "Lower leaves palmated; leaflets linear, pinnatifid." *Root* perennial. *Stems* about a foot high, cylindrical, weak, nearly upright, superficially striated, branched, almost smooth. *Leaves* alternate, sessile, green. *Flowers* large, solitary, terminal; florets of the ray white, or slightly tinged with purple; calyx-leaves elongated, divided by a green line, and ending in a dry brown membrane. A native of the south of France. 12. C. *achilleæ*, Linn. Syst. Nat. Mart. 11. Willd. 13. (C. italicum, Linn. Parthenium foliis tenuissimis, achilleæ cæsuris, Mich. gen. 34, tab. 29.) "Leaves twice pinnated; pinnæ oblong, serrated; flowers in corymbs." Willd. *Root* perennial. *Stem* erect, a foot high, somewhat angular, many-flowered. *Leaves* like those of Millefoil, but eight times as large; besprinkled with scarcely conspicuous, prominent dots; with a few white hairs underneath, and ending in a white stiff point. A native of Italy. As the same synonym from Micheli is referred to by Linnæus under both C. achilleæ and C. italicum, and as no other synonym is quoted under either, it seems almost certain that he has, inadvertently, inserted the same plant twice; and was, perhaps, less likely to detect the error, as, notwithstanding the white ray of C. italicum, he was induced to place it among the chrysanthema, on account of the resemblance of its foliage to some of the species of that division. Desroussseaux maintains, that C. achilleæ is nothing more than a variety of C. corymbosum, which is unquestionably a pyrethrum; but as its seeds are not described, we have left it for the present where Linnæus placed it. 13. C. *argenteum*, Willd. 14. (Matricaria argentea, Linn. Spec. Pl. Encyc. Meth. Mart. Chamœmelum orientale incanum, millefolii folio, Tourn. Cor. 37.) "Leaves twice pinnated, hoary; pinnæ acute, generally quite entire; stem one-flowered, simple." Willd. *Root* perennial. *Stems* scarcely a foot high, erect, cylindrical, downy, often simple, almost destitute of leaves near the top, and surrounded at the base with dry scales, which are the remains of the petioles of the fallen leaves. *Leaves* alternate, oval-oblong, rather obtuse; root ones petioled. *Flowers* rather large, terminal; florets of the disk yellow, of the ray white, linear; scales of the calyx egg-shaped, acute, numerous, closely imbricated, blackish at the edges. A native of the Levant. The whole plant is sweet-scented. 14. C. *tricolor*, Willd. 16. Bot. Mag. 508. Andrews Repos. tab. 109. C. carinatum, Schoasb. Pl. Maroc. tab. 6.) "Leaves twice pinnatifid;

tifid; pinnulæ linear, diſtant, recurved; ſtem erect, branched." *Root* annual. *Flowers* highly beautiful; florets of the diſk dark crimſon; of the ray, white with a yellow baſe; outer ſcales of the calyx keeled; inner ones flat, membranous. There is a variety with perfectly yellow flowers. 15. C. *indicum*, Linn. Sp. Pl. 12. Mart. 13. Willd. 17. Bot. Mag. 327. (Matricaria indica, Encyc. Meth. 23. M. ſinenſis, Pluk. Amel. tab. 430, fig. 2. Rumph. Amb. 5, tab. 91, fig. 1. Tſietti-gu, Rheed. Mal. 10, tab. 44.) "Leaves egg-ſhaped, attenuated at the baſe, three-lobed, toothed; ſtem branched." *Stem* ſomewhat woody, two or three feet high, upright, cylindrical, much branched. *Leaves* reſembling thoſe of mugwort, alternate, petioled, ſerrated, upper ſurface deep green, lower ſurface ſoft to the touch, and clothed with a ſlight down; lobes a little gaſhed and toothed; teeth unequal, peduncled, large, mucronate. *Flowers* large, ſolitary, terminating the branches; florets of the diſk yellow: of the ray whitiſh with a tinge of purple; ſcales of the calyx few, concave, rounded, terminated by a ſcarious ſilvery membrane. A native of China, where, and in other parts of the Eaſt, it has been long cultivated, and highly eſteemed for its beauty. A great number of varieties have, in conſequence, been produced, ſingle, ſemi-double, and double, ſometimes the ſize of the palm of the human hand, reddiſh, quite white, yellowiſh, fleſh-coloured, purple, and of every intermediate colour. Though this magnificent plant has been ſo long cultivated in the Eaſt, it does not appear to have found its way to Europe till 1795, when it flowered for the firſt time in Great Britain, in the collection of Mr. Colville, nurſery-man at Chelſea. It appears to be a hardy green-houſe plant, and as the moſt ſpecious varieties have been ſelected, it promiſes to be a laſting ornament to our conſervatories. The Chineſe employ it to decorate their houſes and tables on feſtive occaſions, and are ſaid to prefer thoſe pieces of porcelain on which it is painted. 16. C. *coccineum*, Willd. 10. (Buphthalmum tanaceti folio ampliore, flore magno coccineo, Tourn. Cor. 37.) "Leaves pinnated, ſmooth; pinnæ pinnatifid, acute; peduncle thickened." *Root* perennial. *Stem* furrowed, ſmooth. *Leaves* ſmooth; ſegments of the pinnæ linear, acute. *Flowers* with a large ſcarlet or purple ray; ſcales of the calyx ſomewhat ſphacelated. A native of Iberia.

** *Florets of the ray yellow.*
Chryſanthema, Tourn.

17. C. *pectinatum*, Linn. Sp. Pl. 17. Mart. 16. Willd. 18. (C. pallidum, Bar. Ic. 421. Matricaria pectinata, Encyc. Meth.) "Leaves pinnated, linear, parallel, acute, quite entire; peduncles ſolitary, one-flowered." *Root* perennial. *Stems* very ſhort, thickiſh, proſtrate, creeping. *Leaves* ſmall, pubeſcent. *Flower* on a longiſh peduncle, with an awl-ſhaped leaf or two at the baſe. A native of Spain and Italy. 18. C. *ſegetum*, yellow ox-eye; or corn marigold, Linn. Sp. Pl. 15. Mart. 17. Willd. 19. Curt. Flor. Lond. faſc. 6, tab. 60. Eng. Bot. 540. (Bellis lutea, foliis profunde inciſis, major, Bauh. Pin. 262.) "Leaves embracing the ſtem, glaucous, laciniated near the ſummit, toothed at the baſe." *Root* annual, ſpindle-ſhaped, ſmall. *Stem* one or two feet high, branched, angular. *Leaves* oblong, variouſly toothed or pinnatifid-laciniated, rarely entire. *Flowers* large, terminal; ſcales of the calyx with a broad membranous edge; florets of the ray inverſely heart-ſhaped, ſpreading. *Seeds* furrowed. A common weed in corn-fields, eſpecially on a gravelly ſoil, in various parts of Europe, flowering from June to Auguſt. 19. C. *umbroſum*, Willd. 22. "Leaves ſeſſile, oblong-lanceolate, attenuated at the baſe, pinnatifid, ſerrated; ſtem erect, branched at the baſe." *Stem* a foot high; branches one-flowered. *Leaves* about three inches long; upper ones linear-lanceolate. A native of mount Athos, deſcribed by Willdenow from a dried ſpecimen. 20. C. *coronarium*, garden chryſanthemum, Linn. Sp. Pl. 16. Mart 22. Willd. 23. Gært. tab. 168. (C. foliis matricariæ, Bauh. Pin. 134. C. creticum, Cluſ. Hiſt. 1. 334. Moriſ. Hiſt. 3. tab. 4. fig. 2, 3. Matricaria coronaria, Encyc. Meth.) "Leaves twice pinnatifid, acute, broader near the ſummit; ſtem branched." *Root* annual. *Stem* two feet high or more, herbaceous, cylindrical, ſtriated, ſmooth, erect; branches forming looſe tufts. *Leaves* alternate, embracing the ſtem. *Flowers* large, terminal, ſolitary; ſcales of the calyx imbricated, oblong, obtuſe, very ſcarious at the edges and ſummit. A native of Candia, Sicily, and Switzerland. There is a variety with double flowers, commonly cultivated as a hardy annual in the Engliſh gardens. 21. C. *floſculoſum*. Linn. Sp. Pl. 19. Mart. 23. (Matricaria rigida, excluding var. β. M. grandis. var. β Encyc. Meth. Balſamita ageratifolia β virgata. C. floſc. β Willd. Tanacetum chryſanthemoides, Gært. tab. 165. "Florets all uniform, hermaphrodite." Deſrouſſeaux (Encyc. Meth.) aſſerts that var. β. is a diſtinct ſpecies, and even ſuſpects that two ſpecies are confounded under the original C. floſculoſum. He thus diſtinguiſhes them: 1. Matricaria *rigida* (Chryſanthemum floſculoſum, Linn. excluding var. β. Bellis ſpinoſa, foliis aggerati, Bauh. Pin. 262. Alp. Exot. tab. 326. Moriſ. Hiſt. 3. tab. 9. fig. 16. Balſamita foliis aggerati, Vail. Act. 339. Tanacetum foliis integris rigidis, Hal. Helv.). "Stem ſhrubby; leaves obovate-wedge-ſhaped, toothed; teeth tranſverſe, rigid." *Root* perennial. *Stem* a foot and half high, ſhrubby, branched; branches cylindrical, ſtriated, nearly ſmooth, leafy almoſt to the ſummit. *Leaves* ſeſſile, a little embracing the ſtem, evergreen, egg-ſhaped, narrowed towards the top, edged with ſtiff, ſharpiſh teeth. *Flowers* ſix or ſeven lines in diameter, yellow, terminal; ſcales of the calyx numerous, imbricated, reflexed at the ſummit, ſcarious, and ſlightly torn, Lam. Encyc. *Seeds* crowned on the outer ſide with an erect, concave, toothed, rim. A native of Africa, and the iſle of Candia. 2. M. *virgata* (Cotula grandis, Jacq. Obſ. 4. p. 4. tab. 81. Chryſanthemum diſcoideum, Allion. Flor. Ped. tab. 11. fig. 1.) "Leaves ſerrated; lower ones ſpatula-ſhaped; upper ones linear-lanceolate; branches rod-like." *Root* annual. *Stems* about a foot and half high, herbaceous, ſlender, elongated, cylindrical, furrowed, almoſt deſtitute of leaves towards their ſummits; branches few, upright, one-flowered. *Leaves* ſcattered, tooth-ſerrated, ſmooth; lower ones narrowed into a petiole; upper ones ſeſſile, narrow. *Flowers* terminal; ſcales of the calyx numerous, imbricated in three or four ranks, lanceolate, ſcarcely ſcarious at the edges. A native of the county of Nice. 3. M. *grandis* (Cotula grandis, Linn. Sp. Pl. Chryſanthemum floſculoſum, β, Linn. Mant. 2. 473.). "Stem generally ſimple, thick, very lofty, hairy toward the bottom, with a large flower." *Root* biennial. *Stem* three or four feet high, ſtriated, villous, rough, with ſtrong hairs near the bottom. *Leaves* fleſhy, ſoft to the touch. *Flowers* near three inches in diameter, yellow, terminal. flat. A native of the coaſt of Barbary. All theſe ſuppoſed ſpecies are deſcribed from living ſpecimens. *Obſ.* The want of a ray inconteſtibly excludes them altogether from the Chryſanthemum and the Matricaria of Linnæus, but we have placed them here, partly that they may not be entirely omitted, the Balſamita of Deſfontaines and Willdenow not having been admitted into the ſyſtem, with a diſtinct generic character, when that part of our alphabet went to the preſs; partly becauſe we wiſhed to lay before our readers at one view the original deſcriptions of Deſrouſſeaux; but chiefly becauſe we are by no means ſatisfied with the manner in which theſe plants are diſpoſed of

 by

by Willdenow. His Balfamita ageratifolia is doubtlefs the original Chryfanthemum flofculofum of Linnæus, the Matricaria rigida of the Encyclopedie Methodique; and this appears to be the only one of the three which had fallen under his notice; but from the toothed rim of the germ it is certainly a Tanacetum, as Gærtner has made it, and not a Balfamita. The other two may poffibly belong to Balfamita, fhould that new genus finally prove a legitimate one. We have to lament that, with refpect to this branch of the fubject, we derive no information whatever from the labours of the French botanift.

*** *Dubious fpecies.*

22. C. *japonicum*, Mart. 24. Willd. 24. Thunb. Jap. 321. "Leaves petioled, gafhed at the tip, toothed." *Stem* fimple, erect, ftriated, villous. *Leaves* alternate, oblong, fmooth, green above, pale underneath. A native of Japan. Though Thunberg's fpecimen was without flower, he pronounces it of this genus; but it was furely a wild, rap-at-a-venture guefs. 23. C. *incanum*, Willd. 25. Thunb. Prod. 161. "Stem fhrubby; leaves trifid, tomentous." 24. C. *glabratum*, Willd. 26. Thunb. Prod. 161. "Stem herbaceous; leaves pinnated, fmooth; pinnæ linear." 25. C. *hirtum*, Willd. 27. Thunb. Prod. 161. "Stem herbaceous; leaves twice pinnatifid, hairy; ftem zig zag." The laft three are natives of the Cape of Good Hope. 26. C. *procumbens*, Mart. 27. Lour. Cochin. 499. (Matricaria finenfis, Pluk. Amalth. tab. 430. fig. 3.) "Leaves finuate-gafhed, blunt; ftem procumbent." *Root* perennial. *Stem* three feet high, frequently creeping, flender, much branched. *Leaves* egg-fhaped, fomewhat downy, petioled. *Flowers* fmall; peduncles many flowered, terminal. A native of Cochinchina and China, where it is alfo cultivated in gardens, and has produced many varieties.

Obf. La Marck, and Defrouffeaux, one of his fucceffors in the botanical department of Encyclopedie Methodique, have entirely difcarded the genus Chryfanthemum, and interfperfed its fpecies among thofe of Matricaria; obferving, not without much fhew of reafon, that the membranous termination of a calyx-fcale is a circumftance too minute and too equivocal to be admitted as an effential part of a generic character. We ourfelves, however, have for the prefent retained the Linnæan divifions. It is rather furprifing that thefe excellent naturalifts fhould have paid no attention to the prefence or abfence of a marginal rim at the top of the feed, a difference which has been received by Gærtner as a fufficient generic diftinction. The genus Pyrethrum, whofe feeds have a marginal rim, has accordingly been adopted by Dr. Smith, with his ufual judgment, and has been avowedly taken up from him by Willdenow.

Chrysanthemum *corymbiferum, frutefcens, inodorum, alpinum, atratum β, ferotinum, arcticum, myconis, bipinnatum, balfamita*, Linn. See Pyrethrum.

Chrysanthemum *Halleri*, Suter. Helv. —— *macrophyllum*, Waldf. and Kitaib. —— *caucaficum*, —— *fufcatum, multicaule, trifurcatum*, Desf. —— *orientale*. See Pyrethrum.

Chrysanthemum *maderafpatanum, fcabiofæ capitulis parvis*, Pluk. Alm. See Spilanthes *pfeudo-acmella*.

Chrysanthemum *bidens Acmella dicta*, Rai. Supp. See Spilantus *acmella*.

Chrysanthemum *aquaticum foliis multifidis*, Herm. Engl. —— *cannabinum coridis indi fol.* Herm. Par. —— *cannabinum cicutariæ foliis*, Morif. Hift. See Bidens *bipinnata*.

Chrysanthemum *conyzoides æthiopicum capitulo aphyllo*, Pluk. Mant. See Protea *levifanus*.

Chrysanthemum *ericoides coronatum*, Breyn. Cent. Pluk. Mant. Morif. Hift. See Staavia.

Chrysanthemum *americanum frutefcens balfaminæ foliis nigris*, Pluk. Alm. See Kleinia *porophyllum*.

Chrysanthemum *bengalenfe anguftifolium*, Pluk. Alm. See Æthulia *divaricata*.

Chrysanthemum *conyzoides cernuum*, Mor. Hif. See Carpesium *cernuum*.

Chrysanthemum *alpinum incanum foliis laciniatis*, Bauh. Pin. See Senecio *incanus*.

Chrysanthemum *alpinum, foliis abrotani multifidis*, Bauh. Pin. —— *alpinum* II. Cluf. Hift. See Senecio *abrotanifolius*.

Chrysanthemum *americanum perenne, caule alato*, Monf. Hift. See Helenium *autumnale*.

Chrysanthemum *exoticum perpufillum, foliis coronopi*, Pluk. Alm. See Cotula *anthemoides*.

Chrysanthemum *exoticum minus, chamæmeli nudi facie*. Breyn. Cent. See Conyza *coronopifolia*.

Chrysanthemum *valentinum*, Cluf. Hift. See Anacyclus *valentinus*.

Chrysanthemum *lufitanicum, agerati folio*, Tourn. Inft. —— *parvum five bellis lutea*, Bauh. Hift. See Anthemis *repanda*.

Chrysanthemum *foliis tanaceti*, Læf. Pruf. Barr. Ic. See Anthemis *tinctoria*.

Chrysanthemum *africanum, leucoii foliis*, Breyn. Prod. See Amellus *lychnitis*.

Chrysanthemum *maderafpatanum, menthæ arvenfis folio*, Pluk. Alm. See Eclipta *proftrata*.

Chrysanthemum *cannabinum americanum alatum*, Sloan. Hift. —— *curaffavicum*, Herm. Par. —— *americanum foliis baccharidis*. —— *americanum bidens*, Pluk. Alm. —— *conyzoides curaffavicum*, Volk. Norib. See Verbesina *alata*.

Chrysanthemum *paluftre minimum repens*, Sloan. —— *humile ranunculi folio*, Plum. See Verbesina *mutica*.

Chrysanthemum *conyzoides nodiflorum*, Sloan. See Verbesina *nodiflora*.

Chrysanthemum *ex infulis caribæis*, Pluk. Alm., Morif. Hift. —— *fruticofum maritimum*, Sloan. Jam., Catefb. Car. See Buphthalmum *frutefcens*.

Chrysanthemum *bermudiana*, Morif. Hift. Pluk. Alm. See Buphthalmum *arborefcens*.

Chrysanthemum *conyzoides lufitanicum*, Breyn. Cent. See Buphthalmum *aquaticum*.

Chrysanthemum *perenne minus*, Morif. Hift. See Buphthalmum *grandiflorum*.

Chrysanthemum *fcropulariæ folio*, Pluk. Alm. Morif. Hift. See Buphthalmum *helianthoides*.

Chrysanthemum *americanum majus perenne*, Morif. Hift. Pluk. Phyt. See Helianthus *multiflorus*.

Chrysanthemum *latifolium brafilianum*, Bauh. Pin. See Helianthus *tuberofus*.

Chrysanthemum *canadenfe latifolium altiffimum*, Morif. Blæf. Bocc. Sic. —— *canadenfe ftrumofum*, Herm. Lugb. Morif. Hift. See Helianthus *ftrumofus*.

Chrysanthemum *virginianum elatius anguftifolium*, Mor. Hift. Pluk. Alm. See Helianthus *giganteus*.

Chrysanthemum *virginianum altiffimum*, Morif. Hift. See Helianthus *altiffimus*.

Chrysanthemum *virginianum repens*, Morif. Hift. See Helianthus *divaricatus*.

Chrysanthemum *americanum perenne, foliis divifis, majus*, Morif. Hift. See Rudbeckia *laciniata*.

Chrysanthemum *americanum majus, foliis magis divifis*, Morif. Hift. See Rudbeckia *digitata*.

Chrysanthemum *cannabinum virginianum*, Pluk. Alm. —— *annuum majus virginianum, umbone nigricante*, Mor. Hift. See Rudbeckia *triloba*.

CHRYSANTHEMUM *helenii folio*, Pluk. Alm. Morif. Hift. See RUDBECKIA *hirta*.

CHRYSANTHEMUM *americanum doronici folio*, Pluk. Alm. Catef. Car. See RUDBECKIA *purpurea*.

CHRYSANTHEMUM *americanum, fcabiofæ tenuiffime divifis foliis ad intervalla confertis*, Pluk. Mant. See COREOPSIS *tenuifolia (verticillata*, Lam.)

CHRYSANTHEMUM *virginianum anagyridis folio*, Morif. Hift. See COREOPSIS *tripteris*.

CHRYSANTHEMUM *americanum, ciceris folio glabro*, Herm. Par. Pluk. Alm. See COREOPSIS *alba*.

CHRYSANTHEMUM *trifoliatum fcandens*, Sloan. Jam. See COREOPSIS *reptans*.

CHRYSANTHEMUM *hirfutum virginianum, auriculato dulcamaræ folio*, Pluk. Alm. —— *virginianum trifoliatum humilius*, Morif. Hift. See COREOPSIS *auriculata*.

CHRYSANTHEMUM *canadenfe bidens, alato caule*, Morif. Blæf. —— *virginianum, alato caule*, Morif. Hift. Pluk. Alm. See COREOPSIS *alternifolia*.

CHRYSANTHEMUM *americanum, caule alato, amplioribus foliis binatis*, Pluk. Alm. See BALTIMORA *recta*.

CHRYSANTHEMUM *virginianum, foliis afperis tribus f. quaternis ad genicula fitis*, Morif. Hift. See SILPHIUM *trifoliatum*.

CHRYSANTHEMUM *angulofis platani foliis*, Pluk. Alm. —— *perenne virginianum majus*, Morif. Hift. See POLYMNIA *uvedalia*.

CHRYSANTHEMUM *virginianum villofum, difco luteo*, Pluk. Alm. See CHRYSOGONUM *virginianum*.

CHRYSANTHEMUM *æthiopicum*, Pluk. Alm. —— *foliorum pinnis breviffimis dentatis*, Burm. Afric. See ARCTOTIS *dentata*.

CHRYSANTHEMUM *africanum frutefcens fpinofum*, Volk. Nor. See OSTEOSPERMUM *fpinefcens*.

CHRYSANTHEMUM *africanum frutefcens telephii fere foliis craffis*; —— *arborefcens æthiopicum foliis populi albæ*, Breyn. Cent. See OSTEOSPERMUM *moniliferum*.

CHRYSANTHEMUM *fruticofum, polygali foliis africanum*, Pluk. Mant. See OSTEOSPERMUM *polygaloides*.

CHRYSANTHEMUM *africanum pumilum ramofum, foliis tenuiffimis*, Rai. Sup. See OTHONNA *tagetes*.

CHRYSANTHEMUM *africanum frutefcens, telephii foliis craffis*, Pluk. Alm. See OTHONNA *frutefcens*.

CHRYSANTHEMUM, in *Gardening*, contains plants of the flowering herbaceous annual, perennial, and fhrubby kinds, of which the fpecies cultivated for ornamental purpofes are chiefly the annual garden chryfanthemum, (C. *coronarium*); the late-flowering creeping chryfanthemum, (C. *ferotinum*); the Montpelier chryfanthemum, or ox-eye, (C. *Monfpelienfe*); the corymbed chryfanthemum (C. *corymbofum*); the fhrubby Canary chryfanthemum, or ox-eye, (C. *frutefcens*); and the baftard fhrubby chryfanthemum, (C. *flofculofum*). Of which the firft has a furrowed, leafy, branching ftem, three feet high, with fmooth ftem clafping leaves; pinnas either pinnate or pinnatifid, the end one very large, bifid, with the pinnules fharply gafhed; the peduncles terminating, one-flowered; the flowers of different colours. It is a native of Sicily, &c.

The fecond has a perennial creeping root; the ftem ftrong, branched, erect, fomewhat villofe, three or four feet high; the leaves are feffile, fmooth; on fome plants with many acuminate ferratures beyond the middle; on others very few towards the end only; others, again, quite entire; the flowers on the ends of the branches of a white colour, appearing in September.

The third is an elegant perennial plant, without fcent, very fmooth, and flightly villofe, with erect branching ftems, three or four feet in height; the lower leaves bipinnatifid; upper pinnatifid, one or two at top, quite entire; the flowers large, white, and radiated, like thofe of the fecond fort.

The fourth is perennial, having an erect ftem, from eighteen inches to two or three feet high or more; the leaves alternate; pinnas pinnate to the middle; the fegments fharply toothed; the ftalks are terminated by corymbs of large white flowers. The whole plant is without fmell or tafte, flowering in July and Auguft, and a native of the fouth of France, &c.

The fifth has a fhrubby ftem, near two feet high, dividing into many branches; the leaves are of a greyifh colour, cut into many narrow fegments; the flowers axillary, ftanding upon naked peduncles fingly, and greatly refembling thofe of common chamomile. There is a fucceffion of thefe for a great part of the year, for which it is chiefly efteemed. It is found in the Canary iflands.

The laft is a procumbent ever-green under-fhrub, two feet in height; the leaves obovate, gradually narrowing into the petiole, finuate, toothed, and ftiffifh; the flowers fmall, terminating, folitary, and of a deep yellow colour. It is found at the Cape of Good Hope.

Of this there are varieties with fingle and double flowers, both white and yellow; with fiftular florets, which has the name of quill-leaved chryfanthemum.

Method of Culture. In the firft, or annual kind, the culture may be effected either by feeds or cuttings, but the latter method is the more expeditious, and, of courfe, more commonly practifed.

In the former of thefe modes, the feed fhould be fown in the early fpring months, on a very moderate hot bed, or under hand-glaffes, and continued fo late as the latter end of April, in a funny fituation in the open ground. It may be put in fmall drills, or on the furface, the mould being previoufly made fine and even, and the feed fown thin, and evenly covered in to the depth of nearly half an inch. When the plants are of fufficient growth, as in May, or the following month, they may be planted out fingly in the fituations where they are to flower. A little water fhould be occafionally given, both while in the beds and when planted out, efpecially when the weather is dry in the latter cafe. And, in order to have fine double forts, care fhould be had to remove all the bad flowers from about them as foon as they can be afcertained, leaving only one or two good ones in a place; and to have them fine in pots, they fhould be removed into them as foon as they can be known, with large balls of earth about their roots, a little water being given at the time to prevent their growth being checked.

The latter method is conftantly employed for continuing the double forts, fo that they may blow early in the fucceeding fummer, in which the cuttings of the ftrong fide-fhoots, about three inches long, which have not flowered, fhould be planted in large pots near the tops, not too nearly together, in the early autumnal months, as the latter end of September, a little water being given at the time, the pots being removed into a frame or a green-houfe for protection during the winter, and air freely admitted in proper weather. About the beginning of April they fhould be removed from the pots into the fituations where they are to flower, being planted out fingly. In this culture they flower much earlier than when raifed from feed. But fome fhould always be raifed from feed, in order to afford cuttings to increafe the double forts from, and thereby avoid their degenerating. The feed made ufe of fhould conftantly be collected from the beft and moft full double-flowered plants.

The fecond, third, and fourth fpecies are capable of being increafed increased by sowing the seeds in March in beds of fine mould, in warm sunny situations, or by dividing the roots and planting them out in the autumnal months, when the season is open and rather moist. The plants in the former of these modes should be transplanted into other beds in the latter end of summer, and set out to the distance of ten or twelve inches, in order to be removed in the autumn following into the places where they are to flower and remain.

The fifth and sixth species are easily increased by planting cuttings of the young branches in pots filled with good rich earth any time during the spring or early summer months, proper shade and water being given. When the plants are well-rooted in the beginning of the autumn, they should be removed, and planted in separate pots, and during the winter placed under the protection of a deep garden-frame or green-house.

The plants of the first sort are well suited for ornament in the beds or borders of pleasure-grounds and other places, as they produce many flowers and continue late in the autumn; and though they are annual, when produced from seeds, the cuttings, as has been seen, when planted out in the autumn continue the winter, and flower earlier in the ensuing summer than the plants raised by seed.

The next three sorts are proper for the borders of extensive ornamented grounds, as they produce an agreeable variety a considerable length of time in autumn, and are of a large as well as hardy growth. And the two last are adapted for green-house collections, where they afford variety among other potted plants of similar growth.

CHRYSANTHERINUS Lapis, in *Natural History*, a name given by old writers to a stone famous for its imaginary virtues of preventing children from sicknesses during the time of dentition, by being worn round the neck by way of necklace; we have no farther account given us of it by authors, than that it was a very brittle stone, and not easily worked into form.

CHRYSAORIS, in *Ancient Geography*, a town of Caria, which afterwards assumed the name of Adrias, or rather Idrias.

CHRYSAORUS, a river of Asia Minor, in Lydia.

CHRYSARGYRUM, a tribute formerly levied on courtesans, and persons of ill fame.

Hoffman says, it was paid in gold and silver; whence its name, χρυσος, *gold*, and αργυρος, *silver*.

Zosimus says, that Constantine first set it on foot; though there appear some traces of it in the life of Caligula by Suetonius; and that of Alexander by Lampridius. Evagrius says, Constantine found it established, and had some thoughts of abolishing it. It was paid every four years: some say, all petty traders were liable to it. It was abolished by Anastasius.

M. Godeau thinks the chrysargyrum was a general tribute, levied every four years, on persons of all conditions, rich and poor, slaves and freemen; nay, even on all animals, as low as dogs; for each whereof they paid six oboli.

CHRYSAS, in *Ancient Geography*, a stream of Sicily, which traversed the country of the Assorins, according to Cicero.

CHRYSE, a promontory near the river Lanos, in the country of the Serres. Pliny.—Also, an island placed by Pliny near and on the other side of the river Indus.—Also, a town near Lemnos, consecrated to Apollo. Steph. Byz.—Also, a town of Asia Minor, in Caria.—Also, a promontory of the island of Lemnos, near Ephestias, and opposite to the island of Tenedos. Steph. Byz.—Also, a town of Pontus, mentioned by Sophocles in his tragedy of Philoctetes.—Also, the name given by Ptolemy to the country, called *Aurea* Chersonesus.

CHRYSEI, a people of India, who inhabited the mountains, between the rivers Iomanes and Indus.

CHRYSIPPA, a town of Asia Minor, in Cilicia. Steph. Byz.

CHRYSIPPUS, in *Biography*, celebrated as a philosopher among the Stoics. He was a native of Solis, a town of Cilicia. He is reported to have spent his paternal fortune in the public service, and then to have devoted himself to philosophy. He fixed his residence at Athens, the great seat of learning and science, and became a disciple of Cleanthes, the successor of Zeno. The scholar did not, however, follow implicitly the doctrines of his master, and the natural powers of his mind enabled him to distinguish himself above his contemporaries. Chrysippus possessed a large share of penetration and acuteness; while, at the same time, he was so industrious, that he rarely suffered a day to elapse without writing 500 lines. He had a great talent for disputation, and discovered so much promptitude and confidence in his mode of arguing, as to be charged with a boldness approaching to audacity. He was accustomed to say, "Give me doctrines, and I will find arguments to support them;" and so highly did he think of himself, and of his own talents, that when he was asked by a friend to point out a proper person as preceptor to his son, he mentioned himself, "for," says he, "if I thought any philosopher excelled me, I would myself become his pupil." He never paid any sort of deference to persons of mere rank, and refused to dedicate to great men or princes any of his works. The violence of his temper in vindicating his own opinions, created him many adversaries, particularly among the Epicureans and followers of the sect of Academics. His own friends could not always justify the course which he took, it being so much his practice to take opposite sides of a question, that he not unfrequently raised objections which he knew not how to answer, and thus furnished his antagonists with weapons against himself. Among his most able adversaries was Carneades, who often availed himself of this circumstance, and refuted Chrysippus by convicting him of inconsistency. Plutarch, in his piece "On Stoic Contradictions," has, it is believed, collected most of his examples from the writings of Chrysippus. His skill in sophistry, and particularly the frequent use which he makes of the figure *sorites* is noticed by Persius, who calls it the heap of Chrysippus:

"Inventus, Chrysippe, tui finitor acervi."

It is generally allowed that this philosopher possessed great learning and ingenuity, so much so, as to rank the next to Zeno, yet, from the fragments of his works that have come down to us, it should seem that his discourses abounded more in curious subtleties, and nice distinctions, than in solid arguments and sound reasoning; and it was the prejudice of the party that dictated the encomium, "that if the gods themselves were to hold disputations, they would adopt the manner of Chrysippus." This philosopher has been charged with maintaining doctrines subversive of religion and the interests of morality; there seems, however, to have been little reason for such an accusation, since his mode of life was not only decent but philosophically frugal and temperate. Plutarch affirms, concerning Chrysippus and his master Cleanthes, that when they had filled heaven, earth, the air, and the sea, with divinities, they allowed none of them to be exempt from death, except Jupiter alone, into whom they imagined that all the other deities would at last be resolved. Hence the Stoics have been charged with maintaining

taining that the divine nature is mutable and corruptible, but the inference is not fairly drawn. According to the ftoical fyftem, the inferior deities, which are portions of that divine fire by which all nature is animated, will, in the general conflagration of the univerfe, return to the fource from which they were originally derived, till a general renovation take place. Cicero has borne his teftimony to the true ftoical faith of Chryfippus, "who," he fays, "is efteemed the moft ingenious interpreter of ftoic dreams, and has affembled a numerous band of unknown gods, indeed fo perfectly unknown, that the human mind, though it be capable of forming conceptions of every kind, is unable to frame a conjecture concerning their nature. He fays, that the divine energy is placed in reafon, and in the foul or mind of the univerfe. The world itfelf he maintains to be God, or an univerfal effufion of his fpirit; and afferts, that the fuperior part of this fpirit, which confifts in mind and reafon, is the common nature of things, containing the whole, and every part. Sometimes he fpeaks of God as the power of fate, and the neceffary chain of events; fometimes he calls him fire; and fometimes he deifies the fluid parts of nature, as water and air; and again, the earth, the fun, the moon and ftars, and the univerfe, in which thefe are comprehended, and even thofe men who have obtained immortality." Such were the opinions of Chryfippus, and fuch, it is well known, were the doctrines maintained by the moft eminent of the ftoic fchool; it appears, therefore, very unjuft to brand this philofopher with any other kind of impiety than that which the fect itfelf, of which he was a chief fupporter, gloried in. Chryfippus, by his great induftry, wrote feveral hundred volumes, of which three hundred are faid to have been on logical fubjects, but in all his works, he borrowed freely from the writings of others. What remains of this voluminous author is to be found difperfed in the more celebrated works of Cicero, Plutarch, Seneca, and Aulus Gellius. He died in the 143d olympiad, at the great age of 83. He was a freeman of Athens, and to his memory a ftatue was erected by Ptolemy. Brucker by Enfield.

CHRYSIS, in *Botany*, Reneal Sp. See HELIANTHUS *annuus*.

CHRYSIS, in *Entomology*, a genus of the hymenopterous order of infects, poffeffing the following character. Mouth horny, projecting; jaws advanced, elongated, horny, linear, with a fingle tooth, tip membranaceous and acute; lip tongue-fhaped, linear, and emarginate at the tip; no tongue. Palpi, or feelers, four, advanced, unequal, and filiform. Antennæ fhort and filiform, confifting of twelve (fometimes thirteen) joints, the firft of which is longeft, and ufually fituated near the mouth. Body fhining, gloffy, and partaking of a golden fplendour in general. Abdomen arched, and concave, fometimes flattifh beneath, with a fcale on each fide. Tail moft commonly dentated; fting fomewhat exferted. Wings flat.

The infects of this tribe or genus obtained the name of chryfis, from the extreme brilliancy of their colours, which, in the greater number of fpecies, emulate the luftre of gold, the ruby, beryl, fapphire, and other precious gems. Few of this genus exceed the fize of the common houfe-fly (mufca domeftica), and many are ftill fmaller than that diminutive infect, which renders them pleafing and convenient objects for microfcopical inveftigation. They are very lively in the fun-fhine, about the middle of the day, hover on the wing in a manner fimilar to the bee, and if difturbed fly fwiftly. During the warmer fummer months they are frequently obferved among fruit trees, and efpecially preferring thofe which are raifed againft walls in a fouthern afpect: they occur likewife againft the trunks of decayed trees on the fide moft expofed to the fun; and fometimes among flowers. Thefe brilliant little infects will not allow themfelves to be captured with impunity; they bite hard, and the fting of the female is a formidable weapon compared with the fize of the infect, and capable of inflicting at leaft a painful puncture, if incautioufly taken in the hand. The larvæ of thefe infects have hitherto efcaped the refearch of naturalifts, or have not certainly been afcertained with any degree of precifion; it is only fuppofed, by analogy, their metamorphofes refemble that of wafps. Degeer found one of the fpecies of this genus, his *chryfis micans*, in a refinous nut-gall formed on the pine, and imagined the infect muft have been depofited there in the egg ftate, and undergone its various changes to the larva, pupa, and perfect ftate within the gall (and which gall moft probably originated from the acrimonious puncture of the parent infect), for he found, on examination, at the bottom of the gall, an empty fpinning of a loofe filky texture, enveloping the remains of the pupa cafe which was burft open, as he prefumed, by the chryfis, when it attained its laft and perfect form. He obferved alfo the excrements of a larva, that of the infect beyond doubt, which had effected its efcape. The generic Englifh term, *golden-fly*, is applicable to moft fpecies of the chryfis genus.

Species.

IGNITA. Smooth and fhining; thorax green, abdomen golden, with four teeth at the apex, Linn. Fn. Suec. Fabr. Donov. Brit. Inf.

This infect is one of the moft beautiful and abundant fpecies of the genus throughout Europe. In England it is partially known by the name of red-tailed golden-fly, but it is the whole of the fuperior furface of the abdomen that is of a fine crimfon colour, changeable to gold. The French call it chryfis en flammé.

FASCIATA. Thorax green, with a blue band; anterior part of the abdomen blue, fafciated with violet, golden in the middle; pofterior end red, with four teeth.—*Chryfis fafciata; thorace viridi fafcia cyanea abdomine antice cyaneo-violaceoque fafciato; medio aureo, poftice rubro quadridentato*, Donov. Inf. India.

"This charming infect is a native of Tranquebar, where there is every reafon to believe it is uncommonly rare. The fpecies does not appear to be defcribed by any author. The only fpecimen we are acquainted with, is in the cabinet of fir J. Banks, bart." See our hiftory of Indian infects above referred to.

SMARAGDULA. Shining green; tail with fix teeth, and blue. Fabr. A native of North America.

CALENS. Shining blue; abdomen golden; tail four toothed, and blue. Fabr.

This is the fame fize as the former; the antennæ and tips of the legs are brown. This is an European fpecies; it has been found in Italy, and alfo in Siberia.

SPLENDIDA. Gloffy blue; tail four-toothed, Fabr. Spec. Inf.

"Very fcarce. This is a native of Tranquebar, where it was difcovered by Dr. Koenig. Fabricius defcribes the infect from a fpecimen in the cabinet of fir Jofeph Banks, bart. A variety of the fame fpecies is found in New Holland," Donov. Inf. India; — which work contains the only figure of Chryfis fplendida extant at prefent.

LYNCEA. Shining blue; fecond fegment of the abdomen with a bluifh eye on each fide; fcutel prominent and acute. Fabr.

Inhabits Africa. The head is grooved; the ocellar fpot on each fide the abdomen has a fulvous pupil; tail armed with four teeth; legs green, and black at the ends.

OCULATA.

Oculata. Shining green; an ocellar golden ſpot on each ſide of the abdomen; tail with ſix teeth, and blue, Fabr. Ent. Syſt.

This inſect is diſtinguiſhed for the peculiar brilliancy of its colours, and the very remarkable ocellated ſpot on each ſide the body on the ſuperior ſurface. Fabricius deſcribed it from a ſpecimen in the Bankſian cabinet taken on the coaſt of Malabar. We have received the ſame kind from Bengal. Vide Donov. Inſ. India.

Carnea. Gloſſy; thorax and firſt ſegment of the abdomen green, reſt fleſh coloured; tail ſerrated. Fabr. Sp. Inſ. Inhabits Italy.

The head is of a green colour, lip villous, and ſilvery; thorax rough and pointed each ſide.

Integra. Shining green; abdomen golden; green at the baſe and tip; tail entire. Fabr.

Reſembles Chryſis ignita in general appearance, but is eaſily diſtinguiſhed by its entire tail. It inhabits Spain.

Bidentata. Smooth, ſhining blue; thorax bidentated, and with the two firſt ſegments of the abdomen golden. Fabr. Degeer. Donov. Brit. Inſ. Inhabits Europe, and is taken rarely in England.

Succincta. Smooth, ſhining green; on the thorax a ſcarlet band; abdomen golden, and armed with three teeth. Fabr. Found in the northern parts of Europe.

Lucidula. Smooth, ſhining green; anterior part of the thorax and abdomen golden; tail entire, Fabr. *Sphex nobilis,* Scopoli.

This inſect is of a ſmall ſize; the antennæ are black; wings marked with a marginal black dot. Inhabits chiefly the ſouth of Europe.

Fulgida. Smooth and gloſſy; thorax and firſt ſegment of the abdomen blue, the reſt golden; tail four-toothed, Linn. Fn. Suec.

Inhabits Europe, and is rather larger than Chryſis ignita.

Purpurata. Smooth, ſhining golden; band in the middle of the abdomen and the ſerrated tail purple. Fabr.

Deſcribed by Fabricius as a native of Saxony. The head is ſcabrous, and golden; antennæ fuſcous; thorax ſcabrous, golden, with three duſky purpliſh lines in the middle; legs golden.

Gloriosa. Smooth, golden, and ſhining; head, breaſt, and legs, blue green. Fabr.

Inhabits Barbary. Deſcribed from the cabinet of Desfontaines. The antennæ are greeniſh blue; head green, with the crown golden; abdomen golden beneath; tail entire; legs blue green. This inſect has ſometimes the whole of the head of a golden colour.

Feroida. Smooth, ſhining golden; abdomen beneath deep black. Fabr.

A ſmall inſect, with the head, thorax, and abdomen, golden, glabrous and ſhining; beneath the wings cyaneous; legs black. Inhabits Italy.

Aenea. Glabrous, ſhining golden; antennæ and legs fuſcous. Fabr.

Deſcribed as a native of Saxony from the collection of Hybner; the ſize is ſmall; wings fuſcous at the tip.

Aurata. Glabrous, and ſhining; thorax green; abdomen golden; tail bidentated. Linn. Fn. Suec.

Found againſt walls in Europe.

Regia. Glabrous, ſhining; thorax blue; abdomen golden; tail entire. Fabr. *Veſpa thorace viridi cæruleo, abdomine aureo cupreo, pene inermi.* Geoff. Inſ.

A native of Europe. The head and thorax are blue without ſpots; abdomen ſubgloboſe, golden, ſhining, ſpotleſs, with the tail entire; antennæ black; wings duſky.

Cyanea. Glabrous, ſhining; thorax and abdomen blue; tail with three teeth. Linn.

Veſpa cærulea nitens, Geoffr. Inhabits Europe. This inſect is very common in England, and has nearly the ſame habits as Chryſis ignita. Donov. Brit. Inſ.

Nitidula. Shining green; thorax bidentated behind; tail with four teeth. Fabr.

Deſcribed from the Bankſian cabinet as an American inſect.

Amethystina. Shining green; tail four-toothed, and blue; wings fuſcous. Fabr.

Inhabits New Holland. Size of the laſt. Antennæ fuſcous, and at the baſe green; thorax green; ſcutel prominent and concave; wings duſky.

Cyanochrysa. Glabrous, green-gold; head and thorax blue; tail with four teeth; wings brown. Forſt. Nov. Gen.

This inſect is a native of Spain. Its ſize is rather leſs than Chryſis ignita; wings and tarſi fuſcous.

Cyanura. Glabrous, ſhining green; thorax bidentated; abdomen four-toothed and tipped with blue. Forſt. Nov. Inſ.

Inhabits the ſame country as the preceding. Its ſize is conſiderable; antennæ black; eyes large and of a purpliſh brown colour; two laſt ſegments of the abdomen blue.

Beryllina. Head greeniſh-blue; thorax blue, greeniſh at the anterior part, and bidentated behind; abdomen green and bluiſh with a reddiſh gloſs; legs blue with a teſtaceous dot. Muſ. Leſk. Linn. Gmel. This kind inhabits Europe.

Thalassina. Head green blue, abdomen golden, the laſt ſegments green blue, and armed with four teeth; thorax gold with a ſquare green ſpot in the middle and green behind. Linn. A native of Europe. Muſ. Leſk.

Inermis. Blue; anterior part of the thorax green; abdomen golden and entire. Linn. Muſ. Leſk. A native of Europe.

Chrysorrhousa. Green; laſt ſegment of the abdomen golden and entire. Linn. Inhabits Europe.

Leskii. Green; ſpot before the ſcutel and abdomen green gold, and entire. Linn. An European ſpecies.

Scutellaris. Shining blue; ſcutel and abdomen golden; tail blue. Fabr.

This and the following new ſpecies are deſcribed by Fabricius in his "Supplementum Entomologiæ Syſtematicæ," one of his laſt publications. Chryſis ſcutellaris is a native of Italy, and bears much affinity with Chryſis calens. The head is blue; antennæ black; thorax blue, gloſſed with green; abdomen ſcarcely toothed; legs blue. Deſcribed from the cabinet of Dr. Allioni.

Cærulescens. Glabrous, ſhining, golden purple; antennæ and poſterior part of the thorax black. Fabr.

A native of France, in the cabinet of Boſc. Size and general appearance ſimilar to that of Chryſis ignita; head, thorax, and abdomen, golden purple; thorax beneath the ſcutel black; breaſt and legs blue and ſhining.

Maculata. Glabrous green and ſhining; occipital band, and dorſal ſpots on the abdomen deep black; tail entire. Fabr. Muſ. Boſc.

Inhabits the American iſlands. The head is braſſy green; antennæ black; thorax green with a bluiſh anterior dot; abdomen braſſy, with the black dorſal ſpots large.

Dimidiata. Glabrous, ſhining green; thorax and two firſt joints of the abdomen golden; tail four-toothed. Fabr. Muſ. Boſc.

The head of this inſect is green; antennæ, and vertical ſpot on the head black; thorax golden, with green breaſt.

Sex-dentata. Glabrous, ſhining green; ſegments of the abdomen blue at the baſe; tail with ſix teeth.

An

An infect of fmall fize, the native country of which is unknown. The thorax is green and without fpots.

CHRYSITES, a name given by the ancients to yellow litharge, fuch as we call litharge of gold. We diftinguifh this only in regard to the colour, and fo did the ancient Greeks; but Avicenna, and the reft of the Arabians, have ufed this word only for the name of fuch litharge as was made from gold, or whatever colour it happened to be; the reft they called by the name of Argyrites, as they tell us, whether it was made of filver, copper, or even of the marcafite melted, and refined by lead. See KLIMIA.

CHRYSITRIX, in *Botany*, (from *χρυσος*, *gold*, and θριξ, hair.) Linn. Mant. 304. Schreb. 1610. Juff. 27. Clafs and order, *polygamia diœcia*. Nat. ord. *Calamariæ*, Linn. *Cyperoideæ*, Juff.

Gen. Ch. Hermaphrodite. *Cal.* Glumes bivalved, numerous, imbricated; valves ovate-oblong, clofe, cartilaginous, permanent. *Cor.* Glumes one-valved, chaff-like, very numerous, fafcicled, briftle-fhaped, membranous, coloured, bright, longer than the calyx, permanent. *Stam.* Filaments folitary, in each glume of the corolla, capillary, the length of the glume; anther linear, adnate to the filament below the tip. *Pift.* Germ oblong, obtufe; ftyle filiform, fhort; ftigmas three, long. *Seed* not known. Male, in a diftinct plant, differing in nothing from the hermaphrodite but the want of a piftil. This genus would therefore be placed by Dr. Smith in the clafs Monandria.

Sp. C. *capenfis*. Mart. Lam. Illuft. Pl. 842. *Root* perennial. Stature of Sifyrinchium. *Leaves* about a foot long, fword-fhaped, equidiftant, of an even furface. *Scape* refembling a leaf, compreffed, membranous. *Spathe* terminal, bivalved; one valve ftraight, as if it were a continuation of the fcape; the other lower, egg-fhaped, dehifcent. *Flower* from the upper edge of the fcape, refembling a faftigiate fafcicle of golden briftles, ftraightened by a cartilaginous perianth. Linn. Mant. A native of the Cape of Good Hope.

CHRYSOANA, in *Ancient Geography*, a river of India, on the other fide of the Ganges. Ptolemy.

CHRYSOBALANUS, in *Botany*, (from *χρυσος*, *gold*, and *βαλανος*, a *drupe*, *acorn*, &c.) Linn. Gen. 621. Schreb. 850. Juff. 340. Vent. 3. 352. Icaquier; Encyc. Meth. Clafs and order, *icofandria monogynia*. Nat. Ord. *Pomaceæ*, Linn. *Rofaceæ*, Juff.

Gen. Ch. *Cal.* Perianth one-leafed, bell-fhaped, fmall, five-cleft to the middle; fegments expanding, withering. *Cor.* Petals five, longer than the calyx, oblong, fpreading, inferted by their claws into the calyx. *Stam.* Filaments numerous, forming a circle, erect, the length of the petals, or longer, flattened and villous near the bafe; anthers fmall, didymous, *Pift.* Germ fuperior, egg-fhaped; ftyle the fhape and length of the ftamens, inferted laterally at the bafe of the germ; ftigma obtufe. *Peric.* Drupe egg-fhaped. *Seed*, nut egg-fhaped, a little pointed at the fummit, obfcurely pentagonal, wrinkled, marked with five longitudinal furrows, fomewhat five-valved, containing an oval kernel.

Eff. Ch. Calyx five-cleft. Petals five. Stamens numerous. Drupe fuperior. Nut furrowed, fomewhat five-valved. Lam.

Sp. C. *icaco*, Linn. Sp. Pl. Mart. Lam. Willd. Jacq. Amer. tab. 94. coloured fig, tab. 141. Lam. Illuft. Pl. 428. (Icaco, Plum. Guajeru, Marcgr. Bras.) An irregular fhrub, eight or ten feet high; branches cylindrical, fmooth, with a brown or ruffet bark, befprinkled with whitifh minute fpots. *Leaves* two inches long, and about one and a half broad, turning brown or blackifh when dried; alternate, egg-fhaped, obtufe, entire, emarginate; fmooth on both fides, coriaceous, veined, on fhort petioles. *Flowers* fmall, whitifh, a little villous or cottony on the outfide without fmell; racemes branched, loofe, a little fhorter than the leaves, axillary and terminal; peduncles a little angular, compreffed; bractes fcale-like, fmall, acutely egg-fhaped, villous, caducous. *Fruit* about the fize and nearly the fhape of a damafcene plumb, either quite entire, or with five, fix, or feven grooves; fkin very thin; pulp in fmall quantity, adhering firmly to the nut, the confiftence of a baked apple, with little fmell, and a fweet fomewhat auftere, but not unpleafant tafte. A native of South America and the Weft Indies, in fituations not far remote from the fea, where it continues in flower almoft the whole year, but generally ripens its fruit in June and December. The fruit is moft commonly yellowifh, or a kind of ruffet white; but is found red, purple, violet, and nearly black; fome of which, on farther examination, may not improbably prove diftinct fpecies. In its native climate, it is fold commonly in the market, and is eaten either raw or preferved in fugar. Its root paffes for an aftringent, and has been employed as fuch in medicine.

CHRYSOBERYL. Oriental or opalefcent chryfolite of the *Jewellers*. The colour of this mineral is afparagus green, paffing into greenifh white on one fide and on the other through olive-green into yellowifh grey, and fometimes reddifh-brown. It generally exhibits a bluifh milky light, undulating within the cryftals. It is ufually met with in fmall rounded pieces, but occafionally poffeffes a well marked cryftalline figure. Its primitive form is a rectangular parallelepiped, but it is alfo found in fhort regular hexahedral prifms either with or without a truncated hexahedral pyramid at each extremity of the prifm. The furface of the rounded pieces is fomewhat rough, and generally reflects glittering variegated colours. The cryftals poffefs a double refraction, are externally fhining, and very brilliant internally, fo that when polifhed it is fometimes miftaken for the yellow diamond. The fracture of chryfoberyl is perfectly conchoidal: its fragments are indeterminate, angular, and fharp-edged: its hardnefs is fuperior to that of quartz; its fp. gr. is 3.7.

It is infufible *per fe* before the blowpipe. It confifts, according to Klaproth, of

Alumine	71.5
Silex	18
Lime	6
Oxyd of Iron	1.5
	97.0

It is procured chiefly from Brazil, where it accompanies topaz. It has alfo been difcovered in fand from the Ifland of Ceylon, together with rubies and fapphires. A few fpecimens have been brought from Nertfchinfk in Siberia. It is however, upon the whole, a rare mineral, and from its hardnefs and luftre is confiderably valued by jewellers.

CHRYSOCERI, in *Antiquity*, a defignation given to oxen defigned for facrifices. They were fo called from their horns being gilded.

CHRYSOCOLLA, in the *Materia Medica of the Ancients*, the name of a fine green arenaceous powder, properly one of the faburræ, and found on the fhores of the Red Sea, on thofe of fome parts of America, and in Ruffia; and that found at this time has all the properties of that mentioned by the ancients. It ferves to the foldering of gold and other metals, and, given internally, is a violent and dangerous emetic.

It is of a very elegant colour, ferments violently with aqua fortis, and is wholly diffolved by it, and tinges it with a bluifh green; and, being calcined, it lofes all its green colour.

Chryfocolla is reprefented by Pliny as found in mines of gold, filver, copper, and lead: its colour, he fays, was various, according to that of the matter in which it is found; yellow, if among gold, white in filver, green in copper, and black in lead. The Arabs and inhabitants of Guzuratte, call the modern chryfocolla, which is borax, tincar or tincal. The beft is that found in copper-mines; and the worft, in thofe of lead.

CHRYSOCOLLA is alfo the name of a fort of precious ftone, mentioned by Pliny, lib. xxxvii. cap. 10, who calls it alfo *amphitane*. He defcribes it as of a gold colour, and of a fquare figure; adding, that it has the virtue of attracting iron, and even gold. But this, in all probability, is fabulous; and the ftone he fpeaks of is apparently no other than the cubic pyrites.

CHRYSOCOMA, in *Botany*, (χρυσοκομη, Diofc. from χρυσος, *gold*, and κομη, *the human head of hair*, alfo *the bufhy top of trees and herbs*.) Goldy-locks. Linn. Gen. 939. Schreb. 1275. Juff. 180. Vent. 2.512. Gært. 967. Clafs and order, *fyngenefia polygamia æqualis*. Nat. ord. *Compofitæ difcoideæ*. *Corymbiferæ*, Juff.

Gen. Ch. *Cal. common*, hemifpherical, imbricated; fcales linear, outwardly convex, acuminate. *Cor.* florets hermaphrodite, tubular, funnel-fhaped, numerous, equal; border five-cleft, revolute. *Stam.* filaments five, very fhort; anthers forming a hollow cylinder. *Pift.* germ oblong, crowned; ftyle filiform, fcarcely longer than the florets; ftigmas two, oblong, depreffed, involute. *Peric. common*, the permanent calyx. *Seeds* folitary, ovate-oblong, compreffed; down fimple. *Recep.* naked, flat.

Eff. Ch. Receptacle naked. Down fimple; calyx hemifpherical, imbricated. Style fcarcely longer than the florets. Willd. Calyx hemifpherical or egg-fhaped, of a moderate fize, imbricated; fcales oblong, externally convex, florets all androgynous, pitted, rough with the toothed-edges of the cavities. Down fimple, often-toothed, rough. Gært.

* *Shrubby*.

Sp. 1. C. *comaurea*, Linn. Sp. Pl. 2. Mart. 2. Willd. 1. "Leaves linear, ftraight, fmooth, decurrent from the back." *Stem* about a foot high, woody; branches numerous, fmall. *Leaves* narrow, deep green, fcattered, with a fhort appendage on the back part, which runs along the petiole. *Flowers* yellow, terminal on flender naked peduncles. A native of the Cape of Good Hope. It is cultivated in our green-houfes, chiefly on account of its continuing in flower the greater part of the year. 2. C. *patula*, Linn. Mant. 280. Mart. 5. Willd. 2. "Somewhat fhrubby; leaves linear, fmooth; branches divaricated." *Stem* compound, branches growing by threes or fours, much divaricated, fmooth. *Leaves* obtufe, fpreading. *Flowers* terminal, folitary, fcarcely peduncled. A native of the Cape of Good Hope; nearly allied to the preceding, differing chiefly in its much divaricated branches, and fcarcely peduncled flowers. 3. C. *fericea*, Linn. jun. fup. Mart. 3. (Conyza fericea, Willd. 42.) "Silky white; leaves linear, channelled; little branches panicled near the top." Branches, leaves, and peduncles, very white, with filky pubefcence. Little branches fimple, but panicled with flower-bearing tip; fhorter little branches, terminated with a few-flowered panicle. *Leaves* long, flaccid. *Flowers* yellow; calyxes fmooth; fcales yellow, awl-fhaped. It differs from tomentofa in being much whiter; and having fmaller flowers, leaves an inch long, and panicled branches, not one-flowered. A native of the Canary iflands, where the acrid pungency of its bark and wood has recommended it as a cure for the tooth-ache. *Obf.* Willdenow has removed this fpecies to the genus Conyza, but as he has not affigned his reafons, we have left it in its original ftation. Authors, when they make fuch changes, fhould always diftinctly fpecify the grounds of their determination, and fhould carefully refer from the old genus to the new; but to this very obvious rule the Berlin profeffor is altogether inattentive, to the great inconvenience of thofe who confult him; for as his unfinifhed work is without an index, it is often at the expence of not a little time and patience that we find out what he has done with a plant. 4. C. *cernua*, Linn. Sp. Pl. . Mart. 6. Willd. 3. (Coma aurea africana fruticans, foliis Linariæ anguftis, major; Comm. Hort. 2. Tab. 45.) "Somewhat fhrubby; leaves linear, recurved, fomewhat fcabrous; flowers nodding at the time when the anthers difcharge their pollen." A lefs plant than C. comaurea, but branching out in the fame manner. *Leaves* fhorter and a little hairy. *Flowers* not half fo large, of a pale fulphur colour. A native of the Cape of Good Hope. It flowers great part of the year, and ripens its feeds in our climate. 5. C. *microphylla*, Willd. 4. Thun. prod. 142. "Leaves round, recurved, fmooth." A native of the Cape of Good Hope. 6. C. *ciliata*, Linn. Sp. Pl. 4. Mart. 7. (C. ciliaris; Reich. 5. Willd. 5. Coma africana fruticans ericæ folio. Comm. Hort. 2. Tab. 48.) "Somewhat fhrubby; leaves linear, ftraight, ciliated; branches pubefcent." A native of the Cape of Good Hope. 7. C. *montana*, Mart. 4. Willd. 6. Vahl. Symb. p. 70. "Leaves oblong, quite entire, flowers folitary." *Stem* branched; branches round, villous. *Leaves* acute, villous. *Flowers* terminal, outer fcales of the calyx oblong, obtufe, fpreading at the tip; inner ones longer, linear, acute; down ferruginous, the length of the calyx. Found by Forfkal on Mount Horeb. 8. C. *tomentofa*, Syft. Veg. 615. Mart. 8. Willd. 7. "Somewhat fhrubby; leaves and branches tomentous." *Leaves* linear. Native country unknown. 9. *C. nivea*, Willd. 8. (Chyfocoma tomentofa; Jacq. Hort. Schœnb. 2. Tab. 147.) "Leaves linear-lanceolate, tomentous, flat; corymbs terminal, feffile." A native of the Cape of Good Hope. It differs from the preceding in its corymbous flowers, on one-flowered branches. 10. C. *fcabra*, Linn. Sp. Pl. 5. Mart. 9. Willd. 9. (Baccharis, Hort. Clif. Conyza Africana tenuifolia, flore aureo, Dill. Elth. tab. 88. fig. 103.) "Somewhat fhrubby; leaves lanceolate, egg-fhaped, recurved, tooth-ferrated; peduncles pubefcent." An underfhrub, nine or twelve inches high. *Leaves* alternate, narrow, fomewhat hairy. *Flowers* fmall, yellow; in heads at firft roundifh, not rough with hairs, afterwards longer, and contracted towards the end; peduncles long, flender, furnifhed with a few fmall leaves; fcales of the calyx numerous, narrow, green. A native of the Cape of Good Hope; flowering in Auguft and September. 11. C. *denticulata*, Willd. 10. Jacq. Hort. Schreb. 3. tab. 368. "Leaves oblong, attenuated at the bafe, flightly toothed, undulated." Native country unknown.

** *Herbaceous*.

12. C. *undulata*, Willd. 11. Thunb. Prod. 142. "Leaves heart-fhaped, lanceolate, undulated." *Root* perennial. A native of the Cape of Good Hope. 13. C. *purpurea*, Mart. 13. Willd. 12. Forft. Prodromus, n. 286. "Leaves elliptic-lanceolate, fomewhat ferrated, pubefcent; panicle terminal, refembling a corymb. 14. C. *linofyris*, Linn. Sp. 6. Mart. 10. Willd. 13. Gært. tab. 176. (Chryfocome Diofcoridis & Plinii, Col. Ecphr. i. tab. 82. Linofyris nuperorum, Lob. Hift. 223. Ic. tab. 409. Ger. Emac. 553. fig. 9. Ofyris auftriaca, Cluf. Hift. i. p. 325. Linariæ tertium genus, Frag. 358. Linaria, foliofo capitulo luteo, major and minor, Bauh. Pin. 213. L. aurea, Ger. 442—8.) "Leaves linear, fmooth; calyxes loofe." *Root*

Root perennial. *Stems* two feet and a half high, round, ſtiff. *Leaves* cloſely and irregularly ſet, long, narrow, of a pale green colour. *Flowers* in an umbel, bright yellow; peduncles one-flowered, ſlender from the upper part of the ſtem. A native of the temperate parts of Europe. The plant, when handled, yields a fine aromatic ſmell. 15. C. *biflora*, Linn. Sp. 7. Mart. 11. Willd. 14. (After, Gmel. Sib. ii. tab. 82. fig. 1. Conyza, Am. Ruth. 192. "Panicled; leaves lanceolate, three-nerved, dotted, naked." *Root* perennial, creeping, and ſpreading to a conſiderable diſtance. *Stems* numerous, erect. *Leaves* acute, rough. *Flowers* yellow, larger than thoſe of the preceding ſpecies. A native of Siberia. The flowers vary with and without a ray, and are ſaid by Willdenow to be either white or blue. 16. C. *villoſa*, Linn. Sp. Plant. 8. Mart. 12. Willd. 15. (After incanus, Gmel. Sib. ii. tab. 82. fig. 2. Conyza tomentoſa & incana, Amm. Ruth. 190.) "Leaves lanceolate, villous; calyxes cloſe." *Root* perennial. *Leaves* quite entire, hoary, alternate, ſeſſile. *Flowers* yellow, in a ſort of umbel; calyx hairy. *Seeds* ſmall, hirſute, crowned with dun-coloured hairs. A native of Siberia and Hungary.

C. *oppoſitifolia*, Linn. Sp. Pl. See Eupatorium *divaricatum*.

C. *graminifolia*, Linn. Sp. Pl. See Solidago *lanceolata*.

C. *æthiopica plantaginis folio*, Breyn. Cent. See Gnaphalium *nudiflorum*.

C. *ſyriaca flore atrorubente*, Breyn. Cent. See Gnaphalium *ſanguineum*.

C. *dichotoma*, Linn. jun. Sup. Jacq. Ic. See Conyza *inuloides*.

CHRYOCOME, Dioſcoridis & Plinii. See Chrysocoma *linoſyris*.

Chrysocome *ſive ſtœchas citrina minor*, Barrel. Ic. See Gnaphalium *ſtœchas*.

Chrysocome *altera*, Cluſ. Hiſt. See Gnaphalium *luteo album*.

Chrysocome *ſive argyrocoma Africana ericoides flore albo*, Seb. Theſ. See Xeranthemum *veſtitum*, Linn. *Elichryſum*, Willd.

Chrysocome *ſive argyrocoma gnaphaloides Africana, ampliſſimis floribus*, Seb. Theſ. See Xeranthemum *ſpecioſiſſimum*, Linn. *Elichryſum*, Willd.

Chrysocome *ſive argyrocoma Africana ericoides, capitis b. ſpei*, Seb. Theſ. See Xeranthemum *ſeſamoides*, Linn. *Elichryſum*, Willd.

CHRYSOGONUM, (χρυσογονον, Dioſcor. from χρυσος, *gold*; and γονυ, *the keel, or a joint.*) Linn. Gen. 988. Schreb. 1337. Juſſ. 188. Gært. 1009. Claſs and order, *ſyngeneſia polygamia neceſſaria*, Linn. *Corymbiferæ*, Juſſ.

Gen. Ch. *Calyx common* ſimple, five-leaved; leaves oblong, acuminate, nearly the length of the ray, rough on the outer, naked on the inner ſide, ſpreading. *Corol. compound* radiate; florets of the diſk numerous, hermaphrodite but barren, funnel-ſhaped, five-toothed, erect; of the ray five, ſtrap-ſhaped, oblong, truncated, three-toothed, fertile. *Stam. of the hermaphrodite*, filaments five, very ſmall; anthers forming a hollow cylinder. *Piſt. of the hermaphrodite*, germ very ſmall, abortive; ſtyle briſtle-ſhaped, the length of the floret; ſtigma obſcure; *of the female*, germ larger; ſtyle ſhorter; ſtigmas two, revolute. *Recep.* chaffy, chaff-like ſcales diſſimilar in form; thoſe of the diſk ſimple, linear-oblong, obtuſe, concave, pubeſcent outwards, one to each floret; thoſe of the ray compound, four to each floret, united ſo as to form a proper pericarp; the outer one very large, inverſely egg-ſhaped, convex outwards, concave within, covering the back of the ſeed; the three inner ones narrow, linear-oblong, ſhutting up the aperture of the larger ſcale, ſo that two cover the ſides of the ſeed, and the third its interior part, the whole forming a complete pericarp, which opens as the ſeed ripens. *Seeds* inverſely egg-ſhaped, convex outwards, concave within, marked with two obſolete longitudinal furrows, and crowned with a membranous, top-ſhaped ſcale, about half the length of the ſeed; teeth generally three, but, according to Gærtner, ſometimes ſix.

Eſſ. Ch. Calyx ſimple, five-leaved. Receptacle chaffy; chaff diſſimilar in form. Seeds incloſed in a chaffy five-ſcaled pericarp, and crowned with a ſimple toothed ſcale.

Obſ. In forming theſe characters, we have chiefly followed Gærtner, as correſponding moſt with our own ideas of the ſtructure of the parts of fructification: but that eminent carpologiſt muſt have been guilty of an egregious overſight in twice ſtating the five diſſimilar ſcales to encloſe the germ of the barren florets, firſt at the end of his deſcription of the receptacle, and afterwards in the reference to his figure; a ſtate altogether inconſiſtent with the former part of his own deſcription, as well as in oppoſition to all other authors.

Sp. C. *virginianum*, Linn. Sp. Mart. Willd. Gært. tab. 174. *Leaves* reſembling thoſe of *Lamium purpureum*, or common balm, oppoſite, moderately hairy, on long petioles. *Flowers* gold-coloured, terminal. A native of Virginia.

Chrysogonum *Dioſcoridis*, Raw. It. Rai. Hiſt. See Leontice *chryſogonum*.

Chrysogonum, Linn. Sp. Pl. Ed. 1. See Linnia *pauciflora*.

Chrysogonum, in the *Materia Medica*, is alſo the name of a Syrian plant, called the red turnep, the leontopetalon coſta ſimplici of Tournefort.

CHRYSOLACHANON, in *Botany*, a name by which Pliny, and ſome other authors, have expreſſed the white-garden beet.

CHRYSOLITE, *Peridot* of the French mineralogiſts. The principal colour of this mineral is piſtachia-green paſſing into browniſh olive. It occurs in angular or rounded fragments, or cryſtallized. Its primitive form is a ſtraight priſm with rectangular baſes; it alſo occurs in eight, ten, and twelve-ſided priſms. Its internal luſtre is brilliant and vitreous. Its fracture is perfectly conchoidal; its fragments are indeterminately angular and ſharp edged. It is perfectly tranſparent, and poſſeſſes a double refraction in a remarkable degree. Its hardneſs exceeds that of glaſs. Sp. gr. 3.34.

It is infuſible *per ſe* before the blow-pipe, but with borax forms a tranſparent green glaſs. It has been analyſed by Klaproth and Vauquelin, with the following reſults.

	Klap.	Vauq.
Silex	39	38
Magneſia	43.5	50.5
Oxyd of iron	19	9.5
	101.5	98.0

It is not known with any certainty whence the chryſolite is procured; Upper Egypt is ſaid to be one of the countries which afford it, and a few come to the jewellers of Europe from the Eaſt Indies. It ranks among the gems, but its ſoftneſs and unattractive tone of colour, eſpecially when the yellow predominates, render it of little value.

Chrysolite is alſo a general name which the ancients gave to all precious ſtones, wherein the yellow, or golden, was the prevailing colour.

When the ſtone was green, they called it *chryſopraſus*: the

the red and blue too had their particular denominations, which expreffed their colour: the gold being fignified by chryfo; which ftill began the name.

We know but few of thefe chryfolites now: or rather, they are referred to the fpecies of ftone which they approach the neareft to: the green to the emerald, the red to the ruby; and fo of the reft.

Chrysolite *pafte*. The way of making an artificial chryfolite pafte is this: take of prepared cryftal two ounces, ordinary red lead eight ounces; mix thefe well together, and add crocus martis made with vinegar, twelve grains: mix all together; put them into a crucible, lute it over, and bake the whole for twenty-four hours, or longer, in a potter's kiln, and it will produce a very elegant refemblance of the true chryfolite.

CHRYSOLORAS, Manuel, in *Biography*, a learned Greek, the firft profeffor of his language in modern Italy, was born at Conftantinople of noble Roman parents, whofe anceftors are fuppofed to have migrated with Conftantine the Great. It is uncertain in what year he came into Italy. It is, however, well afcertained, that, on occafion of the fiege of Conftantinople by the Turks in 1393, the emperor Manuel Paleologus fent him and other envoys and orators to implore the compaffion and affiftance of the weftern princes. After vifiting the coafts of France and England, where he obtained fome contributions and more promifes, he returned with the pecuniary aid he had collected. About the year 1396, the city of Florence fent him an invitation to open there a public fchool for the Greek language: with this he complied, and taught with great affiduity and applaufe for three years; when the emperor Manuel himfelf coming to Milan, Chryfoloras left Florence, and went to that city, where he taught Greek. He was in England again with the emperor about the year 1405; after which, he travelled to Rome, on an invitation from Pope Gregory XII., and opened a fchool there. He was employed on various embaffies, and, in 1413, accompanied two cardinal legates to the court of the emperor Sigifmond, in order to determine the place for holding a general council. This was fixed at Conftance; and Chryfoloras was fent thither, either by the emperor Manuel, or by the Pope, and died while he was performing his miffion. He was interred in the Dominican church of that city: his epitaph was written by Guarino, and many tributes of praife were beftowed on him by his fcholars; among the more celebrated of whom were Poggio, Vergerio, Manetti, and Leonardus Brunus Aretinus: of thefe, the laft in fpeaking of his mafter, fays, "On the arrival of Manuel, I hefitated, whether I fhould defert my legal ftudies, or relinquifh this golden opportunity of being introduced to a familiar converfe with Homer, Plato, and Demofthenes? with thofe poets, philofophers, and orators, of whom fuch wonders are related, and who are celebrated by every age as the great mafters of human fcience? Of profeffors and fcholars in civil law, a fufficient fupply will always be found in our univerfities; but a teacher, and fuch a teacher, of the Greek language, if he be once fuffered to efcape, may never afterwards be retrieved. Convinced by thefe reafons, I gave myfelf to Chryfoloras; and, fo ftrong was my paffion, that the leffons which I had imbibed in the day were the conftant fubject of my nightly dreams." A funeral oration was pronounced for him in Venice by Andrea Guiliano. Chryfoloras wrote a Greek grammar in the Greek language, which was fo highly efteemed, that above a century afterwards, it was ufed by Erafmus. He publifhed alfo a "Parallel between ancient and modern Rome," addreffed to John, fon of the emperor Manuel. He had a nephew and difciple, John Chryfoloras, who was his coadjutor, and very eminent in reviving Greek learning in Italy. John lived chiefly in Conftantinople, and died about 1425. Gibbon. Gen. Biog.

CHRYSOMALLOS, in *Ancient Geography*, a name given to Mount Ida, in Crete, according to Strabo.

CHRYSOMELA, in *Entomology*, a genus of coleopterous infects in the Linnæan fyftem, containing many beautiful fpecies. In the larva ftate they feed on the leaves of trees and plants, the pulp and tender parts of which they devour, but reject the fibres; fome kinds infeft the cotyledons only, and are very deftructive. In the perfect, as in the larva ftate, they are found chiefly in woods and gardens. Many of thefe infects are flow in motion, but fome kinds have the pofterior legs formed for leaping. The antennæ of the chryfomelæ are moniliform, or compofed of little globular articulations. feelers fix, thickeft towards the end; thorax marginate; wing-cafes immarginate; body in moft fpecies oval. Gmel. Linn. Syft. Nat.

In the earlier editions of the Linnæan Syftema Naturæ, the generic character of the Chryfomelæ is fomewhat differently defined: to conftitute a Linnæan Chryfomela it was fufficient that the antenna was moniliform, and gradually increafed in thicknefs towards the end, and that the thorax and elytra were immarginate. Linnæus divided them into five diftinct families; namely, 1. Thofe having the body of an oval form. 2. The *Saltatoriæ*, or thofe whofe pofterior thighs are much thicker than the others, and formed for leaping. 3. Thofe with the body cylindrical. 4. Such as have the body oblong, and the thorax broader than the abdomen. 5. Thofe of a flender form, with the thorax of an equal breadth with the abdomen.

Geoffroy, diffatisfied with the genus Chryfomela, as laid down by the Swedifh naturalift, divides the infects of this tribe into feveral diftinct genera, in his "Hift. des Infects." Schaeffer has followed Geoffroy in alterations, and in fome meafure improved the genera; and the fame may be faid of Scopoli, though we think the latter exceptionable in referring feveral of the Linnæan Chryfomelæ to the Coccinella genus, becaufe their antennæ are fcarcely fo long as the thorax, and others to the genus Attelabus, becaufe their thorax is broader than the head and body. Geoffroy divides the Linnæan Chryfomelæ into feven genera: his firft genus, *galeruca*, differs from the other Linnæan Chryfomelæ in the rugofity or roughnefs, and margin of its thorax. His fecond genus is *chryfomela*, and has the thorax fmooth and margined. *Cryptocephalus*, Geoffroy's third genus, confifts of thofe Linnæan Chryfomelæ which have the articulations of the antennæ rather longer than ufual, and the thorax of an hemifpherical form. Thofe which have the thorax cylindrical conftitute his genus *crioceris*. Of his genus *diaperis* he defcribes only one fpecies; the generic character confifts in the articulations of the antennæ being rather larger than common, and appearing to be perfoliated; and the thorax convex and margined. *Altica* is the fixth genus, and comprehends the Linnæan family Saltatoriæ, or thofe whofe pofterior legs are formed for leaping. The laft genus is *melolontha*, thofe having antennæ ferrated, or with lateral appendices like a faw, and placed on the fore part of the head before the eyes. In Geoffroy's arrangement of this tribe of infects we perceive the bafis upon which the Galeruca, Cryptocephalus, Crioceris, and other analogous genera are founded in the more modern fyftem of Fabricius. In the "Entomologia Britannica," the genus Chryfomela is thus defined; antennæ moniliform, and thickeft towards the end; head inferted; thorax and wing-cafes immarginate; body ovate and convex.

 The

The Fabrician genus Chryſomela conſiſts of thoſe inſects which have ſix feelers thickeſt towards the end; the lip horny and entire; and the antennæ moniliform. Theſe correſpond with the Linnæan character of the Chryſomela, but the ſpecies deſcribed by this writer are numerous, and, with a few exceptions, conſiſt of inſects entirely unknown to Linnæus. The works of Panzer, Marſham, and other recent entomologiſts, comprehend likewiſe a great variety of new ſpecies, the principal of which we ſhall proceed to enumerate.

Chryſomela, Fabr. Linn. &c.
Species.

Obscurata. Above duſky-braſſy; thorax very glabrous; wing-caſes with ſcattered dots. Fabr. Suppl. Inhabits Germany. Daldorff.

14-Guttata. Duſky-teſtaceous; wing-caſes with ſix white dots. Fabr. Suppl. A native of the Cape. Lund.

Ebraea. Deep black, gloſſy; wing-caſes white, varied with deep black dots. Fabr. Suppl. Same country and cabinet as the laſt.

Exclamationis. Ovate; thorax and legs ferruginous; body yellow, with nine black abbreviated lines, the exterior one interrupted. Fabr. &c. Inhabits North America. The head is ferruginous, and without ſpots; thorax ſmooth, ferruginous, with the anterior margin pale and ſcutel ferruginous.

6-Notata. Black; thorax and wing-caſes pale, with two black dots. Fabr. Suppl. Muſ. Lund. *Obſ.* The head of this inſect is of a pale colour, varied with black; thorax pale and gloſſy, with two black dots; wing-caſes ſlightly ſtriated, pale, with a pair of black dots in the middle of each; body black; legs pale; thighs with a black dot at the tip.

Cajennensis. Oblong, ferruginous; wing-caſes with four black ſpots, and a black band in the middle. Fabr. Suppl.

The head of this inſect is duſky ferruginous, with frontal line and antennæ black; the thorax oblong, duſky ferruginous and immaculate; wing-caſes ſmooth and ferruginous, with a pair of black ſpots at the baſe; in the middle a black band, and behind two black ſpots.

Marmorata. Oblong, black; anterior margin of the thorax and the wing-caſes yellow, ſpotted with black. Fabr. Inhabits Cayenne. Cuvier.

Sumptuosa. Very gloſſy; head and thorax braſſy; wing-caſes violaceous. Fabr. Found in the iſland of Trinidad. Ryan. Muſ. Lund.

Bulgharensis. Oblong, azure, gloſſy; wing-caſes with ſcattered dots; antennæ fuſcous. Schrank. Inhabits Germany. Deſcribed from the cabinet of Daldorff.

Punctatissima. Ovate; deep black; wing-caſes yellow, with numerous black dots; ſternum cornuted. Olivier, and Fabr. Ent. Syſt. Inhabits Cayenne.

The head is black, with an oblong impreſſed dot in front; thorax black and gloſſy, with the margin a little prominent; wing-caſes very ſmooth; legs black.

Fustulata. Deep black, with five bands of fulvous dots. Fabr. Ent. Syſt. *Erotylus puſtulatus*, Mant. Inſ. A native of Cayenne. Dr. Schulz.

Morio. Ovate, deep black; antennæ and legs black. Babr. Inhabits Van Diemen's land. Bankſian cabinet.

Coriaria. Ovate; deep black; legs entirely violet. Fabr. *Chryſomela laichert*, Auſt. 143. 2. A native of Germany.

Nigrita. Ovate; blue; wing-caſes punctured and more duſky. Fabr. Found in the neighbourhood of Paris. Boſc.

Goettingensis. Ovate; deep black; legs violet, ends rufous. Linn. Inhabits Germany; alſo found in England, but very rarely. Donov. Brit. Inſ.

Hottentotta. Ovate; blue black; antennæ and legs of the ſame colour; wing-caſes irregularly dotted. Fabr. A native of Germany.

Æthiops. Ovate; black, beneath duſky; wing-caſes irregularly dotted. Fabr. Inhabits Germany. Smidt.

Vittata. Ovate; blue; margin and ſtripe along the middle yellow, Fabr. Inhabits America. Schulz.

Bicolor. Ovate; braſſy-green; beneath violet; wing-caſes ſtriated with dots. Fabr. *Chryſomela viriolicærulea*, Forſk.

This inſect inhabits Alexandria; it is entirely of a duſky-greeniſh-braſſy colour above, and has the wing-caſes ſtriated with dots in pairs.

Bankii. Ovate; above braſſy; beneath teſtaceous. Roſs Fn. Etruſ. A native of Europe, and found in England but rarely. Donov. Brit. Inſ.

Ferruginea. Ovate; ferruginous; beneath black. Fabr. Deſcribed as an African inſect from the Bankſian cabinet.

Lusitanica. Ovate; thorax coppery; wing-caſes braſſy, with impreſſed bluiſh dots; beneath violet. Fabr. A native of Luſitania. Bankſian cabinet.

Affinis. Ovate; obſcure-braſſy, beneath violet; wing-caſes ſmooth. Fabr. Found under ſtones in Barbary. Vahl.

Metallica. Ovate; braſſy, ſhining; antennæ and legs teſtaceous. Fabr. Very much reſembles *Chryſomela Bankſii*. Inhabits Germany. Helwig, &c.

Lamina. Braſſy-green; thorax very glabrous; margin thick; wing-caſes ſtriated with dots. Fabr. Inhabits Germany. Smidt.

Gibbosa. Ovate; black; wing-caſes yellow, with two bands and dots at the baſe black. Fabr. A South American ſpecies. The wing-caſes are yellowiſh, with four black dots at the baſe.

8-Maculata. Ovate; duſky ferruginous; wing-caſes with four yellow ſpots on each. Fabr. A native of Surinam.

10-Pustulata. Ovate; black; wing-caſes with five rufous ſpots. Fabr. Deſcribed from the cabinet of Gigot d'Orcy. It is a native of St. Domingo.

Trimaculata. Blue; wing-caſes yellow, with a band and two ſpots of black. Linn. Inhabits South America.

Adonidis. Black; margin of the thorax yellow, with a black dot; wing-caſes yellow; future and ſtripe black. Fabr. *Chryſomela adonidis*, Pallas It. A variety, β, is deſcribed by Fabricius, with the margin of the thorax teſtaceous inſtead of yellow; and the wing-caſes teſtaceous; the marginal dot on the thorax black, and the future and ſtripe on the elytra of the ſame colour as in the firſt-mentioned inſect. Hubner conſiders it as a ſexual difference.

Clavata. Head and thorax ferruginous; wing-caſes black, with a yellowiſh ſtripe. Fabricius deſcribes this from the Hunterian cabinet. Its country is unknown.

Trifasciata. Dull teſtaceous; wing-caſes yellow, with two braſſy-green bands. Fabr. From Surinam.

Suturalis. Teſtaceous, wing-caſes braſſy, with two dots, and two bands of yellow. Fabr. A native of Cayenne. Von Rohr.

Pulchra. Braſſy; wing-caſes yellow; future and ſtripe braſſy. Fabr. Inhabits North America. Bankſian cabinet.

Guttata. Deep black, with a ſinuate band; margin of the wing-caſes and ſix dots of white. Fabr. Inhabits the Cape of Good Hope. Bankſian cabinet.

14-Punctata. Ovate, teſtaceous; wing-caſes yellow, with 16 black dots, two of which are common, or united. Linn. Inhabits the Eaſt Indies. The poſterior thighs are very thick, and ſingle-toothed.

Ignita.

Ignita. Blue, polished, wing-cases brassy; antennæ and ends of the legs fuscous. Fabr.

Described from the cabinet of Dr. Hunter as a native of Cayenne.

Surinamensis. Blue, very glossy; antennæ and ends of the legs fuscous. Fabr. *Chrysomela Americana,* Sulz. This is an insect of large size, and inhabits Surinam.

Asiatica. Ovate, brassy-green, and highly polished; wing-cases blue. Fabr. *Chrysomela Asiatica,* Pallas. Found in the southern parts of Russia.

Graminis. Ovate, green-blue, polished; antennæ and legs of the same colour, Linn. Inhabits Europe, and is found in England. Donov. Brit. Inf.

Bifrons. Ovate, brassy-green; body blue. Fabr. Found on plants in Italy. Dr. Allioni.

Cuprea. Ovate; head and thorax brassy; wing-cases coppery; body deep black. Geoffroy.

This species is a native of Germany. The body, antennæ, and legs are black; head brassy, with the eyes fuscous; margin of the abdomen sanguineous.

Tristis. Ovate, blue; antennæ fuscous. Fabr. Inhabits the south of Europe.

Hemoptera. Ovate, violaceous; ends of the feet and wings red. Linn.

Found on plants in Europe. Geoffroy, &c. and in England, Marsh.

Varians. Ovate, blue (sometimes brassy); antennæ and legs black. Fabr. *Chrysomela varians,* Act. Hall. *Chrysomela Hyperici,* Degeer. Inhabits Saxony.

Violacea. Subrotund, blue; antennæ and legs same colour. Fabr. Inhabits Germany. Smidt.

Centaurii. Ovate, shining coppery; brassy green beneath; legs coppery. Fabr. *Chrysomela centaura.* Herbst. Inhabits Germany.

Tricolor. Ovate, brassy, polished; beneath black; antennæ, vent, and legs ferruginous. Fabr. Inhabits Virginia.

Luteicornis. Ovate, brassy-black; antennæ yellow. Fabr.

Inhabits the islands of South America. Dr. Pflug. The body is entirely of a brassy black colour, polished, and impressed with scattered dots of a small size. A variety of this species has the legs varied with black and yellow.

Semistriata. Ovate, black; wing-cases yellow with a black band in the middle; and the anterior and posterior part streaked with black. Fabr. This is a Brasilian species.

Populi. Ovate; thorax bluish; wing-cases red tipped with black. Linn.

This insect inhabits Europe generally, and destroys the leaves of the ash tree. The larva has six feet, and is varied with black and white, with a double row of tubercles, from which a yellowish unpleasant moisture is exuded. It has been described by many authors, as Degeer, Merian, Albin, Lister, &c.

Tremula. Ovate, bluish; wing-cases testaceous. Geoffroy. Inhabits Europe, and resembles C. *populi,* but is not above half its size, and has the tip of the wing-cases of the same colour.

Grossa. Ovate, blue, polished; wing-cases testaceous, and without spots. Fabr. Inhabits Italy. Dr. Allioni.

Staphylæa. Ovate, and dull testaceous. Linn. Found on plants in Europe.

Fervida. Ovate, testaceous; wing-cases brassy; margin testaceous. Fabr. A native of the island of Java. Dr. Mauduit.

Polita. Ovate; thorax golden; wing-cases testaceous. Linn. Geoffr. Inhabits Europe on the willow.

Lunata. Ovate; ferruginous; margin of the wing-cases, stripe, and lunate in the middle yellowish. Fabr. Described from the Banksian cabinet. The country unknown.

Glabrata. Ovate, testaceous, polished; wing-cases edged with blue. Fabr. Inhabits Surinam.

Lurida. Ovate, black; wing-cases chesnut, with punctured striæ. Linn. Inhabits Europe.

Vittata. Ovate, thorax black and brassy; wing-cases yellow, with nine fuscous stripes. Fabr. Country unknown.

Stolida. Ovate, ferruginous; head and thorax yellow; wing-cases variegated. Fabr. Inhabits South America.

Nigricornis. Ovate, brassy-black; head, sides of the thorax, and double spot at the base of the wing-cases ferruginous. Fabr.

Inhabits New Holland. Donov. Inf. N. H. Banksian cabinet.

Collaris. Ovate, violet; margin of the thorax white with a black dot. Linn.

Inhabits Europe and America, on willows. The thorax has two impressed dots.

Salicis. Ovate, blue; thorax smooth; margin thick and ferruginous. Fabr. Found in Saxony on the willow.

Senegalensis. Ovate, dull brassy; the thorax and wing-cases margined with ferruginous, thorax with a black dot. Fabr. Inhabits Senegal. Olivier.

Vininalis. Ovate, black; thorax rufous and bimaculated; wing-cases rufous. Linn. Geoffr. Found on willows in Europe.

Cyanipes. Ovate, rufous; wing-cases with blue dots up the apex. Fabr. Donov. Inf. New Holland. From the Banksian cabinet.

Cyanicornis. Ovate, rufous; thorax with a dorsal spot, and two spots of blue; wing-cases with eight blue spots, Fabr. Donov. Inf. New Holland. Banksian cabinet.

10-Punctata. Ovate; thorax red, behind black; wing-cases rufous, with about ten black dots. Linn.

Inhabits Europe. Varieties sometimes occur with a greater number of black dots, others which are destitute of them.

6-Punctata. Black; thorax rufous, with two black dots; wing-cases rufous with three black dots on each. Fabr. A native of Europe.

Pallida. Ovate, yellowish, with black eyes. Linn. and Geoffr.

An European species. A variety of this insect is sometimes found with indistinct black spots on the wing-cases and the body black.

Striata. Ovate, black, polished; wing-cases striated, testaceous, with deep black suture. Fabr. Inhabits the Cape. Banksian cabinet.

Notata. Ovate, thorax fulvous, with four black dots; wing-cases pale varied with black. Fabr. A native of the Cape, in the Banksian cabinet.

Rumicis. Ovate, thorax fulvous with four black dots; wing-cases fulvous with the suture and stripe in the middle black. Fabr. A native of Spain. Vahl.

Vulpina. Ovate, black; margin of the wing-cases four dots, and apex white; the last with three black spots. Fabr. Inhabits the Cape.

Crassicornis. Ovate yellowish wing-cases with two black dots. Fabr. Donov. Inf. New Holland.

Lapponica. Ovate; thorax green; wing-cases red with a blue band between a dot and lunate spot. Linn. Inhabits Europe.

Undulata. Ovate, rufous, wing-cases with three blue-waved lines. Linn. A native of India.

18-Guttata.

18-GUTTATA. Ovate, wing-cases fuscous with eight pale dots, some of which are connected. Fabr.

Described from the Banksian cabinet. Donov. Inf. New Holland.

POLYGONI. Ovate, blue; thorax, thighs, and vent, rufous. Linn. Common in most parts of Europe. Donov. Brit. Inf. &c.

RUSSICA. Ovate, blue; base of the antennæ, thorax, vent, and legs, rufous. Fabr. Inhabits Russia. Bœber.

BRUNNEA. Ovate, testaceous; wing-cases at the suture and small line in the middle fuscous. Fabr. Donov. Inf. New Zealand, &c. Banksian cabinet.

CEREALIS. Ovate, golden; thorax with three, wing-cases with five blue lines. A native of Europe. A most beautiful insect, being varied with stripes of blue, green, and crimson, and marked with slender lines of gold. Discovered British on one of the Cambrian mountains by Mr. Hudson, and inserted on this authority in Donov. Brit. Inf. and since in Marsh. Ent. Brit. Found on the butcher's-broom.

FASTUOSA. Ovate, golden, with three blue lines on the wing-cases. Linn. A native of Europe; sometimes found in England. Donov. Brit. Inf.

MODESTA. Ovate, brassy green; four lines on the thorax and two on the wing-cases coppery. Fabr. Inhabits the East Indies.

MARSHAMI. Thorax greenish golden; wing-cases golden, glossed with red and irregularly punctured. Donov. Brit. Inf. A new species.

AMERICANA. Ovate, brassy-green; wing-cases with five sanguineous streaks. Linn. Found in France. The head is brassy with a vertical scarlet spot.

FESTIVA. Ovate, brassy black, with three lines on the wing-cases, and the anterior part of the suture yellow. Fabr. Described from an American insect in the British Museum. It is the Chrysomela lineata of Degeer.

SPLENDIDA. Ovate, brassy-green; antennæ and ends of the feet black. Fabr. A native of Tranquebar. Lund.

GLORIOSA. Ovate, green, polished; wing-cases with a blue line. Fabr. *Chrysomela cacaliæ*, Schrank. Inhabits Italy.

SPECIOSA. Ovate, green, silky; wing-cases with two golden lines. Linn. Inhabits woods in Europe.

CYANEA. Ovate; thorax rotundate, and cylindrical; body blue and polished; legs black. Fabr. Inhabits South America.

PRÆTIOSA. Ovate; thorax globose; wing-cases very smooth; body blue. Fabr. Inhabits Germany. Smidt.

NITIDA. Ovate; thorax rotundate, brassy-green; antennæ blue. Fabr. Inhabits Siam.

AURATA. Ovate; thorax rounded and blue; wing-cases golden, with a blue margin. Fabr. Inhabits Pennsylvania.

LIMBATA. Ovate, black; wing-cases surrounded with a sanguineous border. Geoff. Inhabits Europe.

CARNIFEX. Ovate, black; wing-cases very smooth; exterior margin sanguineous. Fabr. A native of Germany.

SANGUINOLENTA. Ovate, black; wing cases dotted; exterior margin yellowish. Linn. Found on plants in Europe; a rare English species. Donov. Brit. Inf.

MARGINATA. Ovate, brassy-black; wing-cases punctured with yellow margin. Linn. A native of Europe. The wings are sanguineous.

SCHACH. Ovate; thorax brassy-black, and finely polished; wing-cases dusky, smooth, with margin sanguineous. Fabr. A native of Germany.

HANNOVERANA. Ovate, blue; margin of the thorax and wing-cases with a stripe on the latter ferruginous. Fabr. The antennæ of this insect are black; and the wing-cases striated with dots. One variety of this species has the stripe on the wing-cases abbreviated. Fabricius considers the Chrysomela Hannoverana, Ranunculi, and Potentilla, as the same insect.

AREATA. Ovate, black; thorax and wing-cases very smooth, with margin rufous. Fabr. Inhabits Paris. Cabinet of Bosc.

SCUTELLATA. Ovate, rufous; wing-cases with 5 black spots. Fabr. *Chrysomela scutellata*, Herbst. A native of Germany.

5-PUNCTATA. Ovate, black, with rufous thorax; wing-cases testaceous, with five black dots. Fabr. Inhabits Hamburgh. Dr. Schutz.

CROTONIS. Ovate, brassy-black, with yellow antennæ. Fabr. From the cabinet of Dr. Pflug. Inhabits South America.

PECTORALIS. Ovate, rufous; breast and abdomen at the base black. Fabr. *Dermestes rufus*, Herbst. Inhabits Germany.

LITURA. Ovate, pale rufous; wing cases at the suture, and a longitudinal line of black. Fabr. Marsh, &c. Inhabits England.

FLAVICANS. Ovate, yellowish; wing-cases cinereous-green. Fabr. Inhabits Germany. Hybner, &c.

SACRA. Ovate, above rufous; thoracic line, two dots, and suture of the wing-cases black. Linn. Inhabits Palestine.

HÆMORRHOIDALIS. Ovate, black, and polished; antennæ at the base, yellowish; above red. Linn. Found on the birch and alder in Europe.

FUCATA. Ovate, black, thorax, and wing-cases brassy-green. Fabr. Inhabits Italy.

AENEA. Ovate, brassy-green; tail ferruginous; antennæ and shanks black. Linn. Geoffr., &c. On plants in Europe.

2-PUNCTATA. Ovate, testaceous; wing-cases with a fuscous spot. Fabr. A native of the Cape. Banksian cabinet.

PHILADELPHICA. Ovate, green; wing-cases yellow with green spots; antennæ and legs ferruginous. Linn. A native of Pennsylvania.

ARMORACIÆ. Ovate, bluish, polished, beneath black. Linn. A native of Europe.

COCHLEARIÆ. Ovate, bluish, beneath black; wing-cases striated. Fabr. Inhabits plants in Germany.

PALLIPES. Ovate, black; wing-cases and legs very pale. Fabr. An inhabitant of Germany.

SOPHIÆ. Ovate, blue; shanks and ends of the feet yellow. Fabr. Found in Saxony.

ÆRUGINEA. Subrotund, brassy; legs ferruginous. Fabr. *Chrysomela metallica*, Ross. Fn. Etr. A native of Italy.

TENEBRICOSA. Apterous, blackish-purple; wing-cases uniformly punctured. Marsh. Fabr. *Chysomela tenebrioides*, Gmel. *Tenebrio lævigatus*, Linn.

AHENEA. Brassy-black, polished; legs pitchy. Marsh. A new British species.

OLIVACEA. Olivaceous-testaceous; eyes and suture of the wing-cases black. Forsk. Cent. 22. Inhabits England.

ATERRIMA. Black, polished; thorax very glabrous; wing-cases striated; legs somewhat ferruginous. Marsh. An English insect in the cabinet of Mr. Allen, as is also the following species.

CHALCEA. Brassy; wing-cases with obsolete striæ of dots. Marsh. Ent. Brit.

UNICOLOR. Black-blue, somewhat glossy, with numerous impressed dots. Marsh.

VIRIDI-

Viridi-ænea. Braſſy-green, with numerous dots; antennæ and legs ſame colour. Marſh.

Atro-violescens. Ovate, black-violet; wing-caſes ſtriated; legs pitchy. Marſh. Once taken near Holme, in Norfolk, by the Rev. Mr. Kirby.

** *Saltatoriæ;* having the poſterior thighs thick, and formed for leaping.

Flava. Yellow; thorax dotted with black; wing caſes violet. Fabr. *Altica thoracica*, Fabr. Syſt. Ent.

Caroliniana. Yellowiſh; thorax with two dots, wing-caſes with five ſtripes of yellow. Fabr. Gmel. *Crioceris caroliniana*, Fabr.

Oleracea. Greeniſh-blue. Linn. Fn. Suec. An European inſect.

Albicollis. Thorax pale; wing-caſes braſſy, with two ſpots and a band of gold. Fabr. A native of New Holland.

Fulvicollis. Thorax reddiſh; wing-caſes pale; ſuture and two ſpots black. Fabr. Country unknown.

Bicolor. Rufous; wing-caſes, and poſterior thighs blue. Degeer, &c. Inhabits America.

Quadrifasciata. Ferruginous, with four white bands on the wing-caſes. Fabr. This is a large inſect and inhabits Cayenne.

Cincta. Black; wing caſes braſſy-green; margin and two dots white. Fabr. Inhabits Luſitania.

Quadriguttata. Ferruginous; thorax white; wing-caſes black, with four white dots. Fabr. Inhabits Cayenne.

Biguttata. Ferruginous, thorax and wing-caſes with two white dots. Fabr. A native of Cayenne.

Glabrata. Thorax pale, with three black dots; wing-caſes black, with two white ſtripes. Fabr. *Crioceris glabrata*, Fabr. Sp. Inſ.

Nobilitata. Ferruginous, margin of the wing-caſes and band white. Fabr. A native of Cayenne.

Chrysocephala. Blue-black; head and four anterior legs pale yellow. Linn. Fn. Suec. Inhabits Sweden.

Hyoscyami. Greeniſh-blue; legs teſtaceous, poſterior thighs violet. Linn. Fn. Suec. *Capricornus exiguus ſaltatorius*, Ray. Inhabits Europe.

Quadripustulata. Black; wing-caſes with four rufous dots. Fabr. Inhabits Europe.

Anglicana. Black; wing-caſes and ſhanks pale. Fabr. Found on plants in England.

Atricillæ. Black, thorax, wing-caſes, and ſhanks teſtaceous. Linn. Fn. Suec.

Modeeri. Braſſy, poliſhed; wing-caſes yellow at the tip; anterior legs and ſhanks of the poſterior ones pale yellow. Linn. Inhabits Sweden and other parts of Europe.

Nitidula. Green, ſhining; head and thorax golden; legs ferruginous. Fabr. Inhabits Europe, on the willow.

Trifasciata. Above whitiſh with three brown bands. Fabr. Found on plants in Europe.

Nigripes. Braſſy-green; legs black. Fabr. Inhabits England.

Tabida. Pale, with the eyes black. Fabr. Found on plants in Europe.

Brassicæ. Black; wing-caſes pale, teſtaceous; margin entirely, and a band in the middle black. Fabr. A ſmall ſpecies found in Germany.

Nemorum. Wing-caſes yellow, with the margin entirely black. Fabr. Found on various plants in Europe.

Atra. Black, poliſhed; antennæ at the baſe, and tip of the feet pitchy. Geoffroy, &c. Found in France and Germany.

Rustica. Black; antennæ, legs, and tip of the wing-caſes teſtaceous. Gmel. An European ſpecies. The wing-caſes are very finely punctured.

Pulicaria. Black; wing-caſes with a poſterior ferruginous ſpot. Gmel. Very ſmall. Inhabits Europe.

Rufipes. Obovate, blue; head, thorax, legs, and antennæ rufous. Linn. Inhabits Sweden.

Testacea. Teſtaceous, gibbous; wing-caſes very ſmooth. Fabr. Geoffr. Inhabits Europe.

Fascicornis. Obovate, blue; head, thorax, and legs rufous; antennæ, fuſcous. Hornſt. Inhabits Germany.

Holsatica. Black, poliſhed; a red dot at the end of the wing-caſes. Fabr. A native of Europe.

Æquinoctialis. Thorax red; wing-caſes violet, with four alternate white ſpots. Degeer, &c. Found in South America.

Lens. Entirely blue-back, with dotted wing-caſes. Thunberg. Inhabits Upſal.

Exclamationis. Thorax black; wing-caſes black, with four yellow ſpots. Thunberg. Inhabits Upſal.

Hudsonias. Black, ſomewhat oblong; baſe of the antennæ ferruginous. Forſt. Nov. Inſ. A native of South America.

Quadrinotata. Black, antennæ yellowiſh at the baſe, wing-caſes with four teſtaceous ſpots. Pontoppid. Inhabits Denmark.

Pusilla. Black, antennæ and legs pale. Müll. Inhabits Denmark.

Luteola. Pale yellow, eyes, breaſt, and tip of the antennæ black. Müll. Inhabits Denmark.

Flaveola. Black; thorax and head rufous; wing-caſes, antennæ, and legs pale yellow. Müll. Inhabits Denmark.

Latiuscula. Fuſcous-black; ſhanks and joints of the feet ſomewhat yellowiſh. Müll. Inhabits Denmark.

Cruciferarum. Oblong, braſſy-black; legs black. Geoff. Inhabits France.

Denigrata. Black; thorax and wing-caſes yellow, mouth black. Geoffr. Inhabits France.

Truncata. Black; wing-caſes truncated, the tip ferruginous, legs and antennæ rufous. Scopoli. Inhabits Carniola.

Ovalis. Braſſy-black, legs black. Geoffr. Inhabits France.

Striata. Blue; head, thorax, antennæ, and legs rufous; wing-caſes ſtriated. Degeer. A native of Europe.

Lævigata. Blue; wing-caſes ſprinkled with dots; ſhanks ferruginous. Geoffr.

Crenata. Black; wing-caſes braſſy with crenated ſtriæ, antennæ at the baſe and the ſhanks pitchy. Muſ. Leſk. Linn. Inhabits Europe.

Discolor. Head, and thorax black; wing-caſes teſtaceo-fuſcous, glabrous; four anterior legs, and the ſhanks of the hinder pair ſomewhat teſtaceous. Linn. Muſ. Leſk. Inhabits Europe.

Picipes. Braſſy-green, dotted, legs pitchy, wing-caſes bay-colour, black towards the future. Linn. Muſ. Leſk. Inhabits Europe.

Annulata. Braſſy fuſcous; wing-caſes with crenated ſtriæ; antennæ at the baſe and four anterior ſhanks rufous, the latter with a braſſy-brown ring. Linn. Leſk. Muſ. Inhabits Europe.

A further number of the Linnæan Chryſomelæ will be found under the new genera Cnodulum, Crioceris, Cryptocephalus, Erotylus, and Galleruca.

CHRYSOMITHRES, in *Ornithology*, the name by which ſome call the gold-finch. See Fringilla *carduelis*.

C H R

CHRYSOPAGION, in *Natural Hiſtory*, a name by which ſome of the middle age writers have called the gem deſcribed by Pliny under the name of the *chryſolampis*. Salmaſius is of opinion that it was only a foul kind of the *chryſopraſius*, of which Pliny ſays, that ſome of them were full of ſpecks, and of a variable colour.

CHRYSOPETRON, a name given by Pliny, and others, to the yellower kind of the ancient topaz, that is, our chryſolite.

CHRYSOPHRYS, in *Ichthyology*, among the Greek and Latin authors, a name ſynonymous with Aurata, and applied by them to the fiſh called by Linnæus *Sparus auratas*, which ſee.

CHRYSOPHYLLUM, in *Botany*, (from χρυσος, *gold*, and φυλλον, *a leaf*. Golden leaf.) Linn. gen. 265. Schreb. 355. Willd. 400. Juſſ. 152. Vent. 2. 436. Caimitier. Enc. Meth. Claſs and order, *pentandria monogynia*. Nat. Ord. *Dumoſæ*, Linn. *Sapotæ*, Juſſ.

Gen. Ch. *Cal.* Perianth ſmall, permanent; deeply divided into five, roundiſh, obtuſe ſegments. *Cor.* monopetalous, ſhort, bell-ſhaped, five-cleft; ſegments roundiſh, much expanded; accompanied by five ſmall ſcales, which give it the appearance of being ten-cleft. *Stam.* Filaments five, ſhort, attached to the top of the tube; anthers roundiſh, didymous, incumbent. *Piſt.* Germ ſuperior, roundiſh; ſtyle ſhort; ſtigma obtuſe, obſcurely five-cleft. *Peric.* Berry one or ten-celled, large. *Seeds* one in each cell, bony, compreſſed, marked with a ſcar, ſhining.

Eſſ. Ch. Cor. bell-ſhaped, apparently ten-cleft; alternate ſegments ſpreading. Berry one ſeed in each cell.

Sp. C. *cainito*, Linn. Sp. Pl. 1. Mart. 1. Lam. 1. Willd. 1. Jacq. Amer. 51. tab. 37. pict. 30. tab. 51. Lam. Ill. Pl. 120. Broad-leaved ſtar-apple. "Leaves egg-ſhaped, downy and ſhining underneath; fruit roundiſh, ſhaped like an apple." β. Jamaicenſe; with purple fruit, Jacq. Amer. 52. pict. 31. Brown Jam. tab. 14. fig. 2. γ. cæruleum with fruit entirely blue. A tree from thirty to forty feet high, with a large ſpreading head. *Leaves* about five inches long, and two and a half broad, regularly ſtriated with fine lateral parallel nerves, alternate, petioled, egg-ſhaped, rather acute, quite entire, ſmooth, deep green above, covered underneath with a very fine ſilky ſhining down of a ferruginous gold colour. *Flowers* ſmall, axillary and faſcicled upon each peduncle. *Fruit* globular, about the ſize of a common apple, fleſhy, ſoft, with a ſmooth ſkin, and of a roſe colour, with a yellowiſh tint intermingled with a ſhade of green. It contains a milky, glutinous, ſweetiſh pulp, which envelopes from five to ten nuts, brown without, a little flattened, of an even ſurface, with a rude rugged border. The varieties β and γ appear to differ only in the colour of the fruit. Though the germ always contains the rudiment of a nut in each of the ten cells, it moſt frequently happens that ſome of them afterwards prove abortive. A native of the Weſt Indies, where the fruit is eaten, and the wood uſed for building. 2. C. *olivæforme*, Lam. Encyc. 2. Ill. 2471. (C. cainito; β. Linn. Sp. C. monopyrenum; Willd. Cainito foliis ſubtus aureo, fructu olivæforme; Plum. gen. 10. Burm. Amer. tab. 69. Acomas; Nichol. Doming. 141?) "Leaves ovate-oblong, tomentous and ſhining underneath; fruit the ſhape of an olive, with one ſeed." Damſon plum; Brown Jam.? A tree about the ſize of a common apple-tree, with a rough ruſſet bark beſprinkled with ſmall white ſpots. *Branches* ſpreading; ſmaller ones a little zigzag. *Leaves* alternate, ſomewhat reſembling thoſe of the citron; ſmooth, ſhining and dark green above; covered with a ſilky, golden down underneath; traverſed by a longitudinal rib, whence proceed laterally ſeveral parallel nerves a little curved. *Flowers* ſmall, axillary, faſcicled, one on each peduncle; calyx covered with a golden ferruginous down; ſtigma with five ruſſet diviſions. *Fruit* ſoft, the ſhape of an olive, but a little larger, of a dark violet colour when ripe, having a pleaſant vinous flavour, and containing a bluiſh nut, which encloſes a tender, oblong, acute kernel. Plum. MSS. A native of the Weſt Indies, flowering in October and November, and ripening its fruit in May and June. 3. C. *acuminatum*, Lam. Illuſ. 2469. "Leaves egg-ſhaped, acuminate, ſtriated with parallel lines, downy and ſhining, but pale underneath. A native of St. Domingo. La Marck queſtions whether this be not C. monopyrenum of Swartz. If ſo, there are two ſpecies with only one nut, and monopyrenum cannot be properly retained as a ſpecific name. 4. C. *anguſtifolium*, Lam. Ill. 2470. "Leaves lanceolate, ſtriated with parallel lines, ſhining, covered with a ferruginous down underneath; berries the ſhape of an olive." *Leaves* reſembling thoſe of the olive or privet. *Berry* ſometimes with two ſeeds. La Marck doubts whether this be ſpecifically different from his olivæforme. Are not all three merely varieties of the ſame ſpecies? And is there not ſome ground for a conjecture, that, when more accurately examined, they will be found to have a germ with ten cells, though it ripens only one, or at moſt two ſeeds? In this caſe the generic character may remain as it was firſt formed by Linnæus. 5. C. *microcarpum*, Willd. 3. Mart. 5. Swartz. Prod. 49. Ind. occ. 1. 482. "Leaves egg-ſhaped, ſmooth, pubeſcent underneath; berries oblong, oblique, one-ſeeded." *Fruit* very ſweet. Is not this alſo a variety of C. olivæforme? 6. C. *argenteum*, Mart. 2. Lam. Illuſ. 2472? Jac. Amer. 53. tab. 38. fig. 1. "Leaves falcate-ovate, tomentous and ſhining underneath." Swartz. "Leaves egg-ſhaped, acuminate-falcated; younger ones with a ſhining ſilvery down underneath; the older ones ſmooth on both ſides." Lam. A native of the Weſt Indies. 7. C. *pauciflorum*, Lam. Ill. 2473. Jacq. Amer. tab. 38. fig. 2.? "Leaves egg-ſhaped, acuminate, nearly ſmooth on both ſides, with only a few flowers in the axil of each leaf. A native of Martinico. 8. C. *rugoſum*, Mart. 6. Willd. 5. Swartz. Prod. 49. Ind. occid. 1. 484. "Leaves oblong, acuminate, ſmooth on both ſides; fruit acuminate, rough. A native of woods on mountains in Jamaica. 9. C. *pyriforme*, Willd. 6. (C. Macouco; Lam. Encyc. 4. Illuſt. 2475. Aub. guin. 1. tab. 92.) "Leaves oblong, acuminate, ſmooth on both ſides; fruit pear-ſhaped, with an even ſurface. A tree thirty feet high, and two in diameter, with a large much branched head; bark ſmooth, greyiſh, yielding when rounded a milky juice; wood white; hard and brittle. *Leaves* alternate, oval-oblong, pale green on both ſides. *Fruit* orange-coloured, on ſhort peduncles, growing from two to four together; fleſhy, milky, encloſing ſeveral roundiſh nuts, which contain a white, ſweet, eſculent kernel. According to Aublet the fruit has a more pleaſant flavour than that of the firſt ſpecies. 10. C. *glabrum*, Linn. Sp. Pl. 2. Mart. 3. Lam. Encyc. 3. Willd. 7. Jacq. Amer. tab. 38. fig. 2. "Leaves ovate-oblong, acute, ſmooth on both ſides; fruit elliptical, with an even ſurface." A tree fifteen feet high, ſtraight, branched. *Leaves* alternate, petioled, quite entire, a little coriaceous. *Fruit* blue, about the ſhape and ſize of a ſmall olive, with a ſweetiſh vinous flavour. A native of woods in Martinico.

CHRYSOPHYLLUM *carolinenſe*; Jacq. See BUMELIA *tenax*.

CHRYSOPHYLLUM *crinito*; Aubl. See BUMELIA *tenax*.

CHRYSOPHYLLUM *manglillo*; Lam. Illuſt. See BUMELIA *manglillo*.

CHRYSOPHYLLUM *macrophyllum*; Lam. Ill. See BUMELIA *nervoſa*.

Chrysophyllum *barbasco*; Læfl. it. See Jacquinia *armillaris*.

CHRYSOPILON, in *Natural Hiſtory*, a name given by ſome ancients to a ſpecies of the beryl, which had a yellowiſh tinge.

CHRYSOPIS, more correctly *Chryſops*, in *Entomology*, a name applied by ſome old writers to the inſect called in England the "Golden Eye," from the beautiful gold colour of its eyes. It is of a moderate ſize, with four extremely thin and tranſparent wings of a ſomewhat ſilvery colour, with green ribs or nerves; it is common in gardens, eſpecially about elder trees, and has a remarkably ſtrong ſmell. In the days of Mouffet this inſect was known by the name of *muſca chryſops*; Ray calls it *muſca quadripennis corpore luteo-viridi*, and Petiver, *perla merdam olens*. With Linnæus, and other modern naturaliſts, it is a ſpecies of *hemerobius*. See Hemorobius *perla*.

CHRYSOSPLENIUM, in *Botany*, (from χρυσος, and σπλην, *the ſpleen*, on account of the golden colour of the flowers, and of the ſuppoſed virtue of the plant in diſeaſes of the ſpleen.) Linn. 558. Schreb. 763. Willd. 886. Gært. 252. Tourn. 60. Juſſ. 309. Vent. ii. 284. Dorine, Lam. Encyc. Golden ſaxifrage. Claſs and order, *decandria digynia*. Nat. ord. *Succulentæ*, Linn. *Saxifragæ*, Juſſ.

Gen. Char. *Cal.* perianth one-leafed, ſhort, permanent, coloured, four, or very rarely five-cleft; ſegments oval, obtuſe, ſpreading, oppoſite ones narrower. *Cor.* none. *Stam.* filaments eight, very rarely ten, erect, very ſhort, attached to the lower part of the calyx; anthers ſimple, round. *Piſt.* germ half inferior, ending in two awl-ſhaped ſtyles, the length of the ſtamens; ſtigmas obtuſe. *Peric.* capſule two-beaked, one-celled, half bivalve, ſurrounded at its baſe by the calyx. *Seeds* numerous, ſmall.

Eſſ. Ch. Calyx four or five-cleft, coloured. Corolla none. Capſule two-beaked, one-celled, half inferior, half bivalved, many-ſeeded.

Obſ. Linnæus placed this genus in the claſs *decandria*, on account of the terminating flower, which, in his ideas, determines the true character of the fructification, being ſometimes decandrous; but as this is of very rare occurrence, and as none of our Engliſh botaniſts, after repeated reſearches, have found it ſo in a ſingle inſtance, it has ſcarcely a right to be conſidered as a decandrous plant, notwithſtanding its natural affinity to ſaxifraga. In an artificial ſyſtem octandria ſeems to be its proper claſs, where Dr. Stokes in Withering has accordingly placed it.

Sp. 1. C. *alternifolium*, Linn. Sp. Pl. Mart. Willd. Lam. Encyc. Gært. tab. 44. Flor. Dan. tab. 366. Eng. Bot. 54, but unfortunately taken from an imperfect ſpecimen without root-leaves. (Saxifraga aurea dodonæi, Bauh. Hiſt. S. aurea, foliis pediculis oblongis, Rai Syn. 158. Sedum rotundifolium paluſtra, foliis pediculis longis inſidentibus, Moriſ. Sect. 12. tab. 8. fig. 8.) Alternate-leaved golden ſaxifrage. "Leaves alternate." *Root* perennial, fibrous, throwing out offſets, but no creeping ſuckers. Whole plant ſucculent, tender. *Stem* three-ſided. *Leaves* all deeply notched; root-leaves two or three, kidney-ſhaped, bluntly notched, on long hairy petioles; ſtem-leaves alternate, one of them ſolitary, about the middle of the ſtem, the reſt cluſtered, partly about the root, and partly near the flowers. *Flowers* gold-coloured; in a terminal, dichotomous leafy corymb. A native of England, and other northern parts of Europe, flowering in May; intermingled with the next ſpecies, but much more rare. 2. C. *oppoſitifolium*, Linn. Sp. Pl. Mart. Willd. Lam. Curt. Lond. Faſc. ii. tab. 27. Flor. Dan. tab. 365. Eng. Bot. tab. 490. (Saxifraga aurea, Rai. Syn. 158. Lob. Ic. 612. Sedum paluſtre rotundifolium, Moriſ. tab. 8. fig. 7.) Oppoſite-leaved golden ſaxifrage. "Leaves oppoſite." Habit of the preceding, but paler. *Root* perennial. *Stems* creeping at the bottom, ſquare, or with two oppoſite deep furrows, very tender, beſet with a few ſtiffiſh white hairs about four inches high. *Leaves* petioled, ſpreading, roundiſh, with a few ſtiffiſh white hairs on the upper ſurface, repand, ſomewhat fleſhy, yellowiſh green, whitiſh underneath; the upper ones more deeply notched. *Flowers* yellow, in a ſeſſile faſtigiate corymb. The notched glandular ring, which ſurrounds the baſe of the germ, is placed between that part and the inſertion of the ſtamens, and therefore, as Curtis remarks, cannot be, as Linnæus ſtyles it, a receptacle. It ſeems to be properly a nectary. A native of moiſt places in England and other parts of the north of Europe, flowering, with the preceding, in May.

CHRYSOPOLIS, in *Ancient Geography*, an epiſcopal town of Aſia, mentioned in the council of Conſtantinople.—Alſo, an epiſcopal ſee in Africa, in Mauritania.—Alſo, an ancient town of Aſia Minor, ſituated near Chalcedon, and oppoſite to Byzantium. It had a fine port; and when the Perſians were maſters of it, they collected there the tribute which they drew from the different towns. It was a place of commerce with the inhabitants of Chalcedon. Xenophon ſays, that the Athenians encompaſſed this place with walls; that they impoſed a tenth on the ſhips that came hither from the Euxine ſea; and that they ſtationed here a fleet of 30 ſail for the ſecurity of the port.—Alſo, an ancient epiſcopal town of Aſia, called *Chriſtopolis*, under the metropolitan ſee of Boſtra, in the patriarchate of Antioch.

CHRYSOPRASE. The colour of this mineral is apple-green, paſſing into graſs and olive-green and greeniſh grey. It is found in maſs, in angular fragments, and thick plates. Internally it exhibits a ſlight degree of luſtre. Its fracture is even, paſſing ſometimes into fine ſplintery and flat conchoidal, with indeterminate ſharp-edged fragments. Its hardneſs is ſomewhat leſs than that of chalcedony. Sp. gr. 3.25.

Before the blow-pipe chryſopraſe becomes opake and colourleſs, but it is infuſible *per ſe*. It has been analyſed with great accuracy by Klaproth, and appears to conſiſt of

Silex	-	96.16
Lime	-	0.83
Oxyd of nichol		1
		97.99

It has hitherto been found only at Koſemutz in Lower Sileſia, imbedded in ſerpentine, along with quartz, opal, chalcedony, &c. It paſſes into hornſtone and chalcedony, and appears to differ from this laſt in little elſe than colour.

When kept long in a warm and dry ſituation it loſes the greateſt part of its colour. The apple-green variety is in ſome eſtimation among jewellers, and is cut into ſtones for rings.

CHRYSOPRASUS, in *Chriſtian Antiquity*, the tenth of thoſe precious ſtones which adorned the foundation of the heavenly Jeruſalem; the colour of it was green, much like that of a leek, but ſomething inclining to that of gold, as its name imports.

CHRYSORHOAS, or Chrysorrhoas, in *Ancient Geography*, a river of Aſia, in Syria, which ran near the town of Damas, and fertilized the environs of this town. Pliny and Strabo repreſent this river as diſtributing itſelf in ſtreams

ſtreams.—Alſo, a river of Aſia, in the Colchide territory. Pliny.—Alſo, a river of Aſia Minor, in Lydia, the ſource of which is placed by Pliny near mount Tmoles.

CHRYSORRHOES, a river ſituated towards the extremity of the peninſula on the ſouth-eaſt of the Argolide. It watered the town of Trazena; and derived its name of the "River of Gold," from the quantity of this metal which it depoſited.

CHRYSOSTOM, John, in *Biography*, an eminent and very eloquent father of the church, was a native of Antioch about the year 347. The name of Chryſoſtom, ſignifying in the Greek *golden-mouth*, was not applied to him till after his death, when his works had rendered him illuſtrious for eloquence. He was, at a very early age, inſtructed in the principles of the Chriſtian religion, and derived all the advantage which the beſt maſters in human learning could yield him. He was originally intended for the bar, but, being diſguſted with the profeſſion, he applied himſelf to the ſtudy of the Scriptures, and other departments of ſacred literature: he perſuaded alſo two of his friends, Theodorus and Maximus, to purſue the ſame courſe. When he was about twenty-ſeven years of age, he retired from the world to an aſcetic life, firſt in company with a monk upon a mountain near Antioch, and then in a cave by himſelf. The auſterities which he voluntarily inflicted on himſelf, injuring his health, he returned to Antioch, after having paſſed ſix years in the condition of a hermit. He was then ordained a deacon, and afterwards a prieſt, and, devoting himſelf to the labours of the pulpit, he became ſo celebrated for his eloquence, that, upon the death of Nectarius, he was unanimouſly choſen as patriarch or archbiſhop of Conſtantinople, in 397. While Chryſoſtom was at Antioch he wrote ſeveral books, and acquired much reputation as a preacher. He was a man of great ſimplicity of character, ſeverity of manners, and freedom of ſpeech, which brought him many enemies: but, notwithſtanding his virtues, which are admitted on all hands, it is equally notorious, that he was haughty and arbitrary. It was with difficulty that he was forced from Antioch, but when he came to Conſtantinople, he avoided as much as poſſible promiſcuous ſociety; he devoted his time to his ſtudies and profeſſional duties; and all that he ſaved by economy in his own expences, he liberally beſtowed on the poor. He erected new hoſpitals in that metropolitan city, took care of the ſick and the ſtrangers, and provided for widows and virgins. He was an enthuſiaſtic admirer of the monaſtic life, and exhorted the young of both ſexes to a ſtate of celibacy; and, in other reſpects, he preached up a rigour of manners very incompatible with the character of the times. He indulged a perſecuting ſpirit againſt thoſe who did not rank themſelves with Chriſtians, pulling down the pagan temples, and haraſſing, as much as poſſible, thoſe who were deemed heretics. He extended his archiepiſcopal juriſdiction, and, in a viſitation of the Aſiatic provinces, he depoſed thirteen biſhops of Lydia and Phrygia. This temper, and theſe auſtere manners, created him many enemies, and he was at length accuſed of diſreſpect to the empreſs Eudoxia, and cruelty to ſome of the clergy; a ſynod was convened, in the year 403, before which, articles of accuſation were brought againſt Chryſoſtom. He was ſummoned, but, declining to put himſelf into the hands of his profeſſed enemies, he was condemned, depoſed, and baniſhed. When this event was known at Conſtantinople, a dreadful tumult was excited, which created ſo much alarm, that Eudoxia, who was his principal enemy, petitioned for the archbiſhop's return. Another ſynod, conſiſting of ſixty biſhops, aſſembled at Conſtantinople, and reſcinded all that had been done againſt Chryſoſtom, and he was reſtored with great triumph. Toward the end of this year, the empreſs cauſed her own ſtatue to be erected near the church, and the people celebrated public games before it to her honour. Chryſoſtom, confiding, perhaps, in his own popularity, and irritated againſt the empreſs, preached againſt this as an indecency, openly declaring, that the ſtatue had been erected in contempt of the church. The empreſs endeavoured again to aſſemble the ſynod, but the prelate, far from being intimidated, reproached her conduct in ſtill more bitter terms, repreſenting her as another Herodias, who wiſhed to have the head of another John, meaning his own, in a charger. The empreſs now was bent on his deſtruction, in which ſhe ſucceeded. Chryſoſtom was depoſed, and baniſhed. On the day of his departure, the great church and adjoining palace were burnt to the ground. He was firſt taken to Nice, and thence was conveyed to the place aſſigned for his reſidence, which was Cucuſus, a deſolate town among the ridges of mount Taurus, in Leſſer Armenia. The death of the empreſs, ſome peculiar circumſtances in that of Cyrinus, biſhop of Chalcedon, a bitter enemy of Chryſoſtom, and a dreadful hail-ſtorm, which happened ſoon after his baniſhment, were interpreted by his friends as marks of the Divine diſpleaſure at the conduct of his enemies. Chryſoſtom, in the mean time, did not ſuffer his mind to ſink under his misfortunes; he actively employed himſelf in maintaining a correſpondence with the moſt diſtant provinces, in conſoling and exhorting his adherents left behind him in the metropolis, and in ſupporting his cauſe before the ſee at Rome, which had always been diſpoſed to favour him. That he was able to live ſo comfortably was a great mortification to his enemies: they procured an order for his removal ſtill farther from the capital, to Pitycens, a town on the Euxine Sea; but he died on his journey, at Comanis in Armenia, owing to the great hardſhips to which he was expoſed. After his death, the Eaſt and Weſt were for ſome time divided with reſpect to the tribute due to his memory. By the latter, it was held in great reverence; but the eaſtern biſhops refuſed to inſert his name in the regiſters of thoſe who were to be mentioned with honour at the celebration of the euchariſt. Within ten years, he was generally revered as a ſaint, and, in the year 438, at the ſolicitation of the clergy and people of Conſtantinople, his relics were tranſported from their obſcure ſepulchre to the royal city. The emperor Theodoſius advanced to receive them as far as Chalcedon; and falling proſtrate on the coffin, implored, in the name of his guilty parents, the forgiveneſs of the injured ſaint. Chryſoſtom was undoubtedly the moſt diſtinguiſhed of all the Greek fathers, as Auſtin was among the Latins. He is ſaid to have compoſed more than a thouſand ſeparate pieces; but the greateſt part of his writings are ſermons, or expoſitions of ſcripture delivered as ſermons, with practical improvements annexed to them. His ſtyle is free, copious, and unaffected. He is dignified and correct in his phraſeology, varied and abundant in his figures and illuſtrations. His diſcourſes and illuſtrations of ſcripture are often more fanciful than ſolid, but copious, and full of particulars. In his declamations againſt the vices and follies of the times, he has alluded to ſo many circumſtances, that a hiſtory of the manners and cuſtoms of the times may be derived from his works, which is no where elſe to be met with. The moſt regular of his treatiſes, is a dialogue on the duties of a biſhop. The moſt complete edition of his works is that publiſhed by Montfaucon, the learned Benedictine, in 1734, which is accompanied with a life of the author, prefaces, notes, and various readings. Gibbon. Lardner.

CHRYSTAL. See Crystal.

Chrystal *Mineral*, the ſame as *Sal prunella*.

CHRYSTALLINE. See CRYSTALLINE.

CHRYSTALLIZATION. See CRYSTALLIZATION.

CHRYSTALLUS, in *Ancient Geography*, a name anciently given, according to Plutarch, to the river Thermodou of Scythia, becaufe it was frozen even in fummer.

CHRYSUM, a name given by Ptolemy to the third mouth of the river Indus, reckoning from the weft.

CHRYSUS, a river of Afia Minor, which ran towards Laodicea.—Alfo, a river of Spain, placed by Feftus Avienus in Bœtica.

CHTHONIA, in *Antiquity*, a feftival kept in honour of Ceres, called *Chthonia*. For the ceremonies obferved in it, fee Pott. Archæol. lib. ii. cap. 20.

CHVALINSK, or KHVALYNSK, in *Geography*, a town of Afiatic Ruffia, in the government of Saratof, and alfo its adjacent diftrict, fituated on the Volga, 350 miles S.E. of Peterfburg. N. lat. 52° 25'. E. long. 57° 54'.

CHUB, in *Ichthyology*. See CYPRINUS *Cephalus*.

CHUBANA, in *Ancient Geography*, a town of Afia in Mefopotamia, feated on the eaftern bank of the Euphrates.

CHUBB, THOMAS, in *Biography*, a controverfial writer, was born Sept. 21, 1679, at a fmall village near Salifbury. He received no other education than the firft elements of reading and writing, and was obliged at an early age to feek a livelihood by the labour of his own hands. He was apprentice to a glover, with whom, and afterwards with a tallow-chandler, he worked as a journeyman. Being poffeffed of uncommon natural abilities, and having a very ftudious turn of mind, he fpent his leifure hours in the acquifition of knowledge of various kinds, but his inclination led him chiefly to the ftudy of divinity. In 1710, Mr. Whifton publifhed the hiftorical preface to his "Primitive Chriftianity Revived." The principal point difcuffed in this preface was the fupremacy of God the Father: Chubb read the piece, but not being fatisfied with the ftatement of the argument, he drew up his own opinion on the fubject, which, at the defire of one of his own friends, was fhewn to Mr. Whifton. It fo well coincided with the opinions of this very learned divine, that by the leave of Chubb, he publifhed it with a few alterations which did not in the leaft affect the grand point in queftion. In the year 1715 it appeared under the title of "The Supremacy of the Father afferted; or Eight Arguments from Scripture to prove that the Son is a Being inferior and fubordinate to the Father, and that the Father is the Supreme God." The perfpicuity and ability with which this tract was written procured Mr. Chubb great reputation, but he was alfo affailed from various quarters with much vehement abufe. He found himfelf called upon to vindicate himfelf and his work, and thus commenced the controverfy that ended only with his life. In the year 1730 he publifhed a collection of tracts, in a quarto volume, upon various important topics, moral and theological. Of the author, Mr. Pope fpeaks with great refpect, and fays, that "he had read the whole volume with admiration of the writer, though not always with approbation of the doctrine." The next piece publifhed by Chubb was "A Difcourfe concerning Reafon in Matters of Religion, with Reflections upon the comparative excellency and ufefulnefs of Moral and Pofitive Duties." This meeting with oppofition, he publifhed a vindication of it, infifting more ftrongly upon the fufficiency of reafon to all human beings. In 1734 he publifhed a volume confifting of tracts on the infpiration of the New Teftament; and on the refurrection of Chrift as a proof of the divinity of the doctrine which he taught; on the cafe of Abraham being ordered to offer up his fon; and on the parable of the unmerciful fervant. In the year 1738 he publifhed "The true Gofpel of Jefus Chrift afferted," in which he profeffes to feparate the corruptions of Chriftianity from its effence. One of his next pieces was an "Enquiry into the Ground and Foundation of Religion;" in this he vindicates the principles of natural religion. He afterwards proceeded to the examination of miracles, and at length appears to have taken a decided part with thofe, whom it has been the fafhion to denominate free-thinkers, but who, in truth, reject the truths of revealed religion. In his pofthumous works, publifhed in 1748, we have his mature thoughts on a variety of topics relative to religion and morality, in which though he feems willing to give up the evidences of the Jewifh and Chriftian religion, yet he draws the conclufion that Jefus was probably fent by God as an inftructor of mankind. Chubb began, as we have feen, to write as a rational Chriftian, and he never exprefsly denied the divine miffion of Jefus; he engaged, however, in controverfies to which his limited knowledge was not equal, though his natural abilities might be well adapted for fuch important difquifitions; there is no reafon to believe that he ever examined the hiftorical evidences of revealed religion, yet in his pofthumous works he infinuates many things calculated to prejudice the young and the thoughtlefs againft it. He denies a particular providence, and the neceffity of prayer. With refpect to a future ftate, he expreffes himfelf very varioufly, and without much confidence on either fide of the queftion. Mr. Chubb was never anxious to rife above the humble condition in which fortune had placed him: to the laft period of life he took pleafure in affifting in the trade of a tallow-chandler. He met with many friends who affifted him, among thefe was fir Jofeph Jekyl, who made him his companion in his intervals of leifure. In this fituation Chubb had an opportunity of becoming acquainted with many of fir Jofeph's friends, though it has been afferted that on extraordinary occafions he affifted as a fervant out of livery. It is certain his ftay with that gentleman was not long; he chofe to return to Salifbury. The generofity of his friends followed him in his retreat. Mr. Chefelden, the celebrated furgeon, was one of his benefactors; and in the latter part of his life, Mr. Samuel Dicker offered to fettle an annuity of 50 pounds upon him if he would leave Salifbury, but this offer he declined, as he did not at that time fpend the income of his fortune. He injured his health by too intenfe ftudy; however his life was prolonged to his fixty-eighth year, and agreeably to a wifh which he had been accuftomed to exprefs, he was happily exempted from many of thofe evils which too frequently aggravate the bitternefs of death. On the eighth of Feb. 1746-7, after a fhort complaint of an unufual pain in his ftomach, he fuddenly breathed his laft as he fat in his chair. He was buried in St. Edmund's church in Salifbury. The eminence of Mr. Chubb's intellectual abilities is generally allowed, and on this account he was not only admired by the perfons already named, but by Dr. Clarke, bifhop Hoadly, Dr. John Hoadly, and many other diftinguifhed divines. With refpect to his moral character, he was uniformly formed for integrity, fimplicity and fobriety of manners, and he attended the fervices of his parifh church to the time of his death. Biog. Brit. Leland.

CHUBDARS, a name given in Bengal to thofe Moorifh fervants who are employed to carry meffages, &c. for ftate. Thofe in the Dutch fervice carry a long ftaff in their hand, which is entirely covered with filver, with which they go before the palankeen of the directors and of the two members of the council next in rank; but the latter are allowed no more than two chubdars, and their ftaves may be only half plated with filver.

CHUCHIA, in *Zoology*, a name given by Cardan, Oviedo,

Oviedo, and fome others, to the opoffum, *Diadelphis opoffum* of Schrebers?

CHUCHUNGUA, in *Geography*, a fmall place of South America, in the country of Jaen de Bracamoros, feated on a river of that name, in 25° 29′ S. lat. As the river Marauon is not navigable up to Jaen, this town ferves as a port to it, and thofe who wifh to embark on the Maranon go by land from Juen to Chuchungua, and from hence fall down into the Maranon. This town lies four days journey from the city, but in this mode of reckoning it fhould be confidered, that fuch are the difficulties of the road, as to render it impoffible to travel in half a day or fometimes a whole day, an interval which might be paffed over on good ground in an hour or two.

CHUCKING, among *Rope-makers*, denotes a long, ftout, coarfe, hemp, rather foul, and ufed for making inferior rope. Short chucking is the foul hemp from the ends of the long chucking.

CHUCUITO, *jurifdiction of*, in *Geography*, a province or jurifdiction of South America belonging to the diocefe of La Paz and audience of Charcas. It begins about 20 leagues W. of Paz; and as fome part of it borders on the lake of Titicaca, that collection of waters is alfo called the lake of Chucuito. The extent of this province from N. to S. is between 26 and 28 leagues, its temperature is in general cold and very unpleafant; the frofts continuing one half of the year, and during the other half either fnow or hail is continually falling. Accordingly the only efculent productions of the vegetable kingdom are the papas and quinoas. The inhabitants, however, have a very beneficial trade in cattle, which abound in this jurifdiction, by falting and drying their flefh. The traders who carry it to the coaft exchange it for brandy and wine, and thofe who go to Cochabamba carry alfo papas and quinoas, which they barter for meal. The mountains in this province have filver mines, which formerly produced large quantities of this metal, but they are at prefent totally abandoned.

Chucuito, *lake of*, otherwife called the lake of *Titi-caca*, lies between the provinces comprehended under the general name of Calloa, and is of all the known lakes of America much the largeft. Its figure is fomewhat oval, inclining nearly from N.W. to S.E.; its circumference is about 80 leagues, and the water in fome parts 70 or 80 fathoms deep. Ten or twelve large rivers, befides a great number of fmall ftreams, difcharge themfelves into it. The water, though neither bitter nor brackifh, is turbid, and has a tafte fo naufeous that it cannot be drank; it abounds with fifh of two oppofite kinds; the one large and palatable, which the Indians call "Suchis;" the other, fmall, infipid, and bony, termed long fince by the Spaniards "Boyas." It has alfo a great number of geefe and other wild fowl, and the fhores are covered with flags and rufhes, the materials of which the bridges are made. As the weftern borders of this lake are called Chucuito, thofe on the eaft fide are diftinguifhed by the name of "Omafcuyo." It contains feveral iflands, among which is one very large, and was anciently one mountain, but fince levelled by order of the Incas. It however gave to the lake its own name of Titicaca, which in the Indian language, fignifies a mountain of lead. In this ifland the firft Inca, Mango Capac, the illuftrious founder of the empire of Peru, invented his political fable, that the Sun, his father, had placed him, together with his fifter and confort, Mama Oillo Huaco, there, enjoining them to draw the neighbouring people from the ignorance, rudenefs, and barbarity, in which they lived, and humanize them by cuftoms, laws, and religious rites, dictated by himfelf; and in return for the benefits refulting from this artful ftratagem, the ifland has been confidered, by all the Indians, as facred; and the Incas determining to erect on it a temple to the fun, caufed it to be levelled, that the fituation might be more delightful and commodious.

This was one of the moft fplendid temples in the whole empire. Befides the plates of gold and filver with which its walls were magnificently adorned, it contained an immenfe collection of riches, contributed by all the inhabitants of provinces which depended on the empire, who were under an indifpenfable obligation of vifiting it once a year and offering fome gift. Thus were accumulated gold, filver, and jewels. The Indians when they perceived the rapacious violence of the Spaniards, are thought to have thrown this immenfe mafs of riches into the lake. Towards the fouth part of the lake is a kind of bay formed by the approach of the banks to each other; and this bay terminates in a river called "Al Defaguadero," or the drain, and afterwards forms the lake of Pavia, which has no vifible outlet, but from which the water is difcharged by a fubterraneous paffage.

CHUDLEIGH, in *Geography*, is a fmall but neat town in Devonfhire, England, for which the privilege of holding a weekly market, and two annual fairs, was obtained by the bifhops of Exeter, who had a magnificent palace about a quarter of a mile to the fouth, part of which yet remains. Lord Clifford, of Ugbrooke, now poffeffes the manor, which formerly abounded with wood; the north-eaft fide of the parifh ftill retains the name of Chudleigh-woods. The vicinity prefents fome very beautiful views; and is celebrated for cyder. The town principally confifts of one long ftreet, at the weftern end of which is a fmall white-wafhed church, containing fome monuments of the Courtenay family. Chudleigh is fituated 182 miles W. of London, and contains 414 houfes; the number of inhabitants being 1786. The market is held on Saturdays.

Chudleigh *Rock*, about half a mile from the town, is, in the opinion of Mr. Polwhele, "one of the moft ftriking inland rocks in the ifland." Viewed from the weft, it difplays a bold broad front, almoft perpendicular; which, to appearance, is one folid mafs of marble; from the fouth-eaft, a hollow opens to the fight, with an impetuous ftream, which rufhes over the rude ftones that impede its paffage, and forms a romantic water-fall, which

"In loud confufion o'er the broken fteep
Abruptly pours, and dafhes down the deep."

Midway down the cliff, is a large cavern, whofe gloomy receffes the traditions of the peafantry have affigned for the habitation of Pixies, or Pifgies, a race of fupernatural beings, or fort of fairies. The entrance to the cavern is by a natural arch, about twelve feet wide and ten in height; the paffage continues nearly of the fame dimenfions for about twenty yards, when it fuddenly diminifhes to fix feet by four, and, ftill gradually decreafing in fize, extends about fifteen yards further. Here it expands into a fpacious chamber, which divides and runs off into two different directions; but the rock dropping, neither of them can be purfued to any confiderable diftance.

About one mile fouth-weft of Chudleigh is *Ugbrooke*, the feat of lord Clifford, baron of Chudleigh. This demefne, for internal beauties, furpaffes any in Devon; the park and grounds comprize much beautiful and highly picturefque fcenery; confifting of cluftered woods, rugged rocks, and inequality of furface; they comprehend a fpace of between feven and eight miles in circumference; and abound with oak, elm, afh, and chefnut, of the moft luxuriant growth. Hiftory, &c. of Devonfhire, by Polwhele, fol.

CHUDUCA,

CHUDUCA, in *Ancient Geography*, a town of Asia, placed by Ptolemy in Babylonia.

CHUGANSERAI, in *Geography*, a town of Asia in the soubah of Cabul, or, according to the emperor Baber, at the western extremity of Caferistan, on a river of the same name; 80 miles N.E. of Cabul. N. lat. 34° 55′. E. long. 70° 8′.

CHUGANSERAI, a river of Asia, near the above-mentioned town, which flows from the N.E. quarter in respect of the town, and from behind, *i.e.* from the north of Bijore, and joins the Bacan river, in the district of Kameh, where their united streams take an easterly course.

CHUKA, or CHOOKA, a castle in the country of Bootan, which is a large square building, placed on elevated ground, and having one entrance into it by a flight of steps, and through a spacious gate-way, with large heavy doors; it is built of stone, and the walls are of a prodigious thickness. This castle is seated on the river Tehintchieu, and at a short distance above it is a chain-bridge, called Chuka-chazum, stretched over the river, and admitting only one horse to pass over it at a time. It swings as you tread upon it, reacting at the same time with a force that impels you, every step you take, to quicken your pace. On the five chains that support the platform are placed several layers of strong coarse mats of bamboo, loosely put down, so as to play with the swing of the bridge; and a fence on each side, formed of the same materials, contributes to the security of the passenger. Capt Turner, in his "Account of an Embassy to Tibet," has given a drawing of the plan and sections of this bridge, constructed from a measurement of its different parts, together with a perspective view of it, and the adjacent scenery. There is a similar bridge over the river Tees, described by Hutchinson in his "History and Antiquities of Durham." The superstitious inhabitants consider this bridge as somewhat more than mere human production, and ascribe it to the dewta Tchuptihup, whose origin and history cannot be traced with any degree of certainty. Tradition says, that this distinguished person, in his flight from Bootan to the country of the Racusses, whose ruler he put to death, and the government of which he assumed, passed over a mountain at some distance from Chuka, through a chasm in the solid rock of the depth of 18 or 20 feet, just wide enough to admit a man on horseback, and that in scrambling over the rock, he left a deep impression of his hands and feet upon the stone. The vestiges are still pointed out, and the people are credulous enough to believe the story. This mountain communicates with that which is opposite to it by a very curious and simple bridge, constructed for the accommodation of single passengers. It consists of two large ropes made of twisted creepers, stretched parallel to each other, and encircled with a hoop. The passing traveller places himself between the ropes, and sitting down on the hoop, seizes one rope in each hand, and thus sliding himself along, crosses an abyss which cannot be viewed without shuddering. By this mode of passing from one mountain to another, travellers save a laborious journey of several days. In the vicinage of Chuka are many well cultivated fields of wheat and barley. It is distant from Murichom about 18 miles. N. lat. 27° 15′. E. long. 89° 35′.

CHUKOTSKIJA, a province of Siberia, and the most easterly of the dominions of Russia, extending from 63° to 73° 20′ N. lat. and from 156° 14′ to 189° 14′ E. long. See TSCHUTSKI.

CHULAPU, is one of the deserts of the Andes in South America, in which the Spanish astronomers, deputed to measure the meridian, placed one of their signals.

CHULLABIS, in *Ancient Geography*, a town of Africa, according to St. Augustine.

CHULUTECA, or XERES, in *Geography*, a town of Mexico, in the province of Guatimala, on the N. side of the river Fonseca. N. lat. 13° 20′. W. long. 88° 6′.

CHUMANA, or PHUMANA, in *Ancient Geography*, a town of Chaldæa.

CHUMBI-VILCAS, in *Geography*, a jurisdiction of South America, in the diocese of Cusco; which extends in some parts above 30 leagues, and has different temperatures of air, great quantities of corn and fruits, and large herds of cattle, together with some mines of silver and gold.

CHUMBUL, one of the most considerable rivers in Hindoostan. Taking its rise near the ancient city of Mundu, in the heart of the province of Malwa, within 15 miles of the Nerbudda, it pursues a north-easterly direction, and after washing the city of Kotah, and receiving the tribute of many subordinate streams, at length empties itself into the Jumna, 20 miles below Etawa. The whole length of its course is about 440 miles. The village of Keyterce stands on its southern bank, and the width of its channel is here $\frac{3}{4}$ of a mile.

CHUMDA-TCHIEN, a river of Asia, in the country of Bootan, which flows from the east and discharges itself into the Tehintchieu, near its junction with the Patchieu.

CHUMLEIGH, or CHIMLEIGH, is a small market-town, in Devonshire, England, situated on the north bank of the river Dart. The church was formerly collegiate, and four prebends are still annexed to the rectory. This structure was greatly damaged in July 1797, by a tremendous storm; in which the lightning acted with such amazing force, that a stone, upwards of 200 pounds in weight, was carried from the south-east pinnacle completely over the tower, without touching it. The number of houses in this parish is 296: of inhabitants 1333. Chumleigh is 194 miles W. from London; has a weekly market on Thursday; and an annual fair.

CHUMULAREC, the name of a range of mountains in the southern part of Tibet, about N. lat. 28° 5′, and 89° 20′ E. long.; which is covered with snow all the year. Many rivers originate in these mountains, and flow towards the south, with a rapid descent, through Boutan into Bengal; while others, taking a northerly direction, fall into the Berhampooter, and are conveyed with it, to a junction, in the neighbourhood of the sea, with the waters which flow in a contrary course from the same general source. This fact proves that this part of Little Tibet constitutes the highest point of land.

CHUN, or CUN, in *Ancient Geography*, a town of Asia in Syria, conquered by David, and mentioned in the book of Chronicles.

CHUNAGUR, or JUNAGUR, in *Geography*, a city and fortress of Hindoostan, in the heart of the peninsula of Guzerat.

CHUNAM. See *Calcareous* CEMENT.

CHUNAR, a fortress of Hindoostan, in the country of Benares, situated on a rock on the south side of the Ganges, and surrounded with walls and towers; ceded to the English by the nabob of Oude; 13 miles S. of Benares. N. lat. 25° 10′. E. long. 83° 5′.

CHUNAUB, or JENAUB, a river of the Panjab in India, the *Acesines* of Alexander, and the *Sandabalis* of Ptolemy. This river is larger than the Behut, and has its sources more remote; for it rises on the east of Kishtewar and has two distinct heads. Its general course is remarkably straight from N.E. to S.W.; and after leaving Jummoo, passes through a flat country, gradually approaching the Behut. The junction of these rivers is effected with great violence and noise, and no less danger to navigators; and

this

this circumftance is peculiarly noticed both by the hiftorians of Alexander and of Timur. The fpace between the Chunaub and Behut is no where more than 30 geographical miles, within the limits of the Panjab. The fpace between the Rauvee and Chunaub, at their entry on the plains, is about 54 geographical miles; and they gradually approach each other, during a courfe of feven miles. The junction of the Rauvee with the Chunaub, or rather the Chenaub and Behut collectively, is effected nearly midway between Toulamba and Moultan. The Ayin Acbaree allows 27 coffes between the junction of the Behut and Chunaub, and that of the Rauvee with the Chunaub: but, from circumftances, major Rennell concludes, that the diftance muft be applied to the *courfe* of the river, not to the road by land. When thefe three rivers are united, they form a ftream equal to the Indus itfelf, at the place of confluence; which is from 20 to 30 miles below Moultan.

CHUNCOA, in *Botany*, a barbarous name of a tree borrowed from the natives by Pavon, who found it in woods near the river of Amazons, and adopted by Juffieu as a diftinct genus with the following character: *Cal.* five-cleft, with a fpreading border. *Stam.* ten. *Peric.* capfule, five-cornered; angles winged, the two oppofite ones larger. *Seed* one, not crowned. *Leaves* alternate, diftant. *Flowers* in axillary fpikes, hermaphrodite at the bafe, male near the top. The authors of Flor. Peruv. call it gimbernatia, and have figured it under that name in pl. 36. of their work. It would arrange under polygamia monœcia of the Linnæan fyftem, and is placed in the natural order elæagni by Juffieu.

CHUNDNAH, in *Geography*, one of the fubordinate branches of the Ganges, which feparates from it at Moddapour, and terminates in the Hooringolla. This is the only branch of the Ganges that is at all times navigable.

CHUNG, a town of China, of the third rank, in the province of Pe-tche-li; 20 miles N.E. of Peking.

CHUNGAR, in *Ornithology*. In the hiftory of Timur Beck, mention is made of a fine bird of Tartary, called chon-kui, that was prefented to Gengis-khan by the ambaffadors of Kadjak. The bird appears to be unknown to the European naturalifts. Sonnini fuppofes it may be the Turkifh *chungar*, and therefore a heron or bittern. Others affirm that it is a bird of prey, which, being ornamented with a number of precious gems, is prefented by dependent ftates as a mark of homage. The Ruffians, as well as the Tartars of the Crimea, Sonnini tells us, are obliged by virtue of certain treaties, with the Ottoman empire, to prefent one of thofe birds decorated with a certain number of diamonds every year to the Porte.

CHUNI, in *Ancient Geography*, a people of Sarmatia, placed by Ptolemy between the Bafternæ and Roxolini.

CHUN-KING, a city of China, of the firft rank, in the province of Se-tchuen, comprehending within its diftrict nine cities, of which two are of the fecond rank; 760 miles S.S.W. of Peking. N. lat. 30° 50'. E. long. 105° 44'.

CHUN-LIEOU, a town of Afia, in the kingdom of Corea; 25 miles E.N.E. of Koang-tcheou.

CHUNNA, in the *Salic Laws*, is ufed for an hundred; or rather an hundred pence or *denarii*; the pecuniary penalties of that law are eftimated by *chunnæ*, and reduced to *folidi*, by reckoning forty *denarii* to the *folidum*.

CHUN-NGHAN, in *Geography*, a town of China, of the third rank, in the province of Tche-kiang; 11 leagues N. of Kiu-tcheou.

CHUN-NING, a city of China, of the firft rank, in the province of Yun-nan; 420 leagues S.W. of Peking. N. lat. 24° 37'. E. long. 99° 44'.

CHUN-TCHAN, a town of China, of the third rank, in the province of Fo-kien; 30 miles W.N.W. of Yen-ping.

CHUN-TCHUEN, a town of Afia, in the kingdom of Corea; 22 miles S.E. of Han-tcheou.

CHUN-TE, a city of China, of the firft rank, in the province of Pe-tche-li; 200 miles N.N.E. of Peking. This city has but a fmall diftrict; for there are only nine cities of the third clafs under its jurifdiction; but they are all very populous. The adjacent country is pleafant and fertile; on account of the number of lakes and rivers that water and refrefh it. Its craw-fifh are celebrated; and it produces a fine delicate kind of fand, ufed in polifhing precious ftones, which is fold all over the empire. It abounds alfo with touch-ftone, which is reckoned the beft in China. N. lat. [illegible] E. long. 114° 19'.

CHUN-TIAN, a town of Afia, in the kingdom of Corea; 27 miles S.S.E. of Koang-tcheou.

CHUN-YAN, a town of Afia, in the kingdom of Corea; 20 miles S. of Han-tcheou.

CHUPKA, or KEPTA, a mountain of Bootan, fomewhat more northerly than the valley of Punugga, having half-way up its fide a caftle, in a bleak, but beautifully romantic fituation; the mountains in its neighbourhood appearing to captain Turner the higheft which he had feen in Bootan.

CHUPMESSAHITES, a fect among the Mahometans who believe that Jefus Chrift is God, and the true Meffiah, the redeemer of the world; but without rendering him any public, or declared worfhip.

The word, in the Turkifh language, fignifies "Protector of the Chriftians.

Ricaut fays, there are abundance of the Chupmeffahites among the people of fafhion in Turkey, and fome even in the feraglio.

CHUPUAH, in *Geography*, a town of Hindooftan, in the country of Bahar, on the north coaft of the Ganges; 25 miles N.W. from Patna.

CHUQUIRAGA, in *Botany*, a barbarous name given by the Peruvians to a fyngenefious plant, and adopted by Juffieu and La Marck as a generic one. Juff. 178. Lam. Illuf. Pl. 691. Nat. Ord. *Corymbyferæ*, Juff.

Gen. Ch. *Cal.* large, top-fhaped, compofed of very numerous imbricated fcales; the outward ones growing gradually fmaller. *Flowers* flofculous; florets numerous, very long, nearly entire at their borders; anthers long, with two briftles at their bafe; ftigma one; down feathered, long; receptacle villous.

A branched fhrub. *Leaves* rigid, like thofe of rufcus, acuminate, alternate, denfely imbricated. *Flowers* folitary, terminating the branches. Nearly allied to mutifia, but not radiate; perhaps ftill more nearly allied to the cinarocaphalæ. Defcribed from a dried fpecimen in the herbarium of Jof. Juffieu.

CHURAQUER, in *Geography*, a town of Armenia; 48 miles W. of Erivan.

CHURASCH, a town of Arabia; 44 miles S. of Saade.

CHURCH, an affembly of perfons united by the profeffion of the fame Chriftian faith, and the participation of the fame facraments. Bellarmin, and the Romifh divines, to this definition add, "Under the fame pope, fovereign pontiff, and vicar of Jefus Chrift on earth:" in which circumftance it is that the Romifh and Reformed notions of church differ.

Amelotte, and others, make a vifible head, or chief, effential to a church: accordingly, among the Catholics, the pope; in England, the king; are refpectively allowed heads of of the church. Biſhop Hoadly ſets aſide the notion of a viſible head: Chriſt alone, according to him, is head of the church; which poſition he has maintained, with great addreſs, in a celebrated ſermon before king George I. on theſe words, "My kingdom is not of this world;" and in the ſeveral vindications of it. To this purpoſe, he ſays, that as the church of Chriſt is the kingdom of Chriſt, he himſelf is king; and in this it is alſo implied, that he is himſelf the ſole lawgiver to his ſubjects, and himſelf the ſole judge of their behaviour, in the affairs of conſcience and eternal ſalvation. In theſe points he hath left behind him no viſible, or human authority; no vicegerents, who can be ſaid properly to ſupply his place; no interpreters, upon whom his ſubjects are abſolutely to depend; no judges over the conſciences or religion of his people. Mr. Locke, in his "Letters concerning Toleration," deſcribes a church as a voluntary ſociety of men, who join themſelves together, of their own accord, for the public worſhip of God, in ſuch a manner as they judge acceptable to him, and effectual to the ſalvation of their ſouls. Nobody, he ſays, is born a member of any church; otherwiſe the religion of parents would deſcend to children, by the ſame right of inheritance as their temporal eſtates, and every one would hold his faith by the ſame tenure as he holds his lands; than which nothing can be imagined more abſurd. As the entrance of a perſon into any particular church is voluntary, ſo is alſo his continuance in it. No member of any religious ſociety, ſays Mr. Locke, can be tied with any other bonds but what proceed from the certain expectation of eternal life. A church, then, is a ſociety of members voluntarily uniting to this end. This author further adds, that things, never ſo indifferent in their own nature, when they are brought into the church and worſhip of God, are removed out of the magiſtrate's juriſdiction; becauſe in that uſe they have no connection at all with civil affairs. The only buſineſs of the church is the ſalvation of ſouls: and it noways concerns the commonwealth, or any member of it, that this, or the other ceremony be there made uſe of. Neither the uſe, nor the omiſſion of any ceremonies in theſe religious aſſemblies, does either advantage or prejudice the life, liberty, or eſtate of any man.

The term *eccleſia*, εκκλησια, ſynonymous with our church, is uſed in the Greek and Latin profane authors for any kind of public aſſembly called together upon any public buſineſs, to enact laws, &c. (ſee Æſchines, paſſim, and Lucian, who uſes the words Θεων εκκλησια, *q. d.* an aſſembly of the gods); and the term was even uſed for the place where the aſſembly was held. The ſacred and eccleſiaſtical writers ſometimes alſo uſed it in the ſame ſenſe; but ordinarily they reſtrain the term to the Chriſtians; as the term *ſynagogue*, which originally ſignifies nearly the ſame thing, is in like manner reſtrained to the Jews.

Thus, in the New Teſtament, the Greek εκκλησια ſignifies, almoſt always, the aſſembly of the faithful diffuſed over the whole earth, as Epheſ. v. 24. or the faithful of a particular city or province, as Acts, xi. 22. xv. 22. 2 Cor. viii. 1. or even of a ſingle family, as Rom. xvi. 5.

For the meaning of the term εκκλησια, as it was applied by the ſacred writers, ſee alſo Acts, xix. 32. 40. 1 Cor. xiv. 23. Phil. iv. 15. Heb. xii. 23. From the ſeveral places above cited it appears, that the congregation, and not the place, forms the ſcripture idea of a church. The Hebrew word קהל exactly correſponds to the Greek εκκλησια, and is commonly rendered by it in the Septuagint, the only Greek tranſlation of the Old Teſtament in uſe in the time of our Saviour. Its idiom and phraſeology were conſequently become the ſtandard, in all matters that concerned religion, to all the Jewiſh writers who uſed the Greek language, and who were commonly diſtinguiſhed by the name of Helleniſts. From them the term was originally borrowed by the penmen of the New Teſtament. From their manner of uſing it, therefore, the general meaning of the word is to be ſought. But though the phraſes כל קהל ישראל in Hebrew, and πασα ἡ εκκλησια Ισραηλ in Greek, the whole church of Iſrael, do frequently occur in the Old Teſtament, there is not a ſingle paſſage in which they are not confeſſedly equivalent to the phraſes כל גוי ישראל, and παν το εθνος Ισραηλ, all the nation of Iſrael. The ſame may be ſaid of the phraſes קהל אלהים and עם אלהים, ἡ εκκλησια Θεȣ and ὁ λαος Θεȣ, the church of God, and the people of God. A diſtinction between theſe would have been pronounced by them inconceivable, as being a diſtinction between the church and its conſtituent members. In the Latin tranſlation, called the Vulgate, the date of which is about the beginning of the 5th century, the Greek word is commonly retained, having been long before naturalized among Chriſtians. Accordingly, they rendered theſe phraſes in the Old Teſtament "omnis eccleſia Iſrael," and "eccleſia Dei." Our Engliſh tranſlators, however, have never admitted the word "church" into their verſion of the Old Teſtament, notwithſtanding the frequent uſe they have made of it in the New. They have always rendered the Hebrew word קהל, by the Engliſh words, congregation, aſſembly, or ſome ſynonymous term. Either of theſe Engliſh terms is well adapted to expreſs the ſenſe of the Hebrew: and they were altogether as fit for expreſſing the ſenſe of the word εκκλησια in the New Teſtament as of the word קהל in the Old; the former being the term by which the latter had been rendered almoſt uniformly in the Septuagint, and which had been employed as equivalent by all the Helleniſt Jews. In order to preſerve uniformity, our tranſlators ought conſtantly to have rendered the original expreſſion either "church" in the Old Teſtament, or "congregation" in the New. Terms ſo perfectly coincident in ſignification, as theſe Hebrew and Greek names are, ought to have been tranſlated by the ſame Engliſh word. Indeed, our tranſlators do not refuſe the title of church to the commonwealth of Iſrael, when an occaſion for giving it occurs in the New Teſtament, though they have not availed themſelves of a ſimilar occaſion in the Old. Thus they have rendered the words of Stephen, who ſays, ſpeaking of Moſes, Acts, vii. 38. "This is he that was in the church in the wilderneſs;" Ουτος εστιν ὁ γενομενος εν τη εκκλησια εν τη ερημω. We do not find, however, ſays Dr. Campbell, in his "Eccleſiaſtical Hiſtory" (vol. i. p. 323.), in the uſe of either the Greek word in the New Teſtament, or of the correſpondent word in the Old, any veſtige of an application of the term to a ſmaller part of the community, their governors, paſtors, or prieſts, for inſtance, as repreſenting the whole. The only paſſage that has been alleged, with any appearance of plauſibility, in favour of this application, is Matt. xviii. 17, where our Lord, in the directions he gives for removing offences between brethren, enjoins the party offended, after repeated admonitions in a more private manner have proved ineffectual, to relate the whole to the church, ειπε τη εκκλησια; but Dr. Campbell aſks, "by what rule of ſound criticiſm can we arbitrarily impoſe here on the word "church" the ſignification of church repreſentative, a ſignification which we do not find it bears in one other paſſage of ſcripture?" But that the meaning of the word is here, as in other places, no more than congregation, and that it ſhould have been ſo rendered, he argues from the conſideration that our Lord gave theſe directions during the ſubſiſtence of the Moſaic eſtabliſhment; and if we believe that he ſpoke intelligibly, or with a view to be underſtood, we muſt believe alſo that he uſed the word in an

acceptation

acceptation with which the hearers were acquainted. All the then known acceptations of the name εκκλησια, were these two, the whole Jewish people, and a particular congregation. The scope of the place sufficiently shews, it could not be the former of these senses, and it must therefore be the latter. What further confirms this interpretation is, that the Jews were accustomed to call those assemblies, which met together for worship in the same synagogue, by this appellation; and had, if we may believe some learned men conversant in Jewish antiquities, a rule of procedure similar to that here recommended, which our Lord adopted from the synagogue, and transplanted into his church. This learned writer proceeds to adduce another collateral and corroborative evidence, that by εκκλησια is here meant not a representative body, but the whole of a particular congregation; and this is the actual usage of the church for the first 300 years. As far down as Cyprian's time, about the middle of the third century, when the power of the people was on the decline, it continued to be the practice, that nothing relating to matters of scandal and censure could be concluded without the consent and approval of the congregation. Upon the whole it seems to be evident that the term *church*, denoting, according to its etymology, no more than society or assembly, is sometimes used in the New Testament, with obvious analogy to the common use, to signify the whole community of Christians, considered as one body, of which Christ is denominated the head, and sometimes only a particular congregation of Christians. When this word is limited, or appropriated, as it generally is in the New Testament, by its regimen, as τȣ θεȣ, τȣ κυριȣ, τȣ χριςȣ, or by the scope of the place, it is always to be explained in one or other of the two following senses. It denotes either a single congregation of Christians, or the whole Christian community; nor can we hardly ever be at a loss to know from the context which of the two is implied. The former acceptation of the term is sometimes evident from the words in construction, as της εκκλησιας της εν Κεγχρεαις, and τη εκκλησια τȣ θεȣ τη εν Κορινθω, or the like. In the latter sense it ought always to be understood, when we find nothing in the expression, or in the scope of the passage, to determine us to limit it; *e.g.* in the following, Επι ταυτη τη πετρα οικοδομησω μȣ την εκκλησιαν. Ὁ κυριος προσετιθεις τȣς σωζομενȣς καθ' ἡμεραν τη εκκλησια. In this last acceptation of the word, for the whole body of Christ's disciples, wheresoever dispersed, it came afterwards to be distinguished by the epithet καθολικη. Accordingly, they said ἡ εκκλησια ἡ καθολικη, the catholic or universal church. But, it has been alleged, that in any intermediate sense, between a single congregation and the whole community of Christians, no single instance can be brought of the application of the word in sacred writ. We speak now, indeed (and this has been the manner for ages), of the Gallican church, the Greek church, the church of England, the church of Scotland, as of societies independent and complete in themselves. Such a phraseology was never adopted in the days of the apostles. They did not say, the church of Asia, or the church of Macedonia, or the church of Achaia, but the churches of God in Asia, the churches in Macedonia, the churches in Achaia. The plural number is invariably used when more congregations than one are spoken of, unless the subject be the whole commonwealth of Christ. This is not only the mode of expression adopted by the sacred writers, but it is the constant usage of the term in the writings of ecclesiastical authors for the two first centuries: allowing for one exception to the contrary, which occurs in the epistles of Ignatius. This language is also conformable to the usage, in relation to this term, which had always obtained among the Jews. The whole nation, or commonwealth of Israel, was often denominated πασα ἡ εκκλησια Ισραελ; and after the revolt of the ten tribes, when they ceased to make one people or state with the other two, we hear of πασα ἡ εκκλησια Ιȣδα. This is the large or comprehensive use of the word above noticed. With regard to the more confined application, the same term εκκλησια was also employed to denote a number of people, either actually assembled, or wont to assemble in the same place. Thus, all belonging to the same synagogue were called indifferently εκκλησια, or συναγωγη, as these words in the Jewish use were nearly synonymous. The limitation of the term "church" to the clergy and the ecclesiastical judicatories, and the claims of independency advanced by these, as well as certain claims of power and jurisdiction, in some things differing, and in some things interfering with the claims of the magistrate, arose after the establishment of the Christian religion under Constantine; and hence a distinction subsisted, in the Christian community, at an early period, between the church and state.

We may here remark, that it is doubtful whether the word εκκλησια ever occurs in the New Testament in a sense, in which, indeed, the word "church" is very common with us, as a name for the place of worship. There are two passages, which seem to convey this sense; and they both occur in the 11th chapter of the 1st epistle to the Corinthians. The 1st is v. 18, "when ye come together in the church," συνερχομενων ὑμων εν τη εκκλησια. Here, however, the word is susceptible of another interpretation, as a name for the society. Thus we say "The lords spiritual and temporal, and the commons in parliament assembled," where parliament does not mean the house they meet in, but the assembly properly constituted. The other passage is v. 22. "Have ye not houses to eat and drink in, or despise ye the church of God?" της εκκλησιας τȣ θεȣ καταφρονειτε: where, it is alleged, the opposition of εκκλησια to οικια, the church to their houses, adds a probability to this interpretation. This plea, however, though plausible, is not decisive. The apostle's argument on the contrary hypothesis would stand thus: what can be the reason of this abuse? Is it because ye have not houses of your own in which to eat and drink? Or is it because ye despise the Christian congregation to which you belong? This, though it must be allowed not to convey so exact a verbal antithesis, is, in the judgment of some writers, more in the spirit and style of the New Testament, than to speak of despising stone walls. At length, however, the term εκκλησια, by a common metonymy, the thing contained for the thing containing, came to be universally employed in this acceptation. Among the extraordinary ministers of the Christian church, at the period of its first establishment, we may reckon apostles, prophets, and evangelists, besides those who were endowed with supernatural gifts, and afterwards bishops, presbyters, and deacons. See these several terms.

The word "church," says lord chancellor King (Constitution, Discipline, &c. of the Primitive Church), is both in our modern acceptation, and also in the writings of the fathers, equivocal, having different significations, according to the different subjects to which it is applied. It is often to be understood, 1st, of the "Church Universal," that is, of all those, who, throughout the face of the whole earth, professed faith in Christ, and acknowledged him to be the Saviour of mankind. This is that which they called the "Catholic Church." See Iren. l. i. c. 2. c. 3. Apud Eufeb. l. vi. c. 25. l. vii. c. 10. l. iv. c. 15. 2. The word "church" is frequently to be understood of a "particular church," that is, of a company of believers, who, at one time, in one and the same place, associated themselves together, and concurred in the participation of all the institutions

ſtitutions and ordinances of Jeſus Chriſt, with their proper miniſters and paſtors. Various inſtances of this uſe of the term occur in Irenæus, Cyprian, Ignatius, Origen, &c. 3. The word "church" is ſometimes uſed for the place where a particular church or congregation met for the celebration of divine ſervice; and it is thus uſed by Paulus Samoſatenus, Clemens Alexandrinus, Tertullian, Origen, &c. &c. 4. The word "church" is once uſed by Cyprian for a collection of many particular churches; but when the fathers have occaſion to ſpeak of the Chriſtians in any kingdom or province, they always uſe the plural, "the churches," and never the ſingular, or the church of ſuch a kingdom or province. 5. The word "church" frequently occurs for that which we commonly call the inviſible church, that is, for thoſe who, by a ſound repentance and a lively faith, are actually intereſted in the Lord Jeſus Chriſt; and it is thus uſed by Tertullian, Irenæus, and others of the fathers. 6. The word "church" is frequently to be interpreted of the faith and doctrine of the chuch. It is alſo uſed, according to its original import, for any congregation in general, as we have already ſtated; ſometimes it is applied to any particular ſect of heretics; at other times it is attributed to the orthodox in oppoſition to the heretics; in both which ſenſes it is uſed by Tertullian; ſometimes it is appropriated to the heathen aſſemblies, as by Origen; at other times, in oppoſition to the Jews, it is aſcribed to the believing Gentiles, as by Irenæus: in other places it ſignifies the aſſembly of the ſpirits of juſt men made perfect in heaven, commonly called "the church triumphant," in oppoſition to "the church militant," or the aſſembly of the faithful on earth. To theſe the Catholics add "the church patient," which, according to their doctrine, is that of the faithful in purgatory. Lord King (ubi ſupra) ſays, that he has once found the term "church" denoting the laity only, in oppoſition to the clergy (Επισκοποι και Πρεσβυτεροι, και Διακονοι, και αἱ ἐκκλησιαι τȣ Θεȣ, Euſeb. l. vii. c. 30.): and once ſignifying only Chriſt as the head of the faithful (Eccleſia veri Chriſtus, Tertullian, de Pœnit. p. 302.) After all, this learned writer obſerves, that the uſual and moſt common acceptation of the word is that of a particular church, that is, a ſociety of Chriſtians, meeting in one place, under their proper paſtors, for the performance of religious worſhip, and the exerciſe of Chriſtian diſcipline.

The conſtituent parts of a particular church are the people, who compoſe the body of it, and thoſe perſons who are ſet apart for religious and eccleſiaſtical employments, or, according to our ordinary dialect, the clergy and laity; which is an early diſtinction, being mentioned by Clemens Romanus (Epiſt. 1. ad Corinth.) and after him by Origen (Homil. 11. in Jerem.) and ſeveral others. See Clergy, Bishop, &c.

Every particular church, in ancient times, poſſeſſed the power of exerciſing diſcipline on its own members, without the concurrence of other churches. Accordingly we find, that the exerciſe of this power was formally decreed by two African ſynods, recorded apud Cyprian. Epiſt. 55. § 16. and Epiſt. 72. § 3. Nevertheleſs, a particular church was not the whole church of Chriſt, but only a part or member of the church univerſal; and we therefore find, that though the labours and inſpection of the biſhops were more peculiarly reſtricted to their own pariſhes, yet, as miniſters of the univerſal church, they employed a general kind of inſpection over other churches alſo. Cyprian, Epiſt. 67. § 6. Ed. 29. Euſeb. lib. vii. c. 9. See Council.

With regard to the unity of the church univerſal, in primitive times, the learned author, whom we are now citing, ſhews, that it did not conſiſt in an uniformity of rites and cuſtoms, nor in an unanimity of conſent to the non-eſſential points of Chriſtianity; but it conſiſted in an harmonious aſſent to the eſſential articles of religion, or in an unanimous agreement in the fundamentals of faith and doctrine. If we conſider the word "church," collectively, as denoting a collection of many particular churches, in which ſenſe it is once uſed by Cyprian; then its unity may have conſiſted in a brotherly correſpondence with, and affection towards each other, which they demonſtrated by all outward expreſſions of love and concord. See Schism and Heresy.

The worſhip of the primitive church conſiſted in the reading of the Holy Scriptures, the ſinging of pſalms and hymns, the preaching of the word, and public prayers. To theſe acts of public ſervice, they added the adminiſtration of baptiſm and the Lord's Supper. See each of theſe articles.

In adverting to the articles of the eſtabliſhed church in our own country, we find (art. 19.) that "the viſible church of Chriſt" is defined to be a congregation of faithful men, in the which the pure word of God is preached, and the Sacraments be duly adminiſtered according to Chriſt's ordinance, in all thoſe things that of neceſſity are requiſite to the ſame." The expreſſion of "the viſible church of Chriſt," ſeems here to be uſed in contradiſtinction to the myſtical or inviſible church of Chriſt; which latter conſiſts of thoſe perſons who have truly believed and obeyed the goſpel, and who are conceived, although they have lived at different periods, to be united into one body, which is called myſtical or inviſible; not only becauſe they are not now all upon earth, but becauſe the qualities and properties, which gave them a claim to be members of this bleſſed ſociety, were never the objects of ſenſe, and could not be judged of by men from merely external circumſtances. Whereas, "the viſible church," in its moſt extenſive ſenſe, may include all perſons who are or have been, by outward profeſſion, Chriſtians, whether they have or have not believed all the doctrines, or obeyed all the precepts of the goſpel. This may be called the viſible Catholic church. But in the article, above cited, "the viſible church" is uſed in a more limited ſenſe, and comprehends only the Chriſtians of one country or city, or of one perſuaſion; thus, towards the cloſe, it mentions the church of Jeruſalem, of Alexandria, of Antioch, and of Rome; and in like manner we often ſpeak of the church of England, of Holland, of Geneva, and of the Lutheran church; and all theſe different churches are parts of the viſible Catholic church. "The adherence," ſays Dr. Tomline, biſhop of Lincoln, (Elements of Chriſtian Theology, vol. ii. p. 325.) "to the fundamental principles of the goſpel is ſufficient to conſtitute a viſible church; although every doctrine it maintains may not be founded in truth, or all the parts of public worſhip agreeable to Scripture. We conſider all men as Chriſtians, or as members of the viſible church of Chriſt, who have been baptized, and profeſs their belief in the divine miſſion of Chriſt, even if their faith be in ſome reſpects erroneous, and their lives unworthy of their holy vocation."

The Chriſtian church, with regard to its local eſtabliſhment, extent, and influence, is frequently divided into *Eaſtern* or *Greek* and *Weſtern* or *Latin*.

The firſt jealouſies between the Greek and Latin churches were excited at the council of Sardis, in the year 347, and a vindictive ſpirit prevailed for a long time between the biſhops of Rome and Conſtantinople, which occaſionally broke out into acts of violence. The ambition and fury of theſe contending prelates grew ſtill more keen and vehement about the time of Leo the Iſaurian, when the biſhops of Conſtantinople, ſeconded by the authority and power of the emperors, withdrew from the juriſdiction of the Roman pontiff many provinces, over which they had hitherto exerciſed a ſpiritual

ritual dominion. However, the schism, or total separation, did not take place till the time of Photius, who was elected patriarch of Constantinople in the year 858 by the emperor Michael, in the place of Ignatius, whom that prince drove from his see and sent into exile. Pope Nicholas I. took part with the exiled patriarch, decreed the election to be unwarrantable in a council held at Rome A. D. 862, and excommunicated Photius. The high-spirited patriarch, respected as the most learned and ingenious person of the age in which he lived, assembled a council at Constantinople, A. D. 866, returned the compliment, and declared Nicholas unworthy of his rank in the church, and of even being admitted to the communion of Christians. The pretext alleged by the Roman prelate, in justification of his conduct, was the innocence of Ignatius; but the secret and moving spring seems to have been a desire of recovering from the Greeks the provinces of Illyricum, Macedonia, Epirus, Achaia, Thessaly, and Sicily, which the emperor and Photius had removed from the jurisdiction of his see. The restitution of these provinces had been demanded by a solemn embassy; but his requisition was treated with contempt, and from hence proceeded his zeal in the cause of justice and of Ignatius. The exiled patriarch was soon after restored to his high station by Basilius, who had paved his way to the imperial throne by the murder of his predecessor; and Photius was confined in a monastery. Photius continued to feed the flame of discord, and, having in the year 866 added the province of Bulgaria to the see of Constantinople, he now endeavoured to engage the oriental patriarch in his dispute, and drew up a violent charge of heresy against the Roman bishops, who had been sent among the new-converted Bulgarians, and against the church of Rome in general. Upon the death of Ignatius in 878, the emperor took Photius into favour, and advanced him again to the patriarchal station from which he had been degraded. The grant of Bulgaria to the Roman see was promised to the pontiff John VIII., by the emperor and Greek patriarch, and Photius was acknowledged by John as his brother in Christ. The emperor and Photius falsified their promise, and refused to transfer Bulgaria to the Roman pontiff. After some subsequent occasions of mutual offence, John was succeeded by Marinus, and a new sentence of excommunication was issued against Photius. This sentence was treated with contempt by the haughty patriarch, who, in 886, was deposed by the emperor Leo from the patriarchal see, and confined in an Armenian monastery, where he died in 891. The death of Photius might have terminated the dispute between the eastern and western churches, if the Roman pontiff had not been regardless of the demands of equity as well as of the duty of Christian moderation. But these imperious lords of the church indulged their vindictive zeal beyond measure, and would be satisfied with nothing less than the degradation of all the priests and bishops who had been ordained by Photius. The Greeks, on the other hand, were shocked at the arrogance of these unjust pretensions, and would not submit to them on any conditions. Hence the dispute between the two churches and their partizans was renewed; religious, as well as civil contests, occurred; and by adding new controversies to the old, the fatal schism took place, which produced a total and permanent separation between the Greek and Latin churches.

The doctrine of the Eastern or Greek church, which is, unquestionably, the most ancient, prevails at this day over a greater extent of country than that of any other church in the Christian world. It is professed through a considerable part of Greece, the Grecian isles, Walachia, Moldavia, Egypt, Nubia, Lybia, Arabia, Mesopotamia, Syria, Cilicia, and Palestine; all which are comprehended within the jurisdiction of the patriarchs of Constantinople, Alexandria, Antioch, and Jerusalem; to these, if we add the whole of the Russian empire in Europe, great part of Siberia in Asia, Astracan, Casan, Georgia, and White Russia in Poland, it will be evident that the Greek church has a greater extent of territory than the Latin, with all the branches that are sprung from it.

The *Greek* or *Eastern Church* may be divided into three distinct communities. The *first* is that of the Greek Christians, who agree, in all points of doctrine and worship, with the patriarch residing at Constantinople, and reject the pretended supremacy of the Roman pontiff. The *second* comprehends those Christians, who differ equally from the Roman pontiff and the Grecian patriarch in their religious opinions and institutions, and who live under the government of their own bishops and rulers. The *third* is composed of those who are subject to the see of Rome.

That society of Christians, that maintains religious communion with the patriarch of Constantinople, is, properly speaking, the Greek, though it assumes likewise the title of the Eastern Church. This society is subdivided into two branches, of which the one acknowledges the supreme authority and jurisdiction of the bishop of Constantinople, while the other, though joined in communion of doctrine and worship with that prelate, yet obstinately refuses to receive his legates or to obey his edicts, and is governed by its own laws and institutions, under the jurisdiction of spiritual rulers, who are independent of all foreign authority.

That part of the Greek church, which acknowledges the jurisdiction of the bishop of Constantinople, is divided, as in the early ages of Christianity, into four large districts or provinces, Constantinople, Alexandria, Antioch, and Jerusalem; over every one of which a bishop presides with the title of patriarch, whom the inferior bishops and monastic orders unanimously respect as their common father. This prelate has the privilege of nominating other patriarchs, though that dignity still continues elective, and of approving the election that is made; nor is any thing of moment undertaken or transacted in the church without his express permission, or his special order. Indeed, in the present decayed state of the Greek churches, whose revenues are small, and whose former opulence is almost annihilated, their spiritual rulers enjoy little more than the splendid title of "Patriarchs," without being in a condition to extend their fame or promote their cause, by any undertaking of signal importance.

The spiritual jurisdiction and dominion of the patriarch of Constantinople are very extensive, comprehending a considerable part of Greece, the Grecian isles, Walachia, Moldavia, and several of the European and Asiatic provinces that are subject to the Turks. The patriarch of Alexandria resides generally at Cairo, and exercises his spiritual authority in Egypt, Nubia, Lybia, and a part of Arabia. Damascus is the principal residence of the patriarch of Antioch, whose jurisdiction extends to Mesopotamia, Syria, Cilicia, and other provinces. In Syria there are three bishops, who claim the title and dignity of patriarch of Antioch. The *first* is the bishop of the Melchites, a name given to the Christians in Syria who follow the doctrine, institutions, and worship of the Greek church; the *second* is the spiritual guide of the Syrian Monophysites; and the *third* is the chief of the Maronites, who hold communion with the church of Rome. This last bishop pretends to be the true and lawful patriarch of Antioch, and is acknowledged as such by, or at least receives this denomination from, the Roman pontiff. Nevertheless, it is certain, that the pope creates at

Rome

Rome a patriarch of Antioch of his own choice, so that the see of Antioch has, at this day, four patriarchs, one from the Greeks, two from the Syrians, and one created at Rome, who is patriarch, *in partibus*, i. e. titular patriarch, according to the signification of that phrase.

The patriarch of Jerusalem comprehends, within the bounds of his pontificate, Palestine, Arabia, the country beyond Jordan, Cana in Galilee, and mount Sion.

The episcopal dominions of these three patriarchs are indeed extremely poor and inconsiderable; for the Monophysites have long since assumed the patriarchal seats of Alexandria and Antioch, and have deprived the Greek churches of the greatest part of their members in all those places where they gained an ascendant. And as Jerusalem is the resort of Christians of every sect, who have their respective bishops and rulers, the jurisdiction of the Grecian patriarch is consequently confined there within narrow limits.

The right of electing the patriarch of Constantinople is vested in the 12 bishops who reside nearest that famous capital; but the right of confirming his election, and of enabling the new-chosen patriarch to exercise his spiritual functions, belongs only to the Turkish emperor. But this institution is subject to the grossest perversion and abuse by the corruption and avarice of the reigning ministers. The power of this patriarch among a people dispirited by oppression, and sunk into the grossest superstition by extreme ignorance, must be, and actually is, very considerable and extensive. Besides, his own prerogatives are numerous; for he not only convenes councils by his own authority; but by the special permission of the emperor, he administers justice and takes cognizance of civil causes among the members of his communion. His influence is maintained, on the one hand, by the authority of the Turkish monarch, and, on the other, by his right of excommunicating the disobedient members of the Greek church. The revenue of this patriarch is drawn particularly from the churches that are subject to his jurisdiction; and its produce varies according to the circumstances of the Greek Christians, whose condition is exposed to many vicissitudes.

The Greeks acknowledge, as the rule of their faith, the Holy Scriptures and the decrees of the first seven *general* councils; but no private person has a right to explain, for himself or others, either the declarations of Scripture, or the decisions of these councils; the patriarch and his brethren being the only persons who are authorised to consult these oracles, and to declare their meaning. The substance of the doctrine of the Greek church is contained in a treatise, entitled "The orthodox Confession of the Catholic and Apostolic Eastern Church," drawn up by Peter Mogislaus, bishop of Kiov, in a provincial council assembled in that city. This confession, originally composed in the Russian language, was translated into Greek, and in the year 1643 publicly approved and adoped by Parthenius of Constantinople, and all the other Grecian patriarchs. It was afterwards published in Greek and Latin at the expence of Panagiota, the Turkish emperor's interpreter, who ordered it to be distributed *gratis* among the Greek Christians; and it was also enriched with a recommendatory letter composed by Nectarius, patriarch of Jerusalem. From this confession it evidently appears, that the Greeks differ widely from the votaries of the Roman pontiff, whose doctrines they reject and treat with indignation in several places; but at the same time it appears, that their religious tenets are equally remote from those of the other Christian societies.

With respect to the doctrine of the Greek church, we have already observed, that it is partly derived from the first 7 œcumenical or general councils, viz. that of Nice, A. D. 325; the first of Constantinople, A. D. 381; that of Ephesus, A. D. 431; that of Chalcedon, A. D. 451; the second of Constantinople, A. D. 553; the third of Constantinople in Trullo, A. D. 680; and the second of Nice, A. D. 787. The Nice and the Athanasian creeds are allowed by them; and they hold the doctrine of the Trinity, but with this qualification, that the Holy Ghost proceeds from the Father only, and not from the Father and the Son. The invocation of saints is alike received in the Greek and Roman communion. The Greek church admits the use of pictures to instruct the ignorant, and to assist the devotion of others by those sensible representations. In the Greek church there are 7 mysteries, or sacraments, as they are called in the Latin church, viz. baptism, the Chrism, or baptismal unction, the eucharist, confession, ordination, marriage, and the holy oil or extreme unction. As to baptism, there is nothing peculiar in it. Chrism is called the unction with ointment, and extreme unction is called the consecration with holy oil. The chrism is a mystery peculiar to the Greek communion, and holds the place of confirmation in the Roman. It immediately follows the immersion at baptism, when the priest anoints the person baptized, on the principal parts of the body with an ointment, consecrated with many curious circumstances for that purpose by a bishop; this ceremony is always used at the reception of a proselyte from any other church whatever. As to the eucharist, it has been disputed whether transubstantiation was the doctrine of the ancient Greek church. The Protestants and the eminently learned and eloquent John Claude, maintain the negative; while the Roman Catholics, especially Arnaud, contend for the affirmative; but whether it was maintained in the ancient Greek church or not, it is the doctrine of the present Russian church; for in the oath every bishop now takes at his consecration, he absolutely swears, that "he believes and understands that the transubstantiation of the body and blood of Christ, in the holy supper, as taught by the eastern and ancient Russian doctors, is effected by the influence and operation of the Holy Ghost, when the bishop or priest invokes God the Father in these words, *and make this bread the precious body of thy Christ.* It is held necessary in this church to mix warm water with the wine, and the lay communicants receive both the elements together; the bread being sopped in the cup; but the clergy receive them separate. Children immediately after baptism may receive the communion. Predestination is a dogma of the Greek church, and a very prevailing opinion among the people of Russia. The Greek church admits prayers and services for the dead as an ancient and pious custom, and even prayers for the remission of their sins; but it disallows the doctrine of purgatory, and determines nothing dogmatically concerning the state and condition of departed souls. It also pays a regard to the relics of saints and martyrs of which too superstitious an use is made. Supererogation, indulgences, and dispensations are utterly disallowed in this church; nor does it affect, like the Latin, the character of infallibility, but like most other churches, it is guilty of pretending to be the only true and orthodox church. The confession, or catechism of Mogislaus, above-mentioned, seems to have been at one time received as the standard of the principles of the Russian church; yet there are many points in it, which the present doctors of the church do not approve, others which they consider as trivial; nor, indeed, do they allow the book to have any authority at all.

Many attempts have been made to unite the Greeks with the Latin or Romish church, and also with the Reformed church; but they have hitherto proved unsuccessful. Nothing

thing more deplorable can be conceived than the ſtate of the greateſt part of the members of the Greek church, ſince their ſubjection to the oppreſſive yoke of the Turkiſh emperors. Since that fatal period, almoſt all learning and ſcience, human and divine, have been extinguiſhed among them. Thoſe of them that are in this abject condition have neither ſchools, colleges, nor any of thoſe literary eſtabliſhments, that ennoble human nature, by ſowing in the mind the immortal ſeeds of knowledge and virtue. This ignorance, that reigns among the Greeks, has the moſt pernicious influence upon their morals. Licentiouſneſs and impiety not only abound among the people, but alſo diſhonour their leaders; the calamities that ariſe from this corruption of manners are deplorably augmented by their endleſs contentions and diviſions. Their religion is a motley collection of ceremonies, the moſt of which are either ridiculouſly trifling or ſhockingly abſurd. Yet they are much more zealous in retaining and obſerving thoſe ſenſeleſs rites, than in maintaining the doctrine, or obeying the precepts of the religion they profeſs.

The Ruſſians, Georgians, and Mingrelians adopt the doctrines and ceremonies of the Greek church; though they are entirely free from the juriſdiction and authority of the patriarch of Conſtantinople. Indeed, this prelate formerly enjoyed the privilege of a ſpiritual ſupremacy over the Ruſſians, to whom he ſent a biſhop whenever a vacancy happened. But towards the concluſion of the 16th century, this privilege ceaſed. The ſervice of the Greek church, as it is performed in Ruſſia, &c. is long and complicated; the greateſt part of it varies every day in the year, and every part of the day, except in the communion office, where the larger part is fixed. They have books in many volumes folio, which contain the hymns and particular ſervices for the ſaints and feſtivals as they occur in the calendar throughout the year; and ſuch is the number of ſaints in this church that every day in the year has ſome ſaint, and frequently one day has ſeveral. They contain alſo particular ſervices for the ſeveral days of the week. The one of theſe, comprized in twelve volumes folio; one volume for each month, is called Μηναιον, Minæon, and the other Οκτωηχος, octoechos, in 2 vols. folio, divided into eight voices or tones, as its name indicates; each tone contains hymns and ſervices for the days of one week, and the whole of which ſerves for eight weeks. The "Common Service" is a book which may be conſidered as a ſupplement to thoſe two, and contains ſervices common to all ſaints, martyrs, biſhops, &c. The "Pſalter and the Hours," employ another volume. The "Book of Prayer or the Service" as it is called, contains the ordinary daily prayers, &c. for the prieſts and deacons in the veſpers, matins, and communion offices. The "Lives of the Saints" are in four volumes folio; theſe are read in pariſh churches, but they are uſually read in monaſteries at the matins or morning ſervice. The "Four Goſpels" make one volume by themſelves. There are alſo extracts from the Old Teſtament, and the epiſtles uſed in the ſervice. The "Ritual or Book of Offices" contains the rites of baptiſm, marriage, the burial-ſervice, &c. Theſe books are all in the Sclavonian language, as is conſequently the whole ſervice. In Ruſſia, at this time, they have ſervice, both in monaſteries and pariſh churches, only three times a day; the veſpers, the matins, and the liturgy or communion. The ſervice of every day begins in the evening of the preceding day, as among the Jews. The greater part of the ſervice of this church conſiſts in pſalms and hymns, which ſhould all regularly, according to the primary inſtitution, be ſung; though on account of the length of the ſervice, ſince the joining many forms together, it became the practice to read the greateſt part of them, eſpecially in pariſh churches; yet ſtill they are read in a ſort of recitative. For other particulars, we refer the reader to Dr. King's "Rites and Ceremonies of the Greek church."

A conſiderable reformation was introduced into the Ruſſian church by the wiſdom and active zeal of Peter I. about the beginning of the 18th century, in conſequence of a ſcheme which was projected towards the cloſe of the century preceding. This great prince made no change in the articles of faith received among the Ruſſians, which contain the doctrine of the Greek church. But he took great pains to have this doctrine explained in a manner conformable to the dictates of right reaſon and the ſpirit of the Goſpel; and he uſed the moſt effectual methods to deſtroy, on the one hand, the influence of that hideous ſuperſtition that ſat brooding over the whole nation; and on the other, to diſpel the ignorance of the clergy and that of the people. In order to accelerate the execution of this laudable plan, Peter became the zealous protector and patron of arts and ſciences; and induſtriouſly endeavoured, by a variety of methods, to excite in his ſubjects a deſire of emerging from their ignorance and brutality, and a taſte for knowledge and the uſeful arts. See his biographical article. In reference to the preſent ſubject we may obſerve, that he extinguiſhed the infernal ſpirit of perſecution; aboliſhed the penal laws againſt thoſe who differed merely in religious opinion from the eſtabliſhed church, and granted to Chriſtians of all denominations liberty of conſcience, and the privilege of performing divine worſhip in the manner preſcribed by their reſpective liturgies and inſtitutions. This liberty, however, was ſo modified as to reſtrain and defeat any attempts that might be made by the Latins to promote the intereſts of popery in Ruſſia, or to extend the juriſdiction of the Roman pontiff beyond the chapels of that communion that were tolerated by law. The Jeſuits were not permitted to exerciſe the functions of miſſionaries or public teachers in Ruſſia; and a particular charge was given to the council, taking cognizance of eccleſiaſtical affairs, to uſe their utmoſt care and vigilance for preventing the propagation of Romiſh tenets among the people. Beſides, a very conſiderable change was introduced into the mode of governing the church. The ſplendid dignity of patriarch was ſuppreſſed; and this ſpirited prince claimed in conſequence of his authority as emperor, an abſolute authority in the church. The functions of this high and important office were intruſted with a council aſſembled at Peterſburgh, which was called the "Holy Synod," and in which one of the archbiſhops, the moſt diſtinguiſhed by his integrity and prudence, was appointed as preſident. The other orders of the clergy continued in their reſpective ranks and offices; but both their revenues and their authority were conſiderably diminiſhed. This council, or college, was appointed in the year 1721, and the emperor declared himſelf head of the church. The patriarchate in Ruſſia expired with Adrian, in the year 1700; and he was ſucceeded by an officer of more limited powers, under the name of exarch, or vicegerent of the patriarchal ſee. The government of the exarchy laſted ſomewhat more than 20 years; and by executing the orders of Peter the Great, led the way to the reformation of the clergy. At length the "Holy Legiſlative Synod" was eſtabliſhed by a ſpecial edict publiſhed through the whole empire. This ſynod or college conſiſted at firſt of twelve members; one preſident, two vice-preſidents, four counſellors, and four aſſeſſors; the 12th was charged with the care of eccleſiaſtical concerns at Moſcow, in a particular office, under the name of the ſynodical chancery, which depended on the ſynod.

The members were taken from the biſhops, archimandrites,

drites, hegumens, and prototypes of the moſt eminent monaſteries and churches. To theſe were ſoon added others, both from the regular and ſecular clergy, who were men of learning and fit to govern the church. In the edict by which Peter founded this eccleſiaſtical college, it is called "the general ſpiritual government;" and in the oath taken by the members, it is expreſsly determined, that no other than the ſovereign ſhould be conſidered as its head. In order to give it a higher eſtimation in the minds of the people, he honoured it with the title of "the holy legiſlative ſynod," a title which formerly belonged to the patriarchs. This ſynod was put upon an equality with the ſenate, and inveſted with the ſame powers. The election of biſhops was entruſted to the ſynod, which nominated two candidates, of whom the ſovereign choſe one. Theſe biſhops were authoritatively inſtructed as to their behaviour, power, and viſitation of their dioceſes, the eſtabliſhment and management of ſchools, and a variety of other particulars. The eccleſiaſtical reformation of Peter comprehended alſo the monks, upon whom the order and welfare of the Ruſſian church very much depended, and likewiſe the ſecular prieſts. See the Appendix to the work above cited.

The Georgians and Mingrelians, or as they were anciently called, the Iberians and Colchians, have declined ſo much ſince the Mahometan dominion has been eſtabliſhed in theſe countries, that they can ſcarcely be ranked in the number of Chriſtians. Theſe nations have a pontiff at their head, called "The Catholic;" they have alſo their biſhops and prieſts; but they are ſo ignorant, avaricious, and profligate, that they are a diſgrace to Chriſtianity.

The eaſtern Chriſtians, who renounce the communion of the Greek church, and differ from it both in doctrine and worſhip, may be comprehended under the two claſſes of *Monophyſites* or *Jacobites*, and *Neſtorians* or *Chaldæans*. See theſe articles.

The *Latin* or *Weſtern Church* comprehends all the churches of Italy, France, Spain, Africa, the North, and all other countries whither the Romans carried their language. In a more reſtricted ſenſe the *Latin* church, in contradiſtinction to the Greek church, denotes

The *Church* of *Rome*, which roſe to a very eminent degree of ſplendour and dominion, and exerciſed for ages an almoſt univerſal authority throughout the weſtern world. The various circumſtances that favoured its firſt advancement, and that contributed to the extent and long duration of its dominion, cannot be minutely detailed within our preſcribed limits. We muſt content ourſelves with briefly noticing ſome of the chief and moſt prominent. Rome, from the firſt foundation of the city, gradually advanced into an empire of ſuch extent, revenue, and permanence, as has been unparalleled in the world, either before or ſince. And from the firſt declenſion of that enormous power, ſhe inſenſibly became the ſeat of a new ſpring of empire, which, though not of equal celebrity with the former, has been much more extraordinary, and perhaps more difficult to be ſurmounted, becauſe it is deeply rooted in the paſſions, prejudices, and intereſts of mankind. Independently of the advantage reſulting from the extent of its ſecular dominion, the votaries of the Romiſh church found their right of ſpiritual empire on the prerogatives which they pretend to have been given by our Lord to the apoſtle Peter, and on the ſucceſſion of their biſhops to that apoſtle, and conſequently to thoſe prerogatives. Againſt theſe pretenſions, however, it has been alleged, that Peter did not poſſeſs the prerogatives which they aſcribe to him, and that their biſhops never had any juſt reaſon for denominating themſelves his ſucceſſors. Indeed, in point of right, whatever might have been the prerogatives of Peter, which were perſonal, and not official, no peculiar privilege can be claimed by any church, as derived from this apoſtle. But if we advert from the queſtion of right to the matter of fact, or the ſpecial relation of the ſee of Rome to the apoſtle Peter, the partiſans of papal ambition have never been able to ſupport their affirmations by any thing that deſerves the name of evidence. It has indeed been queſtioned, whether Peter ever was at Rome. The only ground on which the papiſt builds his aſſertion, that he was in that city, and founded the church in it, is tradition; and ſuch a tradition as muſt appear very ſuſpicious to reaſonable Chriſtians, being accompanied with a number of legendary ſtories, which are totally unworthy of regard. See our biographical article St. Peter. Allowing, however, that Peter ſuffered martyrdom at Rome, his journey thither muſt have been poſterior, not only to the period with which the hiſtory of the Acts concludes, but to the writing of Paul's epiſtles, which are wholly ſilent as to this fact. In this caſe it is manifeſt, that he could not have been the founder, nor even one of the earlieſt inſtructors of the Roman church. Moreover, if we admit that Peter, in the courſe of his peregrinations, viſited Rome, and that he was the founder of that church, yet no ſatisfactory evidence can be offered in order to prove that he was the biſhop of the place, according to the proper acceptation of the term, and that their biſhop, whoever he might have been, was diſtinguiſhed by any prerogative whatever, from any other biſhop. The common opinion leads us, if we ſet aſide the apoſtles, to aſſign to Linus the honour of being firſt biſhop of that ſee, who was ordained before the martyrdom both of Peter and of Paul; and yet the latter, in writing to Timothy, a little before his own death, introduces the name of Linus, notwithſtanding his pretended papal dignity, among other obſcure names, no where elſe to be found in the annals of hiſtory, without any marked diſtinction, and without ſo much as giving the ſovereign pontiff the precedency. Beſides, Paul in his epiſtle to the Galatians (chap. ii. 7, 8, 9.), an epiſtle written from Rome, denominates Peter the apoſtle of the circumciſion, to whoſe care was entruſted the converſion of the Jews, throughout the world, and under this character, his miſſion is contraſted with that of Paul, who is ſtyled, by way of eminence, the apoſtle of the Gentiles. To this reaſoning we may add the teſtimony of hiſtory. Irenæus, in a paſſage quoted from him by Euſebius, (l. v. c. 6.) ſhows clearly, that Peter was not conſidered, in his time, or near the end of the ſecond century, as having been biſhop of the church of Rome, or even as its ſole founder. Many other teſtimonies of a ſimilar kind might be produced, if it were neceſſary in ſo plain a caſe. Pope Innocent, who, about the beginning of the fifth century, appears to have been the firſt that thought of deriving the prerogatives of his ſee from the apoſtle Peter, acknowleges that Antioch, as well as Rome, had been properly the ſee of St. Peter; and that it yields to the ſee of Rome only becauſe Peter had accompliſhed there what he had begun at Antioch. After all, no hiſtorical fact can be more unqueſtionable, than that the origin of the ſuperiority of one epiſcopal ſee over another aroſe from the ſecular diviſion of the empire, and from no other conſideration whatever. Hence the pre-eminence of the ſee of Rome, whoſe biſhop, before the converſion of Conſtantine, had only the precedency among the prelates, as biſhop of the imperial city; but no juriſdiction beyond the bounds of the provinces, lying within the vicariate of Rome, as it was called, which was properly no patriarchate, being but the half of the civil dioceſe of Italy, and conſiderably inferior in extent to ſome of the patriarchates. When Conſtantinople became the ſeat of empire, it acquired correſponding

importance;

importance; and though the first place is given to Rome, in the council of Constantinople, A. D. 381, being that from which the emperor still continued to be named, the second was then given to Constantinople, because it was then an imperial city as well as the other. In short, had Rome never been the imperial city, its pastor never could have raised himself above his fellows. Had it continued the imperial city, he might, and probably would, have had such a primacy as to be accounted the first among the patriarchs, but without any thing like papal jurisdiction over church and state. Another circumstance which contributed to the advancement of the Romish church, was the munificence of the emperors, and the misjudged devotion of some great and opulent proselytes, by means of which its bishops rose from a state of obscurity to the most envied opulence and grandeur. Besides the causes already mentioned, viz. the pretended succession from St. Peter, the superior dignity of the city of Rome, and the opulence of her church, there were several others which co-operated in raising her to that astonishing degree of authority and splendour to which, in the course of a few centuries, she attained. The first of these, which we shall cursorily mention, is the vigilant and unremitting policy which she manifested, at an early period, in improving, for her own aggrandizement, every advantage which rank and wealth could bestow. As soon almost as Christianity had received the sanction of the legislature, the bishops of this city began to aspire after a kind of domination over their brethren, which might in time be rendered universal, analogous to the secular authority lodged in the emperors over the subjects of the empire. The distinctions of presbyter, bishop, primate, and patriarch, favoured their views. Their first acquisition, and with this they were for some time satisfied, was the honour of precedency, or primacy, which was conceded to the bishop of Rome. The council of Sardica, about the middle of the 4th century, encouraged the ambitious schemes of these prelates, by enacting a canon, which ordered, that if any bishop should think himself unjustly condemned by his own provincials and metropolitan, his judges might acquaint the bishop of Rome, who might either confirm their judgment, or order a re-examination of the cause. Of this canon the Romish bishops afterwards availed themselves to the exaltation of their see. Valentinian, not many years afterwards, enacted a law, empowering the bishop of Rome to examine and judge other bishops, so that religious disputes might not be decided by profane and secular judges, but by a Christian pontiff and his colleagues. However, neither the canon of Sardica, nor the rescript of the emperor, produced at first any very extensive effect. But the policy of Rome never relinquished any privilege or prerogative which it once obtained; and whilst it was the primary object to advance the papal power, every other consideration gave way to this. This eminently appeared on occasion of the difference which arose between the Eastern and Western churches in the business of Acacius, who, in a matter of controversy, opposed the Roman pontiff; and hence arose a schism between the oriental and occidental churches, which lasted 35 years, and from which the latter, or rather the see of Rome, derived considerable advantage in its progress towards absolute supremacy. In other controversies that occurred, however trivial in themselves, the church of Rome found that, by possessing the prerogative of deciding, she gained accession of authority. The exercise of this power occasioned appeals to the Roman pontiff, which established and extended his influence. It was by flattery of the emperor Phocas, who murdered his sovereign and family, and thus ensuring his favour, that the Roman pontiffs obtained the revocation of the edict which had conferred the title of "Universal bishop" on the patriarch of Constantinople, and a new decree entailing this title in perpetuity on the occupier of the see of Rome, who was actually vested with the primacy of all the bishops of the empire. With similar views of aggrandizement, pope Zachary, in the middle of the 8th century, assisted, with his council and influence, the usurper Pepin to depose his master and benefactor Childeric, king of France, with all his family, and to possess himself of his crown and kingdom. This favour, Pepin, in the next pontificate, retaliated, by aiding the pope to usurp the imperial dominions in Italy. Indeed, it was a maxim on which the Roman pontiffs very uniformly acted, and particularly sanctioned by Gregory, one of the best of them, that every thing, which served to advance the papal power and secure the supremacy of Rome, might be reckoned just and lawful.

Another circumstance, which deserves to be mentioned, because it tended at an early period to advance the authority of the Roman pontiff, was the following: To the vicarage of Rome belonged 10 provinces, including the islands of Sicily, Corsica, and Sardinia; but as in these there were no metropolitans, the vicar of Rome, or pope, had not only the power of an exarch over the whole 10 provinces, but that also of the primate in every province. In him, therefore, coalesced the metropolitical and patriarchal jurisdictions; and he had the charge, either by himself or his delegates, of ordaining every bishop within the provinces of his vicariate. These rights he gradually extended, as circumstances favoured his views, first to the whole prefecture of Italy, which included West Illyricum, and West Africa; afterwards to all the occidental churches, Gaul, Spain, and Britain; and lastly, as of divine right, and, therefore, unalienable, over the whole Catholic church. It was also a great advantage enjoyed by Rome, in consequence of her vast opulence and rich domains, that she was able to employ and support missions, in distant parts of Europe, for the propagation of the gospel; and, of course, when churches were planted in any country by means of missions and expence, they were always counted dependent on that as the mother church by whom the missionaries were employed. Another excellent piece of policy, by which the church of Rome extended and secured its authority, was the legatine power; introduced by Damascus near the end of the 4th century. The general ambition of the clerical order served also to promote the self-aggrandizing schemes of Rome. The monarchical form of the church, supported by the prejudices and superstition of the people, was the only adequate means both of preserving and of extending the high privileges, honours, titles, and immunities claimed universally by the sacred order, and for which they strenuously contended. This could not fail to induce them to put themselves under the protection of the only bishop in the west, who was both able and willing to support their bold pretensions. The ambition of secular princes also concurred in the establishment and exaltation of the papal hierarchy. The bishop of Rome by his extensive influence had it in his power to excite and foment, or to compromise and terminate internal discord, or foreign contests in all the states, which acknowledged his authority. We must not omit to mention another great engine of papal policy, by which its authority and interest were upheld and promoted, and that is the exemption granted by the pontiffs to particular ecclesiastics or communities, by which their subjection to the ordinary was dispensed with, and their immediate dependance on Rome preserved. From the various circumstances that have been recited, and many others of a similar nature, which our limits constrain us to omit, the rise, establishment,

establishment, extensive influence, and long duration of the church of Rome may be accounted for without difficulty. Moreover, it is easy to perceive that, when Rome had every thing at her disposal, all canons, in regard to discipline, and all decrees, in relation to doctrine, would point invariably to the support of this power. Hence, sprung the convenient doctrines of transubstantiation, purgatory, prayers, and masses for the dead, auricular confession, and the virtue of sacerdotal absolution. Hence also were derived, and, with this view, were enforced the canons extending so immensely the forbidden degrees of marriage, the peculiar power in the popes of dispensing with these, and other canons; the power of canonization, the celibacy of the clergy, the supererogatory merits of the saints, indulgences, and many others. See the several articles, and POPERY.

For the support of such an immense fabric as that of the Romish church, very ample revenues were necessary; and its sources of supply were as various and extensive as the different modifications of its influence and dominion. Every country in which it prevailed, contributed, in a variety of ways, not only to its subsistence, but to its magnificence and to all the costly undertakings in which it engaged. Princes and kingdoms were its tributaries; by impositions and by benevolences; by donations and bequests, it filled its treasures, and amassed wealth sufficient to answer all the purposes of its numberless establishments. It would be endless to recount the various claims which it set up under the names of annats, tythes, peter-pence, reservations, resignations, expectations, graces, &c. besides the casualties arising from pilgrimages, jubilees, indulgences, the dues of appeals, confirmations, dispensations, investitures, &c. &c. which were so many sorts of tribute.

After this brief sketch of the principal circumstances that contributed to the rise and establishment of the church of Rome, or Romish hierarchy, we shall terminate this article, with a concise account of the causes that brought about the declension of this wonderful empire over the consciences, the persons, and the property of mankind. The opinions, we may observe, which are the great bulwarks of spiritual tyranny, are founded in ignorance and superstition; and these are always accompanied with great credulity. We may add, that the three great engines which Rome has employed for maintaining the ignorance of her votaries, and for preventing every acquisition in knowledge that might prove subversive of her high pretensions, are the concealment of Scripture from the people, and even of the import of the forms of public worship, by the daily use of a dead language; the prohibition, under the severest penalties, of every thing which might serve to enlighten and undeceive the world; and the system of persecution. The first two were chiefly calculated for preventing all intercourse with that most formidable enemy of superstition, knowledge; and the third intended principally for checking its progress wherever it appears to have made any advances. By the noble discovery of the art of printing, knowledge has been diffused; and this has proved more baneful to the cause of superstition and tyranny than any event that has happened since the first promulgation of the gospel. Although knowledge had been gaining ground for some centuries before, its progress was slow; but the art of printing served to accelerate its progress to an inconceivable degree. When learning was thus brought within the reach of the middle ranks, the dead languages became a very general study. The Scriptures were read by most students in the Latin vulgate, and by some few in the Greek. The early writers of the church were also read: reading occasioned reflection, and comparison. To this purpose, it is said, that a picture which Huss, one of the first reformers, had procured, and exhibited to the people, in which the entry of our Lord into Jerusalem, riding on an ass, attended by his disciples on foot, in a very homely garb, was contrasted by a procession of the pope and cardinals, in their pontifical habits, and magnificently mounted on the finest horses, richly caparisoned, and adorned with gold, and silver, and jewels, did not a little contribute to excite the indignation of spectators against their spiritual lords, as bearing no resemblance to those meek, humble, and unassuming men, from whom they pretended to derive all their high powers and prerogatives. But the disparity was not less remarkable in disposition and character than in external circumstances. The dignified clergy of the Romish church, as they were both wealthy and powerful, were generally indolent, proud, ambitious, envious, vindictive, and sometimes profligate. Those again, on whom the burden of the service was devolved, as they were both needy and dependent, and often ignorant, had a share of the vices, which commonly accompany these circumstances. They were false, mercenary, and servile. This general charge admits, however, of various exceptions; for in the higher and lower ranks of clergymen, there were many persons whose characters were irreproachable, and lives exemplary. It will also be admitted, as a circumstance of additional importance, that the different kingdoms and states of Europe had, at length, attained a better and more settled constitution than formerly; statesmen began to entertain more extensive views of policy, and princes to understand better their own rights and interests. As men's eyes were opened, they saw more clearly the encroachments and usurpations of the Romish priesthood. This discovery, concurring with the abhorrence and contempt they entertained of many of the priests themselves on personal accounts, namely, the neglect or prostitution of their sacred functions, and the dissoluteness of their lives, led them to inquire a little into the foundations of the high powers and privileges which they claimed. This was a subject which would not bear examination. As the great foundations of the papal hierarchy were the people's ignorance, superstition, and credulity; when these were removed, the whole fabric began to totter and gradually fell to pieces. Accordingly, in all the heresies which sprang up in the different parts of Europe, since the revival of letters, church power seems to have been the principal object at which the reputed heretics aimed. This will appear manifest to any one who considers the accusations brought against Waldo of Lyons, and his followers, Wickliff of England, Huss of Bohemia, Luther of Germany, and Zuinglius of Switzerland; and compares them with those brought against the heresiarchs of the primitive ages, such as Arius, Pelagius, Nestorius, Eutychius, in none of whom was there any direct attack against ecclesiastics. The usurpation and tyranny of ecclesiastical superiors, and the ignorance in which they kept the people, were at first almost the only topics. Hence, they proceeded to censure practical abuses in ceremonies and discipline. The third and last step of their progress was to expose errors in doctrine. For some centuries before the time of Luther, the corruptions that had found their way into the church had been the subject of complaint and murmur in various places. From the time of Wickliff, preaching in England and publishing his sentiments to the world in Latin tracts, which was near a century and a half before the reformation, men's attention was roused to such topics, and people grew bolder every day in speaking out their opinions. In the remote kingdom of Bohemia, Wickliff's doctrine extended its influence, and the fate of his two famous disciples, John Huss and Jerome of Prague, afforded melancholy instances of of it. In what related to the corruptions of the church and of the clergy, together with the exorbitance and abufe of ecclefiaftical power; they were evidently the followers of Wickliff, however they might have differed from him in other particulars; and at length emboldened by his writings and example, they bore an open teftimony to the truth in their native country, and fealed it with their blood at Conftance. This happened about a century before the public remonftrances of Luther, and paved the way for the reformation. Thus previoufly difpofed, as Europe feemed to be, towards the clofe of the 15th and beginning of the 16th century, nothing could be more evident to any perfons of difcernment, than that Chriftendom was ripe for a revolution in its ecclefiaftical polity, and feemed only to wait for a favourable occafion. Such an occafion the avarice of pope Leo X., and the impiety, as well as indifcretion, of his minifters and agents, foon furnifhed. Campbell's Ecclef. Hift. paffim. See *Lutheran* CHURCH, *Reformed* CHURCH, LUTHER, and REFORMATION.

CHURCH, *Gallican*, denotes the church of France, as it fubfifted before the revolution, under the direction and government of its bifhops and paftors. This church has always enjoyed certain immunities and franchifes, not as grants from the popes, but derived to her from her firft original, which fhe has carefully maintained. Thefe privileges depend on two maxims; viz. 1. That the pope has no authority or right to command or order any thing, general or particular, in which the temporalities and civil rights of this kingdom are concerned. 2. That notwithftanding the pope's fupremacy is owned in cafes purely fpiritual, yet in France, his power is limited and regulated by the decrees and canons of ancient councils, received in that realm. A fcheme of union between the church of England and the Gallican church was projected by the doctors of the Sorbonne in the beginning of the 18th century; and a correfpondence was carried on, in 1717 and 1718, between archbifhop Wake and Dr. Du Pin on the fubject; which terminated without fuccefs.

CHURCH, *Reformed*, in a general fenfe, comprehends all thofe churches that have feparated from the church of Rome, and that have renounced the fpiritual jurifdiction and fupremacy of the Roman pontiff. Accordingly, the Romanifts call it the "Weftern Schifm," as they denominate the Greek church the "Eaftern Schifm."

The denomination of "reformed" is often reftricted to thofe Proteftant churches which did not embrace the doctrine and difcipline of Luther. The title was firft affumed by the French Proteftants, and afterwards became the common denomination of all the Calviniftical churches on the continent. But in England the term "reformed" is generally ufed in its genuine and extenfive fenfe, as ftanding in oppofition to popery alone; and in this large fenfe it comprehends the Lutheran church in all its modifications, the Calvinift church, the church of England, the church of Scotland, &c. When this epithet of "reformed" is ufed in oppofition to the community founded by Luther, it reprefents not a fingle church, as the epifcopal, Prefbyterian, or Independent, but rather a collection of churches; which, though they be invifibly united by a belief and profeffion of the fundamental doctrines of Chriftianity, yet frequent feparate places of worfhip, and have, each of them, a vifible centre of external union peculiar to themfelves, which is formed by certain peculiarities in their refpective rules of public worfhip and ecclefiaftical government. This matter may be illuftrated by an attentive examination of the difcipline, polity, and worfhip of the churches of England, Scotland, Holland, and Switzerland. The firft of thefe churches, being governed by bifhops, and not admitting the validity of the Prefbyterian ordination, differs from the other three more than any of thefe differ from each other. There are, however, peculiarities of government and worfhip, that diftinguifh the church of Holland from that of Scotland. The inftitution of deacons, the ufe of forms for the celebration of the facrament, an ordinary form of prayer, the obfervation of the feftivals of Chriftmas, Eafter, Afcenfion-day, and Whitfuntide are eftablifhed in the Dutch church; and, it is well known, that the church of Scotland differs from it extremely in thefe refpects. For an account of the origin, progrefs, and eftablifhment of the "reformed church," in the more general fenfe of the term; fee REFORMATION.

The founder of the "reformed church," in a more reftricted fenfe, was Ulrick Zuingle, a native of Switzerland, who combined, with uncommon penetration and acutenefs, an ardent zeal for truth. Zuingle wifhed to remove out of the churches, and to abolifh in the ceremonies and appendages of public worfhip, many things which Luther was difpofed to treat with toleration and indulgence; fuch as images, altars, wax-tapers, the form of exorcifm, and private confeffion. What he aimed at eftablifhing in his country was a method and form of divine worfhip diftinguifhed by its fimplicity, and as far remote as could be from every thing that might have the fmalleft tendency, according to his ideas, to nourifh a fpirit of fuperftition. Moreover, his fentiments concerning feveral points of theology, and more efpecially his opinions relating to the facrament of the Lord's Supper, were very different from thofe of Luther. Of thefe fentiments and opinions feveral were adopted in Switzerland by thofe who concurred with Zuingle in promoting the caufe of the reformation, and were tranfmitted by them to all the Helvetic churches that threw off the yoke of Rome. From Switzerland thefe opinions were propagated among the neighbouring nations by the friends and difciples of Zuingle; and thus the primitive reformed church, that was founded by this eminent ecclefiaftic, and whofe extent at firft was not very confiderable, gathered ftrength by degrees, and made daily new acquifitions. After the death of Zuingle, feveral Lutheran doctors of the more moderate fort, and particularly Martin Bucer, made an attempt to form a kind of reconciliation between the partizans of the Lutheran and reformed churches; but their endeavours were unfuccefsful. The breach between them was widened by Calvin, who, by his activity and zeal, confiderably enlarged the boundaries of the reformed church, propagated his doctrine, and gained profelytes and patrons to his theological fyftem, in feveral countries of Europe. The plan of doctrine and difcipline, which Zuingle had formed, was altered and corrected by Calvin, particularly in relation to three points. Zuingle, in his form of ecclefiaftical government, had given an abfolute and unbounded power, in religious matters, to the civil magiftrate, to whom he had placed the clergy in a degree of fubjection, with which many were offended. He allowed, however, certain fubordination and difference of rank among the minifters of the church, and thought it expedient to place at their head a perpetual prefident, or fuperintendant, with a certain degree of infpection and authority over the whole body. Calvin, on the contrary, reduced the power of the magiftrate, in religious matters, within narrow bounds. He declared the church a feparate and independent body, endowed with the power of legiflating for itfelf. He maintained that it was to be governed by two ecclefiaftical bodies, viz. "the venerable company" of the paftors and profeffors, and the "confiftory;" and he left to the civil magiftrate little elfe befides the privilege of protecting and defending the church, and providing for what related to its external exigencies and concerns. Thus this eminent reformer introduced into the republic of Geneva, and endeavoured to introduce into all the reformed churches throughout Europe, that form of ecclesiastical government, which is called "Presbyterian," from its neither admitting the institution of bishops, nor any subordination among the clergy; and conformably to this principle, that all ministers of the Gospel are, by the law of God, declared to be equal in rank and authority. In consequence of this principle, he established at Geneva a consistory, or ecclesiastical judicatory, over which he himself presided (though at his death he advised the clergy not to give him a successor), composed of ruling elders, partly pastors and partly laymen; and he invested this ecclesiastical body with a high degree of power and authority. He also convened synods, composed of the ruling elders of different churches, and in these consistories and synods had laws enacted for the regulation of all matters of a religious nature, and among other things restored to its former vigour the ancient practice of excommunication. All these things were done with the consent of the greatest part of the senate of Geneva. Calvin also, with a view, as it is said, of facilitating the desired union with the Lutheran church, substituted, instead of the system adopted by Zuingle with regard to the eucharist, another, which appeared more conformable to the doctrine of that church, and which, in reality, differed little from it. The doctrine of Zuingle supposed only a symbolical, or figurative, presence of the body and blood of Christ in the eucharist, and represented a pious remembrance of Christ's death, and of the benefits it procured to mankind, as the only fruits that arose from the celebration of the Lord's Supper; whereas Calvin acknowledged a real, though spiritual, presence of Christ in this sacrament; or, in other words, he maintained, that true Christians were, by this ordinance, in a certain manner united to the man Christ; and that from this union the spiritual life derived true vigour in the soul, and was still carried on, in a progressive motion, to greater degrees of purity and perfection. See CONSUBSTANTIATION, EUCHARIST, and IMPANATION. Moreover, Calvin zealously inculcated the absolute decree of God, with respect to the future and everlasting condition of the human race, which formed no part of the theological creed of Zuingle. The first of the above-mentioned points was not universally allowed, notwithstanding the credit and influence of Calvin, in the reformed churches. The English and Germans rejected it, and even the Swiss refused to adopt it. It was, however, received by the reformed churches in France, Holland, and Scotland. Several churches, more especially those of Zurich and Bern, obstinately maintained the doctrine of Zuingle in relation to the eucharist; neither could they be easily persuaded to admit, as an article of faith, the doctrine of predestination, as it had been taught by Calvin. His followers, nevertheless, in process of time, aided by his high reputation and learned writings, induced almost all the reformed churches to adopt his theological system. In various provinces of Germany, the tenets, rites, and institutions of the church of Geneva, were adopted and enforced by the ruling powers. This was the case, particularly, with the palatinate and the republic of Bremen. The French Protestants, very generally, entered into the bonds of fraternal communion with the church of Geneva. See CHURCH of *Scotland* and CHURCH of *England*.

CHURCH, *Lutheran*, derives its appellation from Luther, who, having been eminently instrumental in bringing about the reformation (which see), formed the project of founding a church upon principles entirely opposite to those of Rome, and of establishing in it a system of doctrine and ecclesiastical discipline, which he conceived to be agreeable to the spirit and precepts of the Gospel. Accordingly, the rise of this church must be dated from that remarkable period, when the pontiff Leo X. drove Martin Luther, with his friends and followers, from the bosom of the Roman hierarchy, by a solemn and violent sentence of excommunication; and it began to acquire a regular form, and a considerable degree of stability and consistence, from the year 1530, when the system of doctrine and morality it had adopted was drawn up and presented to the diet of Augsburg. It was raised to the dignity of a lawful and complete hierarchy, totally independent on the laws and jurisdiction of the Roman pontiff, in consequence of the treaty concluded at Passau in the year 1552, between Charles V. and Maurice, elector of Saxony, relating to the religious affairs of the empire. The great and leading principle of the Lutheran church, says Mosheim (Eccl. Hist. vol. iv.) is, that the Holy Scriptures are the only source from whence we are to draw our religious sentiments, whether they relate to faith or practice; and that these inspired writings are, in all matters essential to salvation, so plain, and so easy to be thoroughly understood, that their signification may be learned, without the aid of an expositor, by every person of common sense, who has a competent knowledge of the language in which they are composed. There are, also, certain formularies adopted by this church, which contain the principal points of its doctrine; but the books, containing these formularies, have no authority beyond what they derive from the scriptures of truth, whose sense and meaning they are designed to convey; nor are the Lutheran doctors permitted to interpret or explain these books so as to draw from thence any propositions that are inconsistent with the express declarations of the word of God. The principal of these human productions is the "Confession of Augsburg," with the annexed "Defence" of it. In the next rank may be placed the "Articles of Smalcald," together with the shorter and larger "Catechisms of Luther." To these standard books most churches add the "Form of Concord." The supreme civil rulers of every Lutheran state are invested with the dignity and perform the functions of supremacy in the church; but they are effectually restrained, by the fundamental pinciples of the doctrine they profess, from any attempt to change or destroy the established rule of faith and manners, to make any alteration in the essential doctrines of their religion, or in any thing that is intimately connected with them, or to impose their particular opinions upon their subjects in an arbitrary and despotic manner.

The councils, or societies, appointed by the sovereign to watch over the interests of the church, and to govern and direct its affairs, are composed of persons versed in the knowledge both of civil and ecclesiastical law, and, according to a very ancient denomination, are called "consistories." The internal government of the Lutheran church seems equally removed from episcopacy on the one hand, and from Presbyterianism on the other, if we except the kingdoms of Sweden and Denmark, in which the church is ruled by bishops and superintendents, under the inspection and authority of the sovereign. The archbishop of Upsal is primate of Sweden, and the only archbishop among the Lutherans; and his revenues do not amount to more than 400l. annually; and those of the other bishops are proportionably small. Every country has its own liturgies which prescribe every thing that relates to external worship and the public exercise of religion. Assemblies for the celebration of divine worship meet every where at stated times. The Holy Scriptures are publicly read, prayers and hymns are addressed to the Deity, the sacraments are administered, and the people are instructed in the knowledge of religion, and excited to the practice of

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virtue by the discourses of their ministers. Among the days that are held sacred in the Lutheran church, besides Sunday, we may reckon all such as were signalized by the glorious and important events that proclaim the celestial mission of the Saviour, and the divine authority of his holy religion. The Lutheran church has extended itself to Asia and America; and formed several congregations in those remote parts of the world. Mosheim's E.H. vol. iv.

CHURCH *of England* is that branch of the reformed church which was established in England after the separation from the Romish church; which took place in the reign of Henry VIII. who renounced the pope's supremacy. The English, who first threw off the yoke of Rome, seemed to be more inclined to the sentiments of Luther concerning the eucharist, the form of public worship, and ecclesiastical government, than to those of the Swiss churches. But after the death of Henry VIII. the scene changed; when, by the industrious zeal of Calvin and his disciples, more especially Peter Martyr, the cause of Lutheranism lost ground considerably; and the universities, schools, and churches, became the oracles of Calvinism, which also acquired new votaries among the people. Accordingly, when it was proposed, in the reign of Edward VI. to give a fixed and stable form to the doctrine and discipline of the church, Geneva was acknowledged as a sister church; and the theological system, then established by Calvin, was adopted, and rendered the public rule of faith in England. This, however, was done without any change of the episcopal form of government which had always taken place, and was entirely different from that of Geneva; and several religious rites and ceremonies were retained, which many of the reformed considered as superstitious. This latter circumstance gave rise to many dissensions in subsequent ages, which proved detrimental both to the civil and ecclesiastical constitution of Great Britain. The controversy concerning the ceremonial part of divine worship, commenced with those exiles who, in 1554, fled from the bloody rage and inhuman tyranny of queen Mary, and took refuge in Germany. After the accession of queen Elizabeth, these exiles returned to their own country, and renewed the contest at home which had begun abroad. Queen Elizabeth, unwilling to strip religion of the ceremonies which remained in it, was rather inclined to bring the public worship still nearer the Romish ritual; and had a great propensity to several usages in the church of Rome, which were justly looked upon as superstitious. She publicly thanked one of her chaplains, who had preached in defence of the real presence; she was fond of images, and retained some in her private chapel, and would undoubtedly have forbidden the marriage of the clergy, if Cecil, her secretary, had not interposed. Having appointed a committee of divines to review king Edward's liturgy, she gave them an order to strike out all offensive passages against the pope, and to make people easy about the corporal presence of Christ in the sacrament. For an account of the disputes that agitated the country on this occasion, see the article PURITAN.

From the time of Henry VIII. the kings of England have considered themselves as supreme heads of the church, in relation both to its spiritual and its temporal concerns; and on the ground of this title, both Henry VIII. and his son Edward assumed an extensive authority and jurisdiction in the church, and seemed to consider their spiritual power as equal to that which had been unworthily possessed and exercised by the Roman pontiff. Accordingly the constitution of the church of England resembled that of the state, and a striking analogy subsists between the civil and ecclesiastical governments established in this country. The clergy, consisting of the upper and lower houses of convocation, are assembled (whenever they do assemble) by the archbishop of Canterbury, in consequence of an order from the sovereign, and in these meetings are proposed, in common council, such measures as seem to be necessary to the well-being of the church: these measures are laid before the king and parliament, and derive from their approbation and authority the form of laws.

The 37th article of the church of England expressly declares and ordains that "the queen's majesty hath the chief power in this realm of England, and other her dominions, unto whom the chief government of all estates of this realm, whether they be ecclesiastical or civil, in all causes, doth appertain, and is not, nor ought to be, subject to any foreign jurisdiction." It is well known, however, that for the first three centuries, the Christian religion was not embraced or protected by any Roman emperor. But after the conversion of Constantine, this first Christian emperor, and many of his successors, enacted laws which are now extant in the codes of Theodosius and Justinian, relative to ecclesiastical matters. When the empire of Rome was divided into independent kingdoms, the sovereigns exercised the same authority over all their subjects, without any distinction, and made such regulations, free from all foreign controul, as appeared to them expedient for the good government of their respective churches. This continued to be the case till the aspiring ambition of the bishops of Rome prompted them to claim universal dominion, not only over ecclesiastics, but over sovereign princes, throughout the Christian world. Of the fact there is no question; and it has been alleged by the advocates of the supremacy of the sovereign, that the authority which the constitution of Great Britain gives to our sovereign in ecclesiastical affairs, is founded in Scripture; is conformable to the practice of the times previous to the corruptions and usurpations of popery; and is perfectly agreeable to the reason and nature of things. This claim, however, was contested, on the grounds both of reason and Scripture, soon after it was assumed; and it has been considered by many persons in later times as inconsistent with the evangelical constitution of the Christian church, and with the sole legislative, judicial, and sovereign authority of Christ, the head of the church, in all religious matters. It has been also maintained, that the subjection to higher powers, and obedience to magistrates, which the Scripture enjoins on Christians, relate only to civil, but not at all to religious matters; for this obvious reason, that the magistracy at that time was every where Pagan. See SUPREMACY.

Moreover, the 20th article of the church of England declares and ordains, "that the church hath power to decree rites and ceremonies, and authority in controversies of faith; and yet it is not lawful for the church to ordain any thing that is contrary to God's word written, neither may it so expound one place of Scripture, that it be repugnant to another." This article, from the time of its first introduction to the present day, has been the occasion of great difference of opinion and of dispute between its defenders on the one hand, and its opposers on the other. By the former it has been argued, that, the church being a society of men united for the most important purposes, it is necessary that its affairs, like those of every other society, should be conducted by certain rules; and that, although the New Testament does not contain any particular directions upon the subject of rites and ceremonies, every church is left at liberty to prescribe such to its own members as are consistent with the general precepts enjoined by the sacred writers; such as "Give none offence;" "Let all things be done decently and in order;" "Let all things be done unto edifying, &c."

This

This liberty, it is said, was allowed under the Jewish dispensation; and hence it is concluded that it is lawful for a society of Christians, whose religion is designed for all ages and countries, to make any regulations which may tend to promote the great objects for which they have formed themselves into one body. In vindication of the authority ascribed to the church in controversies of faith, reference has been made to the decree of the apostles and elders assembled at Jerusalem, which was communicated to the churches then established in different parts of Asia, and to which their obedience was required; and it has been said, that this was an instance of authority exercised by the church, under the direction of the inspired apostles, in a controversy of faith. Two passages have also been cited (viz. 1 Tim. i. 3, and Titus iii. 10.) in order to shew, that Timothy and Titus had authority given them to regulate the faith of the churches over which they were appointed to preside; and hence it has been inferred, that there must have been, at that very early period, some fixed test, by which the faith of professed Christians was to be judged: the consequence of not conforming to which test was, by apostolical authority, excommunication. It is further added, that this practice appears, from ecclesiastical history, to have been usual in every period of the Christian church. See the lord bishop of Lincoln's Elements of Christian Theology, vol. ii. On the other hand, it has been pleaded, that this authority claimed by the church of England is lodged in the king and parliament of these realms, and not with the church, considered as composed of the bishops and clergy. It has been said, that all the clergy of this kingdom, with all the bishops at their head, have not the least authority to enjoin one ceremony or rite of worship; or to either establish or annul one article of faith. All power and jurisdiction pertaining to these matters is lodged chiefly in lay-hands; it is solely in the king and parliament, under whose direction and controul the clergy are to act. It has been also said, that the bishops and clergy were so far from having any hand in the first forming of our present established church, or in ordering its rites and articles of faith; that it was done not only without, but in actual opposition to them: for in the 1st of queen Elizabeth the parliament alone established the queen's supremacy and the common-prayer book, in spite of all opposition from the bishops in the House of Lords; and the convocation then sitting was so far from having any hand in those church acts for reformation, that it presented to the parliament several propositions in behalf of the tenets of popery, directly contrary to the proceedings of the parliament. It has been also queried, who gave the civil magistrate this power to decree rites in Christian worship, which Christ never decreed, and to make articles of faith which Christ never made? See Mr. White's Three Letters, and the Dissenting Gentleman's Answer.

It was the general opinion of the British divines that lived in the earliest period of the Reformation, and though it was first abandoned by archbishop Whitgift, it has been maintained by later writers of the highest rank in the church, (see Elem. of Theology, above cited,) "that Jesus Christ has left upon record no express injunctions with respect to the external form of government that is to be observed in his church; and, consequently, that every nation hath a right to establish such a form, as seemeth conducive to the interests, and to the peculiar state, circumstances, and exigencies of the community, provided that such an establishment be in no respect prejudicial to truth, or favourable to the revival of superstition." See Bishop.

The doctrines of the church of England are contained in the 39 articles. (See Article *of Faith*.) These articles were principally compiled by archbishop Cranmer; and it appears, from some passages quoted by the bishop of Lincoln, (*ubi supra*,) from a publication, entitled, "Necessary Doctrine and Erudition for any Christian Man," which was confirmed by act of parliament, that his sentiments on the subject of predestination and grace inclined more to those afterwards inculcated by Arminius and the synod of Dort, than to those of Calvin; and in this respect the sentiments of Ridley, Latimer, and Hooper, coincided with those of Cranmer. The worship of the church of England was directed by a liturgy, for an account of which, see Liturgy. When James I. ascended the throne on the death of Elizabeth, the Puritans entertained hopes, from his having received his education in Scotland, that he would mitigate the vexations they had suffered from their attachment to the discipline and worship of the church of Geneva. But they soon found that their expectations were unfounded. An episcopal hierarchy was more favourable to his views than the Presbyterian form of ecclesiastical government; and he, therefore, distinguished the bishops with peculiar expressions of his favour, extended their authority, increased their prerogatives, and publicly adopted and inculcated the following maxim, "No bishop, no king." When the British divines returned from the synod at Dort, the king, together with the greatest part of the episcopal clergy, discovered their inclination to the sentiments of Arminius, relating to the divine decrees, which they thought preferable to those of Calvin and Gomarus. His son and successor, Charles I., who had imbibed his father's political and religious principles, directed the whole scope of his administration towards the three following objects: "The extending of the royal prerogative, and the raising of the power of the crown above the authority of the law—the reduction of all the churches of Great Britain and Ireland under the jurisdiction of bishops, whose government he looked upon as of divine institution, and also as the most adapted to guard the privileges and majesty of the throne—and, lastly, the suppression of the opinions and institutions that were peculiar to Calvinism, and the modelling of the doctrine, discipline, ceremonies, and policy of the church of England, after the spirit and constitution of the primitive church." The instrument he employed for the execution of his plan was bishop Laud of London, afterwards archbishop of Canterbury. (See the article Laud.) After the death of Laud, when the dissensions between the king and parliament arrived at their height, the great council of the nation, instigated by the Puritans and Independents, abolished episcopal government; and proceeded to condemn and abrogate every thing in the ecclesiastical establishment that was contrary to the doctrine, worship, and discipline of the church of Geneva. As soon as Charles II. was re-established on the throne of his ancestors, the ancient forms of ecclesiastical government and public worship were restored; and in 1662, a public law, intitled, the "Act of Uniformity," was enacted, by which all who refused to observe the rites, and subscribe the doctrines, of the church of England, were entirely excluded from its dominion. In the reign of king William, and particularly in 1689, the divisions among the friends of episcopacy ran high, and terminated in that famous schism, if it may be so called, in the church of England, which produced the two parties denominated "High Church," or "Non-Jurors," and "Low-Churchmen."

The Church of England which is now the chief and leading branch of the great community distinguished by the denomination of the Reformed Church, continues much in the same state and is governed by the same principles, which it assumed at the revolution, under the reign of king William

liam III. The established form of church-government is episcopacy, which is embraced by the sovereign, the nobility, and the greatest part of the people. The Presbyterians and other numerous sects comprehended under the general appellation of non-conformists, enjoy the sweets of religious liberty, under the influence of a legal toleration; and whatever may be the private sentiments or governing dispositions of a few individuals, the dignitaries of the church and the rulers of the state manifest a liberal and candid temper; nor is there any reason to apprehend any species or degree of persecution, in the present enlightened age, either from the church or the state. Those who are comprehended within the pale of the church, and those who are without it, enjoy, as far as the civil or ecclesiastical government is concerned, unmolested freedom and tranquillity. The members of this church may be divided into two classes, according to their different ideas of the origin, extent, and dignity of episcopal jurisdiction. Whilst some look upon the government of bishops to be founded on the authority of a divine institution, and are zealous for extending the power and prerogatives of the church, of which description, the number, we conceive, is very inconsiderable; others, and they form the very decided majority, of a more mild and sedate spirit, though they consider the episcopal form of government as far superior to every other system of ecclesiastical polity, and recommend all the precautions that are necessary for its preservation and the independence of the clergy, yet do not carry this attachment to such an excessive degree, as to refuse the name of a "church" to every religious community that is not governed by a bishop, or to defend the prerogatives and pretensions of the episcopal order with an intemperate zeal. To the spirit of the established church of England, in relation to those who dissent from its rule of doctrine and government, we have already paid our tribute of respect and commendation. We shall close this part of our article with the words of the learned and amiable Dr. Jortin, (Diss. ii. p. 3.) as they are cited by the bishop of Lincoln *(ubi supra)*, without taking upon us to determine whether the articles of the church are Calvinistic or Arminian, or what is the proportion of those who adopt either scheme of interpreting them, or vouching for the justice of the representation: "In England, at the time of the synod of Dort, we were much divided in our opinion concerning the controverted articles; but our divines having taken the liberty to think and judge for themselves, and the civil government not interposing, it has come to pass, that from that time to this, almost all persons here, of any note for learning and abilities, have bid adieu to Calvinism, have sided with the Remonstrants, and have left the Fatalists to follow their own opinions, and to rejoice (since they can rejoice) in a religious system consisting of human creatures without liberty, doctrines without sense, faith without reason, and a God without mercy."

The revenue of the church of England has been stated by two late writers, from whose publications we shall extract the following particulars. The bishop of Landaff (Dr. Watson) in his "Letter to the Archbishop of Canterbury," printed in 1783, assures us, that the whole income of the church, including bishoprics, deans and chapters, rectories, vicarages, dignities, and benefices of all kinds, and even the two universities with their respective colleges, doth not amount, upon the most liberal calculation, to 1,500,000 *l.* a year. Consequently, if we had no bishops to inspect and govern the church; no deaneries, prebendaries, or canonries, to stimulate the clergy to excel in literary attainments; no universities or colleges to instruct our youth; nothing but parochial clergy, and all of these provided for by an equal partition of the present ecclesiastical revenues, there would not be, estimating the number of the clergy at ten thousand, above 150 *l.* a year for each individual. The learned prelate adds, that though the whole revenue of the church is so inconsiderable, as not to admit any diminution of it, yet a somewhat better distribution of it might be introduced, with much advantage to the state, and without the least injustice to any individual. For an account of the plan which he proposes, see AUGMENTATION. Another writer, Mr. Cove, vicar of Sithney in Cornwall, in his "Essay on the Revenues of the Church of England," 2d ed. 1797, says, that though the cathedral revenues, throughout the kingdom, amount to the gross sum of 140,000 *l.* *per annum*, there are in all, not less than 1700 persons who, in a greater or smaller proportion, participate these revenues. The parochial clergy, he adds, have been more fortunate and successful than either their episcopal or dignified brethren. Their incomes, being chiefly dependent on the state of landed property, whosoever might be the possessors of it, have been necessarily more augmented by the increased value of the rental of that property; and their rights and claims, not being of a fleeting nature, but immoveably affixed to the soil of each parish, have suffered little diminution, except from the easiness, inattention, and neglect of the clergy themselves.

It appears from the "Liber Regis," according to archdeacon Plymley in his "Charge to the Clergy of Salop, in the year 1793," that there are in England and Wales 5,098 rectories, 3,687 vicarages, and 2,970 churches, which are neither rectorial nor vicarial; in all 11,755 churches, contained in about 10,000 parishes, at which number the parishes throughout the kingdom are usually estimated.

Of these rectories many are, without doubt, highly valuable. The same may be said in respect to some of the vicarages, from being possessed of large glebes or large endowments, or from both causes united; but however there are many rectories, and vicarages, in particular, whose tithes are wholly impropriated, and without even any parsonage house. Of the churches, which are neither rectorial nor vicarial, perhaps two-fifths are merely chapels of ease, and appendant to some extensive and valuable benefices, or else built on speculation in populous parts of the kingdom, in which districts they are chiefly to be found. And of the remaining churches to which neither houses, glebes, nor tithes most commonly belong, the incomes must necessarily be very inconsiderable, as they can alone proceed from trifling contingencies.

From the aggregate amount of the incomes of 3,181 livings, now and formerly in charge in the king's books, situated in every county in the kingdom, and whose value hath been collected almost entirely within the last ten years, from various sources of public and private information, it appears that each of these livings is now worth, on the average, 141 *l.* per annum, and that when compared with the value annexed to them in the king's books, they have all increased in the general proportion of about ten to one, since the time of the reformation; but that the rectories have increased in the ratio of nearly eleven to one, and are at present of the yearly value of 162 *l.* each, and that the vicarages have increased in the ratio of rather more than nine to one, and are at present of the yearly value of 106 *l.* each. The number of rectories included in this calculation, is 2,037, and of the vicarages 1,144; the collective value of the former in the king's books being 30,158 *l.* and of the latter 13,379 *l.*, and the collective value of the former at present being 330,754 *l.* and of the latter 121,403 *l.* per annum.

 According,

According, then, to the prefent average value of thefe rectories and vicarages, and to the number of the rectorial, vicarial, and other churches throughout the kingdom, as before given from the "Liber Regis," the revenues of the parochial clergy will be increafed to the amount of 1,313,000 *l.* per annum, as thus appears: 5,098 rectories, at 162 *l.* each, will give 825,876 *l.*—3,687 vicarages, at 106 *l.* each, will give 398,222 *l.* And 1782 (that is, three-fifths of 2,970) churches, which are neither rectorial nor vicarial, but are prefumed to be parochial cures, at, fuppofe the ample allowance of—50 *l.* each, will give 89,100 *l.* And, when to thefe fums are added the epifcopal, cathedral, and univerfity revenues amounting, to 392,000 *l.* per annum, it will be feen that the bifhop of Landaff's valuation of the church and univerfity revenues is exceeded by the fum of 205,000 *l.*

From the revenues, this author proceeds to form an eftimate of the number of the eftablifhed clergy:

They have been varioufly eftimated, as much above 20,000 as below 15,000; a medium between both, or 18,000, is, moft probably, the correcteft ftatement of them, as it will allow a fupernumerary or curate to about one half of the before ftated number of 11,755 churches.

Thefe eighteen thoufand perfons, whether beneficed or expectant, with their families and dependents, make up poffibly near 100,000 fouls, reckoning at the rate of five and an half perfons to a family. However, as a part of the clergy, like thofe of other profeffions, may be fuppofed to be fingle men, this computation will therefore at firft fight appear exaggerated; but, when it is confidered that the clergy are an exception to thofe of other profeffions, and are for the moft part married men with numerous families in general, the calculation, in eftimating the whole body of them with each a family of five and an half perfons, may turn out neither rafh nor ill-founded; and more efpecially, fince computing two-thirds of them to be married men, with families and dependents of feven perfons each, the fame grofs product will almoft appear, as feven times twelve thoufand amount to 84,000, and the remaining one-third, (or 6,000 fingle men) with one dependent each, will make up the whole number to be 96,000.

And thus, taking the population of the kingdom at 8,000,000 of perfons, the clergy, with their families and dependents, are about an eightieth part of the people.

It appears that, by the addition of the cathedral and the equalization of the parochial incomes, the revenue to be enjoyed by each parifh prieft would not exceed 172 *l.* per annum.

Church *of Scotland*, is that branch of the reformed church which was eftablifhed in Scotland. One of the principal agents in accelerating and completing the progrefs of the reformation in Scotland was John Knox, who, with better qualifications of learning, and more extenfive views than any of his predeceffors in Scotland, poffeffed a natural intrepidity of mind, which fet him above fear. He began his public miniftry at St. Andrew's, in the year 1547, with that fuccefs which always accompanies a bold and popular eloquence. Inftead of amufing himfelf with lopping the branches, he ftruck directly at the root of popery, and attacked both the doctrine and difcipline of the eftablifhed church, with a vehemence peculiar to himfelf, but admirably fuited to the temper and wifhes of the age. The great revolution in England, which followed upon the death of Henry VIII. contributed no lefs than the zeal of Knox towards demolifhing the popifh church in Scotland. Several noblemen of the greateft diftinction having about this time openly efpoufed the principles of the reformer, they were no longer under the neceffity of inculcating their fentiments with the referve which they had before practifed; and with greater fecurity and encouragement, they had likewife greater fuccefs. The ambition of the houfe of Guife and the bigotry of Mary of England haftened the fubverfion of the papal throne in Scotland; and by a fingular difpofition of Providence, the perfons who oppofed the reformation in every other part of Europe with the fierceft zeal, were made inftruments for advancing it in that kingdom. It was not, however, till about the year 1560 that the Proteftant church of Scotland began to affume a regular form. But the model introduced by the reformers differed extremely from that, which had been fo long eftablifhed. As the vices of the clergy had, at firft, fays Dr. Robertfon (Hift. of Scotland), excited the indignation of mankind, and roufed that fpirit of inquiry, which proved fo fatal to the whole popifh fyftem; as this difguft at the vices of ecclefiaftics was foon transferred to their perfons, and fhifting from them, by no violent tranfition, fettled at laft on the offices which they enjoyed; the effects of the reformation would naturally have extended not only to the doctrine, but to the government of the popifh church; and the fame fpirit which abolifhed the former would have abolifhed the latter. But, in a great part of Germany, in England, and in the northern kingdoms, its operations were checked by the power and policy of their princes; and the ancient epifcopal jurifdiction, under a few limitations, was ftill continued in thofe churches. The epifcopal hierarchy appears to be more conformable to the practice of the church, fince Chriftianity became the eftablifhed religion of the Roman empire. The ecclefiaftical government was, at that time, plainly copied from the civil; the firft not only borrowed its form, but derived its authority from the latter; and the diocefes and jurifdictions of patriarchs, archbifhops, and bifhops, correfponded with the divifion and conftitution of the empire. In Switzerland, and the Low Countries, the nature of the government allowing full fcope to the genius of the reformation, all pre-eminence of order in the church was deftroyed, and an equality eftablifhed more fuitable to the fpirit of republican policy. The fituation of the primitive church fuggefted the idea, and furnifhed the model of the latter fyftem, which has fince been called "Prefbyterian." The firft Chriftians, oppreffed by continual perfecutions, and obliged to hold their religious affembles by ftealth, and in corners, were contented with a form of government extremely fimple. The influence of religion concurred with the fenfe of danger in extinguifhing among them the fpirit of ambition, and in preferving a parity of rank, the effect of their fufferings, and the caufe of many of their virtues. Calvin, whofe decifions were received, among the Proteftants of that age, with incredible fubmiffion, was the patron and reftorer of this fcheme of ecclefiaftical policy. The church of Geneva, formed under his eye, and by his direction, was efteemed the moft perfect model of this government; and Knox, who, during his refidence in this city, had ftudied and admired it, warmly recommended it to the imitation of his countrymen. Among the Scottifh nobility, fome hated the perfons, and others coveted the wealth of the dignified clergy; and by abolifhing that order of men, the former indulged their refentment, and the latter hoped to gratify their avarice. The people, inflamed with the moft violent deteftation of popery, and approving every fcheme that departed fartheft from the practice of the Romifh church, were delighted with a fyftem, fo admirably fuited to their predominant paffion. While the friends of civil liberty beheld, with pleafure, the Proteftant clergy pulling down, with their own hands, that fabric of ecclefiaftical power, which their predeceffors had reared with fo much art and induftry; and flattered.

ed themselves, that by lending their aid to strip churchmen of their dignity and wealth, they might entirely deliver the nation from their exorbitant and oppressive jurisdiction. However, on the first introduction of his system, Knox did not deem it expedient to depart altogether from the ancient form. Instead of bishops, he proposed to establish 10 or 12 superintendents in different parts of the kingdom. These, as the name implies, were empowered to inspect the life and doctrine of the other clergy. They presided in the inferior judicatories of the church, and performed several other parts of the episcopal function. Their jurisdiction, however, extended to sacred things only; they claimed no seat in parliament; and pretended to no right to the dignity, or revenues, of the former bishops. The number of inferior clergy, to whom the care of parochial duty could be committed, was still extremely small, and much dispersed through the different provinces of the kingdom; and in a few places only, were they formed into regular classes or societies. The first general assembly of the church was held this year (December 20, 1560.) See *General* ASSEMBLY. In order to give greater strength and consistence to the Presbyterian plan, Knox, assisted by his brethren, composed the first book of discipline, which contains the model or platform of the intended policy. From this period to the present times, the form of doctrine, worship, and discipline, that had been established at Geneva by the ministry of Calvin, and introduced with certain modifications by Knox into Scotland, has been maintained with invincible steadiness and zeal; and every attempt to introduce into that kingdom the rites and government of the church of England, or to re-establish popery, has proved impotent and unsuccessful.

The church of Scotland is, of course, considered by its members as founded upon the principle of the primitive church, in which they perceive no distinction between presbyters and bishops. A body of presbyters having a moderator, who conducts the proceedings, and executes the sentences, is regarded as competent to perform all the acts which, in an episcopal government, belong exclusively to the bishop. It tries the qualifications of candidates for the office of the ministry; it confers orders by the imposition of hands; to those who are nominated by persons having right of nomination, it grants the investiture of the sacred office, or induction into the charge of a particular parish; and it exercises inspection and jurisdiction over the pastors of all the parishes within its bounds.

In the exercise of his spiritual functions a pastor acts within his parish, according to his own discretion: and for the discharge of the pastoral duties, he is accountable only to the presbytery from whom he received the charge of the parish; but in every thing which relates to *discipline*, he is assisted by lay-elders. These, like the deacons of the primitive church, attend to the interests of the poor. But their peculiar business is expressed by the name *ruling-elders;* in every question of jurisdiction within the parish, they form a spiritual court, of which the minister is moderator. In the presbytery also they sit as representatives of sessions or consistories.

Ministers are admitted into a church by a presbytery. When a student has gone through his university education, according to certain prescribed rules, he may be proposed to a presbytery, in order to be taken upon his trials; the consent of a superior court, called a synod, having been first obtained; to which court an appeal lies, if the presbytery should be oppressive. A person entered upon his trials, having obtained a licence to preach, is called a probationer; and in this character has no fixed charge, though he is allowed to assist a clergyman disabled by age or sickness. When he receives a presentation, he undergoes a second trial before the presbytery, to whom the presentation is addressed: if they find that he is not qualified in respect of doctrine, literature, or moral character, their sentence declaring him unqualified, unless it be reversed by their ecclesiastical superiors, renders his presentation void. If, upon a vacancy in the living, the patron do not present within six months, the presbytery take such steps as they judge proper to supply the vacancy. None but *licentiates* or probationers, or those who have been previously inducted to another living, can be presented. The people have no right to elect a person to be presented to the presbytery; this right being reserved to the patrons, except when it is transferred by the patron to the parishioners. Yet the people are not overlooked; but have two ways allowed them of expressing their sentiments of the person who is to minister to them, either by subscribing or refusing to subscribe a paper, named a *call*, inviting him to be their minister; or by supporting a charge of immorality of conduct or unsoundness of doctrine. The former of these seems of little importance, as a *call* may be sustained, however small the number of subscribers. If no objection occur, the person is ordained, by imposition of the hands of the presbytery, who assemble at a time appointed for the purpose; the presentee having first answered the questions, and made the promises and engagements required by the law.

The lowest judicatory in the church of Scotland is the *kirk-session*, composed of the minister of the parish and of lay elders. New elders are chosen by the session, but are liable to be objected against by any member of the congregation. If the objections be not valid, they are at an appointed time set apart to their office by prayer; having first declared their assent to all that is contained in the confession of faith.

A presbytery is composed of an indefinite number of parishes; in some populous districts of not less than thirty, in some more remote of not more than four. This judicatory consists of the ministers of all the parishes within the district; of the professors of divinity, if they be ministers, in any university that is within the same district; and of one elder from each parish. A moderator, who must be a minister, is chosen twice a year. At present there are seventy-eight presbyteries in Scotland.

Three or more presbyteries, as the matter happens to be regulated, compose a *provincial synod*. There are at present fifteen of these judicatories, most of which meet twice in the year. This court is formed of every minister of all the presbyteries within the bounds of the synod, and the same elder who had last represented the kirk-session in the presbytery.

The next and highest ecclesiastical court is the *general* ASSEMBLY. It is composed in the following manner: all presbyteries consisting of twelve parishes, or under that number, send two ministers and one ruling elder; all presbyteries consisting of eighteen or fewer, but above twelve, send three ministers and one ruling elder; all presbyteries consisting of twenty-four parishes, or fewer, but above eighteen, send four ministers and two elders; all of above twenty-four, but under thirty parishes, send five ministers and two ruling elders; and all that consist of more than thirty parishes, send six ministers and three ruling elders. The sixty-six royal burghs of Scotland are represented in the general assembly by ruling elders: Edinburgh sending two, and every other burgh one; and each of the five universities is represented by one of its members. The general assembly, therefore, is composed of two hundred ministers representing presbyteries, eighty-nine elders representing presbyteries, sixty-seven elders representing royal burghs, five ministers or elders representing universities: in all 361. In this assembly, the sovereign is represented by the lord high commissioner. This assembly meets annually in the month of May, and continues to sit for

ten

ten days. But as it may be impoffible, in that fpace of time, to decide all the queftions that are brought before it, and circumftances may occur in the intervals between general affemblies requiring the interpofition of this fupreme court, a commiffion is annually formed of the general affembly: which differs from the general affembly chiefly in not being honoured by the reprefentation of the fovereign, and may be confidered as a committee of the whole houfe. Thirty-one members, of whom twenty-one are always to be minifters, conftitute a quorum, which meets four times in the year, or oftener, for the difpatch of bufinefs.

Thefe four courts are fo conftituted, that each inferior court is fubject to the controul of its fuperior. The power of the fuperior court may be exercifed at its own pleafure, upon reference from an inferior court, and upon appeal or complaint. In matters purely ecclefiaftical, the civil power does not interfere with thefe fpiritual courts; but in every queftion of a civil nature, fuch as refpect glebes, &c. the decifion of a prefbytery is cognizable by a civil judicatory.

The judicial power of the church of Scotland appears in the infliction or removal of fuch cenfures as are thought to belong to a fpiritual fociety. The objects of thefe cenfures are grofs immorality, herefy, and fchifm. The minifter of the parifh has no power of this nature, but as a member of the kirk-feffion: and he again is fubject to no control lefs than that of the prefbytery by whom he was ordained, and by whom alone he may be fufpended or depofed. The nature of thefe cenfures, and the method of inflicting them, are defined in a code of laws, confeffedly imperfect, called the form of procefs.

General laws were formerly made and repealed by the general affembly alone. The barrier act enables an individual to propofe to the prefbytery new laws, or the amendment or repeal of old laws. Such propofals muft be tranfmitted to the general affembly, and by them are either difmiffed, or fent to all the prefbyteries for their approbation. The refult is returned to the next general affembly, and paffes into a ftanding law, if not lefs than forty prefbyteries have approved. To prevent the delay which muft thus be occafioned, the general affembly, if it thinks fit, can order the propofed meafure to be obferved as a law, during the term which intervenes between its firft being propofed, and the rejection or confirmation of it by the prefbyteries at its fucceeding meeting.

The church of Scotland receives annually from the exchequer of that country, 2000 *l.* Of this, 500 *l.* are fet apart for the falaries of the procurator and agent of the church, the law-officers, clerks, &c.; and the remaining 1500 *l.* for the defraying of the expences incident to the dignified ftation of the reprefentative of the fovereign of the general affembly. Emoluments are alfo annexed to the offices of his majefty's chaplains for Scotland, and the deans of the chapel-royal. The ftipends of the minifters arife chiefly from the teinds or tythes, paid either in money or in kind by the titular of the teinds, who is not always the landholder, but in fome cafes the crown, in others an individual or a corporation. The landholder in Scotland enjoys a privilege in refpect of the payment of tythes, which is not known in other Chriftian ftates: he may value his teinds before a court of feffion; and that valuation being eftablifhed, how much foever the rent of his lands may rife by the improvements of agriculture, &c. the increafe is entirely his own, becaufe the teinds never go beyond the rate at which the valuation had fixed them. The landholder, if he be not titular, as is frequently the cafe, may compel the titular to fell the teinds to him; excepting where the teinds are held by the crown, or when they have been granted for the fupport of public inftitutions. If the titular does not pay the whole of the teinds, according to their valuation, to the minifter, the court of feffion may grant an augmentation, but never beyond the quantity or fum fixed when the teinds were valued. Befides the teinds, the minifter of every country parifh is provided with a dwelling houfe, or manfe; with a garden; with a glebe of not lefs than four acres of arable land; with grafs for one horfe and one cow, and with the out-houfes neceffary for the management of his fmall farm. By another legal provifion, called the ann, the half-year's ftipend that becomes due after the death of a minifter, is paid to his widow or executors. See Dr. Hill's Theological Inftitutes, part ii.

In a parallel drawn between the church eftablifhments of England and Scotland (fee Cove's Effay on the Revenues of the Church of England), we learn, that the whole provifion of the minifters of the Kirk of Scotland, was eftimated, about the year 1755, at about 68,500 *l.* per annum; which, being divided between 944 minifters, afforded to each of them, on an average, an annual income of 72 *l.* This provifion may, indeed, have been augmented fince; but it appears to be very incompetent to a decent and confortable maintenance, even in Scotland, and difcourages the youth of refpectable families and connections from entering, as they formerly did, into the miniftry.

Church, *High*, was a denomination originally given to thofe, otherwife called *Nonjurors*, who refufed to acknowledge the title of William III. to the crown of Great Britain, under a notion that James II. though excluded, was ftill their rightful fovereign. This appellation was given them, becaufe they entertained high notions of the dignity and power of the church, and the extent of its prerogatives and jurifdiction. And thofe, on the contrary, were called *low-church* men, who difapproved of the feceffion and obftinacy of the Nonjurors, diftinguifhed themfelves by their moderation toward diffenters, and were lefs ardent in extending the limits of church authority. The denomination of *high-church* men is now more generally applied to all who form pompous and ambitious conceptions of the authority and jurifdiction of the church, and who would raife it to an abfolute independence on all human power.

The non-jurors, or high-churchmen, who boaft with peculiar oftentation of their orthodoxy, and treat the Low-church as unfound and fchifmatical, differ in feveral things from the members of the epifcopal church, in its prefent eftablifhment; but they are more particularly diftinguifhed by the following principles: 1. "That it is never lawful for the people, under any provocation or pretext whatever, to refift the fovereign." This is called in England "paffive obedience," and is a doctrine warmly oppofed by many, who think it both lawful and neceffary, in certain circumftances, and in cafes of an urgent and momentous nature, to refift the prince for the happinefs of the people. They maintain further, 2. "That the hereditary fucceffion to the throne is of divine inftitution, and therefore can never be interrupted, confounded, or annulled, on any pretext." 3. "That the church is fubject to the jurifdiction—not of the civil magiftrate, but of God alone, particularly in matters of a religious nature." 4. "That confequently Sancroft and the other bifhops, depofed by king William III. remained, notwithftanding their depofition, *true bifhops* to the day of their death; and that thofe who were fubftituted in their places were the unjuft poffeffors of other men's property." 5. "That thefe unjuft poffeffors of ecclefiaftical dignities were rebels againft the ftate, as well as fchifmatics in the church; and that all, therefore, who held communion with them were alfo chargeable with rebellion and fchifm." 6. "That this

this schism, which rends the church in pieces, is a most heinous sin, whose punishment must fall upon all those who do not return sincerely to the true church, from which they have departed." Mosheim's Eccl. Hist. vol. v.

Church is also used for a Christian temple, built and consecrated to the honour of God; and, anciently, under the invocation of some particular saint, whose name it assumed.

In this sense, churches are variously denominated, according to the rank, degree, discipline, &c. as metropolitan church, patriarchal church, cathedral church, parochial church, cardinal church, &c. See each under its proper article, Metropolis, Patriarch, Cathedral, Parochial, Cardinal, &c. In ecclesiastical writers, we meet with grand church, for the chief church of a place, particularly in the Greek liturgy, for the church of St. Sophia at Constantinople, the see of the patriarch, founded by Constantine, and consecrated under Justinian. It was at that time so magnificent, that Justinian is said to have cried out in the consecration thereof, Ενικησα σε, Σολομων; *I have out-done thee, Solomon.* The dome, which is said to have been the first that was built, is 330 feet diameter.

The first church publicly built by the Christians, some authors maintain to be that of St. Saviour at Rome, founded by Constantine: others contend, that several churches abroad, called by the name of St. *Peter Vivus*, were built in honour of that apostle during his life-time.

In the first ages the Christians assembled for social worship in private houses and sequestered places: and therefore if any are pleased to give the name of a church to a house or part of a house, which, though appointed as the place of religious worship, was neither separated from common use, nor considered as holy in the opinion of the common people, it must be granted that the most ancient Christians had churches. It is the opinion of many learned men, particularly Suicer (ad vocem Ναος) that the Christians had no public edifices during the three first centuries, as they have shewn from the authorities of Origen, Minutius Felix, Arnobius, and Lactantius. Tillemont, in discussing the antiquity of Christian churches (Mem. Eccl. tom. iii. part 2) refers the first construction of them to the peace of Alexander Severus; but Mr. Moyle (vol. i.) ascribes it to the peace of Galienus. Between the years 211 and 249, during a calm of 38 years, Christians, it has been said, were permitted to erect and consecrate convenient edifices for the purpose of religious worship; to purchase lands, even at Rome itself, for the use of the community; and to conduct the elections of their ecclesiastical ministers in so public, but at the same time in so exemplary a manner, as to deserve the respectful attention of the Gentiles. Under the persecuting edicts of Dioclesian, the Christian churches were generally demolished; and though in some places the magistrates contented themselves with shutting up the places of religious worship, in others they proceeded to a more severe extreme; and after taking away the doors, the benches, and the pulpit, which they burnt, as it were in a funeral pile, they completely destroyed the remaining edifice. In the age of Constantine, the Christian temples of Antioch, Alexandria, Jerusalem, Constantinople, &c. displayed the ostentatious piety of a prince, ambitious in a declining age to equal the perfect labours of antiquity. The form of these religious edifices was simple and oblong; though they might sometimes swell into the shape of a dome, and sometimes branch into the figure of a cross. The timbers were framed for the most part of cedars of Libanus; the roof was covered with tiles, perhaps of gilt brass; and the walls, the columns, the pavement, were incrusted with variegated marbles. The most precious ornaments of gold and silver, of silk and gems, were profusely dedicated to the service of the altar; and this specious magnificence was supported on the solid and perpetual basis of landed property. In the space of two centuries, from the reign of Constantine to that of Justinian, the 1800 churches of the empire were enriched by the frequent and unalienable gifts of the prince and people. In the 10th century all Europe was alarmed with a terrifying apprehension, that the day of judgment was at hand, and that the world was approaching to its final dissolution; and, among the other effects of this general panic, the churches and monasteries were suffered to fall into ruin, or at least to remain without repair, from a notion that they would soon be involved in the general fate of all sublunary things. But when these apprehensions were removed, the tottering temples were rebuilt, and the greatest zeal, attended with the richest and most liberal donations, was employed in restoring the sacred edifices to their former lustre, or rather in giving them new degrees of magnificence and beauty. Accordingly, during the whole of the 11th century, all the European nations were diligently employed in rebuilding, repairing, and adorning their churches.

The churches of the first ages, however magnificent and splendid those of some favoured countries and places might have been, were generally plain and simple structures. Sulpicius Severus describes one of the churches of Cyrene in the deserts of Libya, which, he says, was made of small rods interwoven, not much more stately than his own house, in which a man could hardly stand upright; and the description given by our venerable Bede of the church which Finan, the second bishop of Lindisfarne, or Holy Island, since called the bishopric of Durham, built, will furnish a just idea of the simplicity of many of our oldest churches.

Places appropriated to religious worship were distinguished by a variety of names, both in the East and West. Εκκλησια and εκκλησιαστηριον, whence the French "Eglise," and the British "Eglwys," are often used indiscriminately, though sometimes, as we have already shewn in a preceding article, the former signified the assembly of Christians, and the latter the place where they assembled. One of the earliest names is "oratory" or "house of prayer," προσευκτηριον and οικος ευκτηριος, which names were afterwards restricted to chapels in private families. The Latins called the church "Dominicum" or "domus Dei," God's house; which answers to the Greek κυριακον, whence the Saxons derived their name "kyrick" or "kyrch," and the Scots and English "kyrk" and "church." Tertullian called it "domus Columbæ." The word "temple," which was not used during the three first ages, was introduced after the heathen temples were converted into churches for the worship of the true God. Mr. Bingham, in his "Antiquities," has collected a variety of other names, which we need not recite. Churches, which were built, after the persecutions ceased, over the grave of any martyr or saint, from respect to their memory, were called "martyrium" and "memoria," and thence the word "cemetery" came also to signify a church. This practice, perhaps, suggested the idea of dedicating these structures to some particular saint, and gave rise to the custom of putting some portion of the relics of a martyr into the foundation of every church, with a view of encouraging men to submit to a fate which was likely to befal them in those ages; and thence they proceeded to dedicate them to the honour of the Virgin, or to some remarkable circumstance in the life or sufferings of our blessed Lord. Mr. Bingham says that the word "mensa" was used for a church, because an altar or communion-table was erected at the place where the martyr suffered, at which sermons were preached;

preached; but this part seems rather to have answered to the "trapeza," a refectory in monasteries, where those discourses were held; these were never preached at the altar, which would have been very inconvenient for the auditors; the laity being never permitted to enter there.

A *church*, in order to be adjudged such by our laws, must have administration of the sacraments and sepulture annexed to it. If the king founds a church, he may exempt it from the jurisdiction of an ordinary; but it is otherwise in case of a subject.

The manner of founding churches in ancient times was as follows: after the founders had made their application to the bishop of the diocese, and had his licence, the bishop or his commissioners sat up a cross, and settled the boundaries of the church-yard where the church was to be erected, and then the founders might proceed with the building; and when the edifice was completed, the bishop consecrated it; then, and not before, the sacraments were to be administered in it. (See Stillingfleet's Ecclesiastical Cases.) But by the common law and custom of this realm, any person, who is a good Christian, may build a church without licence from the bishop, so that it be not prejudicial to any ancient churches; though the law takes no notice of it as a church, till it is consecrated by the bishop, which is the reason why *church*, and *no church*, &c. is to be tried and certified by the bishop. And in some cases, though a church has been consecrated, it must be consecrated again; as in case any murder, adultery, or fornication be committed in it, by which it is defiled; or if the church be destroyed by fire, &c.

The ancient ceremonies used in consecrating the ground on which it was proposed to build a church, and the church itself, were as follow: when the materials were provided for building, the bishop came in his robes to the place, &c. and having prayed, he perfumed the ground with incense, and the people sung a collect in praise of that saint to whom the church was dedicated; then the corner stone was brought to the bishop, which he crossed and laid for the foundation; and a great feast was made on that day, or on the day of the saint to whom it was dedicated; but the form of consecration was left to the bishop, as it is at this day.

A *Church* in general, legally considered, consists of three principal parts, viz. the belfry or steeple, the body of the church with the aisles, and the chancel; and not only the freehold of the whole church, but of the church-yard, are in the parson or rector; and the parson may have an action of trespass against any one that shall commit a trespass in the church or church-yard; as in the breaking of seats annexed to the church, or the windows, taking away the leads, or any of the materials of the church, cutting the trees in the church-yard, &c. But church-wardens may, by custom, have a fee for burying in the church; the church-yard is a common place of burial for all the parishioners. Moreover, the actions for taking away the seats must be brought in the name of the church-wardens, the parishioners paying the expence. If a person erect a pew in a church, or hang up a bell, &c. in it, they then become church goods, though not expresly given to the church; and he may not afterwards remove them. The parson only is to grant licence for burying in the church; but for defacing a monument in a church, &c. the builder or heir of the deceased may have an action. And a man may be indicted for digging up the graves of persons buried and taking away their burial dresses, &c. Although the parson hath the freehold of the church and church-yard, he hath not the fee-simple, which is always in abeyance; but in some respects the parson hath a fee-simple qualified. (Litt. 644, 645.) The chancel of the church is to be repaired by the parson, unless there be a custom to the contrary; and for these repairs he may cut down trees in the church-yard, but not otherwise. (Stat. 35 Ed. I. st. 2.) The church-wardens are to see that the body of the church and steeple are in repair; but not any aisle, &c. which any person claims by prescription, to him or to his house. Concerning these repairs the canons require every person who hath authority to hold ecclesiastical visitation to view the churches within their jurisdiction once in three years, either in person, or to cause it to be done; and they are to certify the defects to the ordinary, and the names of those who ought to repair them; and these repairs must be done by the church-wardens, at the expence of the parishioners. Can. 86.

By the common law, parishioners of every parish are to repair the church; but by the canon law, the parson is obliged to do it; and so it is in foreign countries, (1 Salk. 164.) In London the parishioners repair both the church and the chancel. The spiritual court may compel the parishioners to repair the church, and excommunicate every one of them till it be done; but those that are willing to contribute shall be absolved till the greater part agree to a tax, when the excommunication is to be taken off; but the spiritual court cannot assess them towards it. (1 Mod. 194. 1 Vent. 367.) For though this court hath power to oblige the parishioners to repair by ecclesiastical censures; yet they cannot appoint in what sum, or set a rate, for that must be settled by the church-wardens, &c. (2 Mod. 8.) If a church be down, and the parish is increased, the majority of the parish may raise a tax for the necessary enlargement of it, as well as the repairing of it, &c. (1 Mod. 237.) But in some law-books it is said, that if a church falls down, the parishioners are not obliged to rebuild it; though they ought to keep it in due repair. (1 Vent. 35.) On the rebuilding of churches, it is now usual, on the petition of the parishioners, to obtain briefs. See BRIEFS.

By stat. 37 Hen. VIII. c. 21, churches, not above six pounds a year in the king's books, may, by the assent of the ordinary, patron, and incumbent, be united; and by stat. 17 Car. II. c. 3, in cities and corporations, &c. churches may be united by the bishop, patrons, and chief magistrates, unless the income exceeds 100 *l. per annum*, and then the parishioners are to consent, &c. By stat. 9 Ann. c. 22. (See also stat. 10 Ann. c. 11.) 50 new churches were built in or near London and Westminster, for which purpose a duty of two shillings per chaldron was laid on coals; the rectors of these churches are to be appointed by the crown, &c. A duty is also granted on coals imported into London, to be appropriated for the maintenance of ministers for the new churches. Stat. 1 Geo. I. c. 23.

No man shall cover his head in the church, in time of divine service, except with a cap if he have some infirmity; and all persons are to kneel or stand, &c. as directed by the Common Prayer, during service. Can. 18. No ill language is to be used, or noise made in churches or church-yards; and persons striking, or laying violent hands on others there are to be excommunicated; and for striking with a weapon, or drawing a weapon with an intent to strike, shall lose one of his ears; nor may a man lawfully return blows in his own defence in these circumstances, stat. 5 and 6 Ed. VI. c. 4. 1 Hawk. P. C. c. 63, §. 24, &c. See BURGLARY and LARCENY.

No fairs or markets shall be kept in church-yards. Stat. 13 Ed. I. st. 2, c. 6.

Any person may be indicted for indecent or irreverent behaviour in the church; and those that offend against the acts of uniformity, are punishable either by indictment upon the statute, or by the ordinary.

Church, *Mother*, *Matrix ecclesia*. See Mother-churches.

Church, with regard to *Architecture*, Daviler defines a large oblong edifice, in form of a ship, with nave, choir, aisles, chapel, belfry, &c. See each part under its proper head.

Church, *simple*, is that which has only a nave and a choir.

Church *with aisles*, that which has a row of porticos, in form of vaulted galleries, with chapels in its circumference.

Church *in a Greek cross*, that where the length of the transverse part is equal to that of the nave; so called, because most of the Greek churches are built in this form.

Church *in a Latin cross*, that whose nave is longer than the cross part, as in most of the Gothic churches.

Church *in rotundo*, that whose plan is a perfect circle, in imitation of the Pantheon.

As to the form of the ancient Greek churches, when they had all their parts, it was as follows: first was the *narthex*, porch, or portico, and then the part called the *vaunt-nave*, προναος; this was adorned with columns on the outside, and on the inside surrounded with a wall; in the middle whereof was a door, through which they passed into a second portico. The first of these porticos was destined for the *energumeni*, and penitents in the first stage of their repentance; the second was much longer, destined for penitents of the second class, and the catechumens, and hence, called ναρθηξ, *ferula*, because those placed in it began to be subject to the discipline of the church. These two porticos took up about one third of the space of the church. From the second portico, they passed into the nave, ναος, which took up near another third of the church. In the middle, or at one side of the nave, was the *ambo*, where the deacons and priests read the gospel, and preached. The nave was destined for the reception of the people, who here assisted at prayers.

Near the entrance of this was the Baptistery, or Font. Beyond the nave was the choir, χορος, set with seats, and round: the first seat on the right, next to the sanctuary, being for the chantor, or *choragus*.

From the choir, they ascended by steps to the sanctuary, which was entered at three doors. The sanctuary had three apsides in its length; a great one in the middle; under which was the altar, crowned with a baldachin, supported by four columns. Under each of the small apsides, was a kind of table, or cupboard, in manner of a beaufet. Nevertheless, of the Greek churches now remaining, few have all the parts above described; most of them having been reduced to ruins, or converted into mosques.

M. Frezier, engineer to the French king, and F. Cordemoy, a regular canon, have disputed the form of the ancient and modern churches, and the best manner of building them, with a good deal of learning, in the Journals de Trevoux.

For the form of the Latin churches, though it be various, yet may all the variety be reduced to two heads; viz. those in form of a ship, and those of a cross.

Churches, *round*. Among the more ancient architectural structures of Great Britain which appear to have been connected in their origin as well as in their form, is one class, of which but few instances, if they were ever numerous, remain; known by the appellation of the Round Churches. Dr. Stukeley hazarded a conjecture, (Itin. Curios. p. 35.) that they were the most ancient churches in England; and were either erected in the later time of the Romans for Christian service, or in the earlier periods of the Saxons. Another opinion, equally strange, but far more general, was that which attributed the construction of them to the Jews.

The first writer who seems to have treated their real history with success, was Mr. Essex, whose "Observations" are to be found in the sixth volume of the Archæologiæ. But Mr. Britton, to whom more numerous sources of intelligence were open, appears almost to have exhausted the subject, in his "Architectural Antiquities," in which the principal of the round churches are both engraved and accurately described.

That the circular form for the temple was a very ancient one in the heathen world, may be proved from a variety of instances. Though nothing will be gained by comparing it either with the irregular structure of the Druid circle, or with the occasional temples of that form, which are found among the buildings of the Romans.

The round churches of this country appear to have been indebted for their origin to those who returned from the crusades; on whose minds the venerable form of the church of the sepulchre at Jerusalem had left a strong and durable impression.

The parent model had been rebuilt by Charlemagne about the year 812, to a certain extent, in imitation of the church of Santa Sophia at Constantinople: and the devotees of the cross, either considering it as the original work of Helena, the mother of Constantine the Great, or from the sacred relics it was supposed to have contained at a former period, appear to have adopted its form, not only in this country, but in others; considering it as one which was likely to exhibit a character of peculiar sanctity.

Santa Sophia, however, has at different times received accessions, and is now surrounded by a multitude of minarets which confuse the exterior outline of the rotunda. The church of the sepulchre at Jerusalem also has been enlarged: a second rotunda was added in the eleventh century by Godfrey of Bulloigne; and a tower at the west end, at a period much later. The best idea of it may be obtained from sir Robert Ainslie's Views in Egypt, Palestine, &c.

But a church still nearer to our own, both in design and character, is described by the German writer of "Voyage en Sicile et dans la Grande Gréce, addressé a l'Abbé Winckelman," 8vo. 1773. The account answers exactly to the churches of the same description in England.

"On donne l'Eglise du S. Sepulcre pour un temple antique; c'etoit une rotonde; cet edifice n'est point du bon tems de l'architecture: sa forme n'est pas parfaitement circulaire, et il n'y a point de portique à l'entrée, et il decrit un demi circle différent, qui ne fait point corps avec le reste du batiment; ce que lui donne une irregularité désagreable. L'on reconnoit aussi le mauvais goût du tems de la decadence des arts aux ornemens de l'ancienne porte qui est murée aujourd'hui. Cet edifice est vouté et soutenu entierèment par des colonnes de marbre."

Of the English round Churches, that of St. Sepulchre's, Cambridge, is supposed by Mr. Essex to be the oldest: he dates it between the first and second crusades, in the reign of Henry I. From the ground plan, with the interior and exterior views of the building, given by Mr. Britton, we perceive that it originally consisted of a circular wall perforated with six semicircular-headed windows, and an ornamented door-way of the same shape. The latter is still perfect; but the former appear to have been materially altered by widening, and the introduction of mullions. Within is a circular colonnade of eight columns. These are short and massy, without any base, and with a narrow ornamented capital, which varies in different columns. The tower ap-

pears

pears to have been raised one story, for the reception of bells, in the reign of Edward the Second; and the east end or chancel, with the north aisle, were added as late as 1313.

In regard to the history of St. Sepulchre's Church, Northampton, we are without authentic documents. It is universally asserted, that the circular part of the church was built by the knights templars, who obtained their organization and their fame in the vicinity of the church of the Holy Sepulchre at Jerusalem. Mr. Britton observes, that it advances a little in beauty of proportion from the church at Cambridge, and dates it at the end of the twelfth or the beginning of the thirteenth century. By the ground-plan and exterior view, he observes, it may be perceived that the walls of the circular building are thicker than those of the round church at Cambridge; that the columns are smaller and higher; that they have bases and capitals, some square and some round; that the circular aisle has no arched roof, but is merely covered with timber; and that, immediately above the columns, the wall becomes octangular. These are peculiarities which distinguish it from the other circular churches, and render it an unique example of ancient architecture.

In elegance of construction, the Temple church in London is far superior to those we have already mentioned. It seems to have been built upon the same plan with the old temple church in Holborn, the circular walls of which are said to have been discovered about a century ago, and was consecrated in 1185. The ground-plan and exterior wall of the round part are probably thus old; but the interior, with the six clustered columns, and their incumbent arches, as well as the choir, appear to have been erected about 1244, (when Sir William Dugdale tells us the church was again dedicated,) and correspond with the generality of those examples of ecclesiastical architecture which are known to have been erected in the reign of Henry the third. In raising the superstructure of the circular part, the architects appear to have mixed the new with the old style of arches.

Another church of the circular kind occurs at Maplestead in Essex; and still more instances may probably be found in remote corners of the kingdom. It is not unlikely, that the old church of St. Selpulchre, by Newgate, had the same form: and some allowance must probably be made for copies from the church of the Sepulchre taken at different periods.

According to a curious manuscript in the Bodleian Library at Oxford, a pilgrim who visited the Holy Land in 1462, upon his return, deposited the following curious articles in the abbey of Edyngton, in Wiltshire: "*A chapel made to the likeness of our Lord's sepulchre at Jerusalem*, and a variety of vestments, with imitations in wood of the chapel of Calvary, the church at Bethlem, the Mount Olivet, and the valley of Jehosaphat."

CHURCH, *discipline*, *government*, *policy*, *revenue*, &c. See these articles, and the preceding articles of *church of England*, &c. &c.

CHURCH *lands*, in *Agriculture*, are all such lands as belong to and are held under religious establishments. It has been observed by the author of "Modern Husbandry," that lands held by corporations, whether civil or religious, experience has proved are, in scarcely any instance, managed in such a way as to insure their permanent improvement. The writer of the "Report of the County of Lancaster" also remarks, that glebe or church lands, or any other appropriated to the support of meeting houses, and those lands which appertain to small livings purchased by the bounty of queen Anne, are generally under a bad state of cultivation, the uncertainty of lease depending on a contingency of a single life operating as a strong obstacle to any degree of even modern improvements, and, in consequence, they are in general under the very worst sort of management. This account of the management of church lands Mr. Donaldson thinks is strictly true, when applied to other parts of England as well as to the county of Lancaster. This, in some degree, proceeds from the want of some proper regulations in respect to the tithes. And he supposes that the modes of leasing lands, either for a term of twenty-one years, renewable on payment of a fine at the end of every seven, or on one or two lives, renewable on the demise of one of the persons named in the lease, on the payment also of an arbitrary fine, as practised by the dignitaries of the church of England, are well known to operate powerfully against the improvement of church-lands. It is impossible, says he, it should be otherwise, for who in his senses will think of expending money on the improvement of land, when these very improvements are to operate against himself at the renewal of a lease, which, in one case, is limited to seven years, and, in the other, is held on a very precarious tenure? Such regulations in regard to leasing church-lands, ought, he thinks, to be made, as would leave the tenants at liberty to expend part of their capitals in the improvements of their farms, without being compelled to pay a ransom at the end of every seven years for the improvements which their own money, labour, and industry, have effected in the intervals.

That something is necessary to be done in these cases, cannot be disputed by those who have seen the comparatively bad state in which much of the lands under such tenures still remains.

CHURCH *Bay*, in *Geography*, a bay on the S.W. coast of the Isle of Rathlin, at the N.W. extremity of Ireland. The ground in this bay is clean, and vessels can ride safe, except with westerly winds, which cause a great swell of sea there. M'Kenzie.

CHURCH *Creek Town*, a town of America, in the county of Dorchester, and state of Maryland, lying at the head of Church-creek, a branch of Hudson's river, 7 miles south-westerly from Cambridge.

CHURCH *Point*, a cape on the west coast of the island of Barbadoes; $\frac{3}{4}$ of a mile north of Hole Town.

CHURCH-*rate*. See CHURCH-*wardens*.

CHURCH-*reves*. See CHURCH-*wardens*.

CHURCH *Rock*, in *Geography*, a rock in the bay of Bengal, near the coast of Ava. N. lat. 17° 32′ E. lon. 94° 14′.

CHURCH-*scot*, or CHURCH-*esset*, in *Ecclesiastical History*, a payment, or contribution, so denominated in domesday, and by the Latin writers frequently called *primitiæ seminum*; being, at first, a certain measure of wheat, paid to the priest on St. Martin's day, as the first fruits of harvest.

This was enjoined by the laws of king Malcolm IV. and Canut. c. 10. But after this, church-scot came to signify a reserve of corn-rent paid to the secular priests, or to the religious; and sometimes it was taken in so general a sense as to include poultry, or any other provision that was paid in kind to the religious. From these customary oblations to the parish priest, the religious sometimes purchased an exemption for themselves and their tenants.

CHURCH-*Stretton*, in *Geography*, a small market town of Shropshire, England, is situated in a narrow, deep vale, between several high mountains: here are not above 100 houses, the greater part of which are occupied by day-labourers and small farmers. A free-school, church, and a decayed market-house or town-hall, are the only public buildings in this place. The mountainous ridges here are of great altitude, and furnish food to numerous flocks of small sheep: the wool and lambs of which constitute the chief incomes of the farmers and yeomen. On the top of the highest hill, called

Caer-Caradoc, is a large fortified entrenchment, which is traditionally said to have been the celebrated camp of Caractacus, the British monarch who so valiantly defended his kingdom against the warlike Romans. See CARACTACUS.

Here are a small weekly market on Thursday, and two fairs annually. It is 158 miles N.W. from London, and 13 S. from Shrewsbury.

CHURCH-*wardens*, anciently called CHURCH-*reves*, or *ecclesiæ guardiani*, the guardians or keepers of the church, and representatives of the body of the parish, are officers chosen yearly in Easter week, by the parson, and his parishioners, according to the custom of the place; to look to the church, church-yard, church-revenues, &c. observe the behaviour of the parishioners with regard to faults that come under the jurisdiction of the ecclesiastical court; present scandalous livers to the bishop; take care none preach without licence, &c. These officers are chosen by the joint consent of the parishioners and minister; but by custom, on which the right of chusing them depends, the minister may chuse one, and the parishioners another; or the parishioners may elect both. In most of the parishes in London, the parishioners chuse both church-wardens by custom: but in all parishes erected by stat. 9 Ann, c. 12, the canon (Can. 89, 90.) shall take place, and this directs the choice to be made by the joint consent of the minister and the parishioners; or, in case of disagreement, the minister shall chuse one, and the parishioners another. When the parishioners chuse, the majority of those who meet at the vestry, upon a written notice for that purpose, shall bind the rest: and by custom, the choice of church-wardens may be by a select vestry, or a particular number of the parishioners. The validity of the custom of chusing church-wardens is to be decided by the courts of common law, and not by the spiritual court.

All peers of the realm, and clergymen, members of parliament, aldermen, counsellors and attornies, physicians, surgeons and apothecaries, and dissenting ministers, are exempt from this office; and persons who have sued a felon to conviction, and the first assignee of the certificate thereof, are exempted from the office of church-warden, in the parish where the offence was committed. The same exemption extends to persons serving in the militia, during such service. Dissenters are allowed to execute the office by a sufficient deputy. No person living out of the parish, although he occupies lands within the parish, is eligible. A person, refusing the office, is liable to excommunication. They are sworn into their office by the archdeacon, or ordinary of the diocese, who is compellable by a mandamus to admit those whom the parish appoint.

The church-wardens are a kind of corporation: and are enabled by law to sue, and be sued, for any thing belonging to the church, or the poor of the parish.

They may purchase goods, but not lands, except by custom, in London, where they, with the minister, form a corporation for lands as well as goods, and may hold, purchase, and take lands for the use of the church, &c. If they waste the goods of the church, the new church-wardens (but not the parishioners) may have action against them, or call them to account. They have a certain special property in the organ, bells, parish-books, bible, chalice, surplice, &c. belonging to the church; of which, they have the custody on behalf of the parish, whose property they really are; and they may bring an action at law against those who steal or damage them. To them belongs the office, with the consent of the minister, of giving seats to the parishioners in the body of the church, reserving those who belong by prescription to particular messuages, &c. They have also the care of the benefice during its vacancy, and, as soon as there is any avoidance, they are to apply to the chancellor of the diocese for a sequestration: and when this is obtained, they are to manage all the profits and expences of the benefice for him that succeeds, and appoint a curate, approved by the bishop, to serve the benefice, and pay him out of the profits. It is their business also to summon a vestry, in order to settle any rates. Their duty comprehends a great variety of particulars, already noticed in the beginning of this article. To them it belongs to repair the church, and to make rates, and levies, with the consent of the parishioners, for this purpose. It is their province to provide, in conjunction with the overseers, for those who need assistance; to keep the key of the belfry, and to prevent the bells being rung without proper cause; to collect charity-money upon briefs; to give consent for burying a person in a different parish from that in which he dies; not to allow suicides or excommunicated persons to be buried in the church or church-yard, without licence from the bishop; and, by stat. 30 Car. II. c. 3. to apply to the magistrates for convicting offenders who do not bury their dead in woollen. They are also to take care that the church be well aired, as well as in good repair; to provide the proper books, as a large bible, a common prayer, and a book of homilies, a font of stone, a decent table, and other articles for the communion, and to see that the ten commandments are set up at the end of the church, &c. They are to sign the certificates of persons taking the sacrament as a qualification for offices. It is also their duty to prevent any irreverence or indecency in the church; and they may pull off a person's hat in the church, or turn him out if he disturb the congregation. They may refuse to open the church at the instance of any person, except the parson, or any one acting under him; they are not to suffer any one to preach, unless he appears qualified, by producing a licence. To them belongs the care of the church-yard as well as of the church; and they are to prevent all games and feasts, and profane usages, from taking place in either. Churchwardens are to levy the penalty of 12 *d.* on persons not coming to church each Sunday under stat. 1 Eliz. c. 2. They are to observe, whether the parson reads the thirty-nine articles twice a year, the canons once a year, preaches every Sunday good doctrine, reads the common prayer, administers the sacraments, &c. &c. They are also to superintend the conduct of the parishioners, with regard to their coming to church, having their children baptized, women churched, persons not marrying within the prohibited degrees, or without banns or licence, &c. &c. They are also by their oath to present, or certify to the bishop or his officers, all things presentable by the ecclesiastical law, which relate to the church, to the minister, and to the parishioners. To them belong the care and inspection of the parish register; and they are to levy penalties on those who profane the Sunday, under stat. 1 Car. I. c. 1. and 29 Car. II. c. 7. At the end of every year they are to deliver just accounts to the minister and parishioners; over which accounts, however, justices of the peace have no jurisdiction.

CHURCH-*yard*, a place adjoining to a church, employed commonly for the interment of the deceased. See COEMETERIUM.

CHURCHILL, JOHN, in *Biography*, duke of Marlborough, a prince of the holy Roman empire, one of the ablest statesmen and politest courtiers, as well as one of the most illustrious heroes that this, or, perhaps, any country ever produced, was the son of sir Winston Churchill, distinguished for his monarchical principles during the reigns of Charles I. and II. John was born at Ashe in Devonshire,

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on Midfummer-day, 1650, and was educated in his father's houfe under a clergyman. When he was only twelve years old, his father took him to court, where the beauty of his perfon, the brilliancy of his underftanding, and the modefty of his behaviour recommended him to general notice. He became page and favourite to the duke of York, and in the year 1666, he was prefented with a pair of colours in the guards. His firft military fervice was at the fiege of Tangier, and from this time he feems to have devoted himfelf to the profeffion of arms. Upon his return to England, he continued his attendance at court, and received from the king, as well as from the duke, repeated marks of kindnefs and favour. He gained an intereft with the fair fex, though with fuch prudence as not to excite the jealoufy of any one. The duchefs of Cleveland, the king's favourite miftrefs, made him a prefent of 5000 *l.*, with which he immediately purchafed an annuity; and his favour with the duke of York was fecured by means of his fifter, who was miftrefs to that prince. In 1672, the duke of Monmouth commanding a body of Englifh auxiliaries in the fervice of France, Mr. Churchill attended him, and was foon after captain of the grenadiers in his grace's own regiment. He was engaged in all the actions of that campaign which humbled the republic of Holland. At the fiege of Nimeguen, captain Churchill fo diftinguifhed himfelf, that he obtained the particular notice of the great Turenne, who beftowed upon him the name of the "Handfome Englifhman." For his conduct at the fiege of Maeftricht he received the public thanks of the king of France; and the duke of Monmouth, in relating to his father what had happened at the attack, acknowledged that he was indebted to captain Churchill for much of his glory, and for his fafety altogether, fince his life had been preferved by his bravery. This good fortune, which began in his twenty-fecond year, attended all his fucceeding undertakings. The laurels which he brought from France, entitled him to preferment at home; he was accordingly promoted to a lieutenant-colonelcy by the king, and the duke made him gentleman of his bedchamber, and foon after mafter of the robes. As a courtier he acted his part with great warinefs, making his way through all the contending factions. In 1679, he accompanied the duke of York to the Low Countries; and in the next year he attended him into Scotland, where, as a declared favourite, he received every refpect from the nobility who wifhed to pay their court to the duke. While he waited upon the duke, a regiment of dragoons was given him, and, in a fhort time afterwards he married Sarah Jennings, a lady of great beauty and good connections, then an attendant upon the princefs, afterwards queen Anne. In the fpring of 1682, he fuffered fhipwreck with the duke of York in a paffage to Scotland, and obtained a fignal proof of his mafter's regard, in his folicitude to fave him, while a great part of the crew, and feveral perfons of quality were left to perifh. In the fame year, he obtained other preferments and a title, and on the acceffion of James II. to the throne he was fent ambaffador to notify the event to the court of France, and in a fhort time afterwards he was raifed to an Englifh peerage by the title of baron Churchill of Sundridge. Through the whole of this reign lord Churchill's conduct was regulated by the principles of prudence, and an invariable attention to his own intereft. He avoided public bufinefs, and, for a confiderable time, never declared himfelf. At length, when it was impoffible for a perfon of his rank and confideration to remain neuter, he made his decifion, and joined in the invitation to the prince of Orange. To obviate the charge of ingratitude, it is generally believed that he had often declared, if the king attempted to overturn the eftablifhed religion he would leave him; he never diffembled his zeal for the church of England, and had been taught from his infancy to regard it with the greateft reverence. The king, however, had no doubt of his fidelity, and entrufted him even with the command of 5000 men to oppofe the progrefs of the prince of Orange. James was advertifed of his difloyalty, but gave no credit to the report, till he, with the duke of Grafton, and fome other officers withdrew from the king's quarters, and joined the prince of Orange at Axminfter. By his advice, prince George of Denmark and the princefs Anne took the fame ftep. Lord Churchill was received with marks of efteem and refpect by the prince of Orange, and was, in the enfuing year, rewarded with the earldom of Marlborough. He affifted at the coronation of their majefties, and was foon after appointed to command the Englifh forces that were fent over to Holland, in order to make part of the army of the allies. He difplayed great military talents at the battle of Walcourt: and in the next year he ferved in Ireland with great reputation. The enfuing campaign he paffed on the continent with king William, where he exhibited great fagacity, by penetrating into the enemy's defigns of befieging Mons, in which the Dutch deputies were deceived. While he was proceeding by hafty fteps to the pinnacle of fame and of fortune, he received a meffage, without any warning, that the king had no further occafion for his fervices. This fudden deprivation of all his employments was followed by his commitment to the Tower, on a charge of high treafon. No evidence was brought againft him; he was bailed, and the principal author of the accufation, then a prifoner in Newgate, was convicted of perjury and punifhed, and the earl cleared. It is now generally believed that though no proofs were then brought forward againft the earl, yet a correfpondence had been carried on between him and the exiled king with a view of reftoring him to the throne. It is certain that, during the life of queen Mary, Churchill kept at a diftance from court, and attended, with his lady principally, to the princefs Anne, whofe influence probably prevented his intrigues from being inquired into. After the death of Mary, Churchill was made a privy counfellor, and, in 1698, was appointed governor to the dnke of Gloucefter: on this occafion the king very handfomely faid to the earl, "My lord, make him but what you are, and my nephew will be all I wifh to fee him." He continued in favour during the remainder of the reign, and received more than once the moft unequivocal marks of the king's efteem.

Immediately upon the acceffion of queen Anne to the throne in 1702, the earl of Marlborough was raifed to that height of power and greatnefs which left no fubject in Europe his equal. He attained to every honour to which ambition itfelf could afpire, and he gained lucrative appointments for his friends. He was created a duke, had a penfion granted him by the queen for her life, and received the thanks of parliament for his conduct abroad. This courfe of good fortune was balanced by the lofs which he fuftained in the death of an only fon, a youth of eighteen, then at Cambridge, but the duke fought and found relief in an active performance of the high duties of his ftation. We cannot follow this great and illuftrious general through all his campaigns, in which it has been faid, that he never drew his fword but victory purfued him. The bufinefs of 1704 was, however, fo celebrated, and was fo fignalized by the duke's mafterly execution of his own plans of pufhing to the Danube, that it muft not be paffed over. After a march of fifty days from the frontiers of Holland, he arrived, unexpectedly, at the lines of Schellenburgh, defended

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by 20,000 men, which he instantly attacked, and forced, after an obstinate resistance. This success brought on the famous battle of Hochlett, or as it is more generally called by us, the battle of Blenheim, fought August 2d, between the allied army commanded by the duke of Marlborough and prince Eugene, and the French and Bavarians, commanded by marshall Tallard and the elector of Bavaria. Nothing could be more complete than the victory on the side of the allies. The pride of Louis XIV. received a check which it never afterwards recovered, and the battle of Blenheim may be reckoned the date of that reverse of fortune which embittered the latter years of that monarch's life. The French were pursued till they crossed the Rhine, Landau was taken, and France trembled for its own safety. It is not possible to enumerate all the popular triumphs of the duke of Marlborough upon his return to England. The more substantial expressions of the nation's gratitude consisted in the public gift of the honour of Woodstock and hundred of Wotton, and the erection of a magnificent palace for his residence. The next campaign produced nothing worthy of public expectation, on which account discontents began to manifest themselves in England. The duke employed the latter end of the year in visiting the courts of Berlin, Hanover, and Vienna, where his talents for negociation were equally useful to the common cause, as his military talents in the field. No man ever displayed happier powers in conciliating different tempers and interests; to which a perfect command of himself, and the habitual practice of all the engaging arts of good-breeding greatly contributed. The emperor Joseph presented the duke with the principality of Mindelheim, which accompanied his title of prince of the empire. By great exertions he was able to meet the French army under marshal Villeroy, and on the 11th of May, 1706, he gained the decisive battle of Ramillies, and with that the reduction of all Brabant, with Antwerp and its territory. Ostend, Menin, Dendermonde, and Aeth, were added to the conquests of the year. On account of his successes, a bill was passed to settle his honours upon the male and female issue of his daughters.

The duke of Marlborough had now attained to the zenith of his glory. In the campaign of 1707, his antagonist was the celebrated duke of Vendome, by whom he was so well matched as to be able to gain no material advantage; and he was mortified in being unable to infuse a spirit of zeal, at a conference at Frankfort, in the German part of the confederacy. On returning to England, he had the still further mortification of finding his duchess supplanted in the affections of her mistress, by a new and more obsequious favourite. His own presence reclaimed the queen's attentions for a time, but the impression was made which at length put an end to his consequence. In the campaign of 1708, the French, under the dukes of Burgundy and Vendome, were defeated at the battle of Oudenard, by the superior skill of prince Eugene and the duke of Marlborough. Lisle was afterwards invested, which, though it resisted several months, at length, with its citadel, surrendered. The duke also recovered Ghent, Bruges, and other places taken by the French at the beginning of the campaign. France was now obliged to set on foot a negociation, and the duke of Marlborough, who had so often met and defeated her generals in the field, was appointed the queen's plenipotentiary, and went to Holland. The preliminaries proposed by the duke, in which he had carefully regarded the interests of the allies, were such as the French minister could not agree to, and the war was again renewed. The duke of Marlborough was now to contend with marshal Villars, a general of great experience and skill. The battle of Malplaquet was fought on the 31st of August, the French lines were completely broken, and the result was one of the most destructive actions of the whole war. It cost the allies 18,000 men, killed and wounded. The city of Mons was captured, but the purchase was reckoned too dear, even by those who were not accustomed to set a proper value upon human lives. The English nation, long accustomed to victory, began to lose its relish for triumphs, in which itself had no real or very apparent concern. The war became unpopular; the tory part of the country were loud in the clamours against its continuance, and the duke himself was slighted. His winter visit, though attended with public honours, was very inauspicious to the expectations which he had formed; he found that a total breach had been made between the queen and his duchess. He took the field again early in 1710, and, in conjunction with prince Eugene, conducted a campaign against marshal Villars, in which they captured several places of strength and importance. The duke's victories on the continent could not prevent the machinations of his enemies at home. The queen had called to her council men wholly inimical to his views. They wished and expected his resignation; but either private interest, or a desire of being absent from the scene of things in which he could take no part, or, perhaps, from a regard to the public interests of his country, he dissembled his indignation, and again met his antagonist Villars. In this campaign he maintained his superiority, but the advantages gained were neither very brilliant nor of very great consequence. His influence at court was now completely gone, still he seemed willing to retain his command in the army, but as he did not resign, the honour was taken from him. In the House of Commons he was charged with peculation, for which there was no such strong ground as should have induced his enemies to have pursued him with so much indignity. They were jealous of his power, and were determined to keep no terms with the man who had been so long and so deservedly regarded as the first person in the nation, and who, whatever might be his failings, merited the esteem and veneration of his country. To escape the mortification that he was liable to experience in his own country, he paid a visit, in the winter of 1712, to the Low Countries, where he was received with the honours due to his high character. In two years he returned, and upon the accession of George I. was again summoned to the court, and enjoyed the smiles of royal favour. He was re-instated in the supreme military command, and his advice was taken and acted upon with regard to the suppression of the rebellion in 1715. This was the last public business in which he took a part. His mental faculties began to droop, and he at length experienced those changes which are so humiliating to the human understanding, and which induce the state of complete second infancy. He died at Windsor lodge on the 16th of June, 1722, in the 73d year of his age, leaving behind him a numerous posterity by his four daughters, married into families of the greatest consequence in the kingdom. Biog. Brit.

Churchill, Charles, was the eldest son of the rev. Mr. Churchill, rector of Rainham in Essex; and when about eight years old he was sent to Westminster school. His proficiency in classical learning was considerable, but not so extraordinary as to entitle him to any pre-eminence over several of his school-fellows in the same class with himself. At the age of fifteen he became a candidate to be admitted on the foundation at Westminster, and went in head of the election. On entering his nineteenth year he quitted Westminster school, and applied for matriculation at the university of Oxford, but was refused on account of a deficiency in classical fical learning; he was however admitted of Trinity College, Cambridge, in the year 1749. Immediately after his admiffion he returned to Weftminfter, but quickly put an end to his education, by an imprudent marriage with a young lady in the neighbourhood. To this premature and highly inconfiderate meafure, moft of the difficulties in which our author was afterwards involved may be afcribed; and in his endeavours to forget or elude thofe difficulties he acquired fuch habits of diffipation, as indirectly terminated his life. His father, who had been reluctantly reconciled to this imprudent match, received this youthful couple into his houfe, where they refided about a year, during which the conduct of the fon was exemplary and domeftic. In the year 1751 he retired to the north of England, and applied himfelf to thofe ftudies which fhould qualify him for his future deftination in the church. At the age of twenty-two he again vifited the metropolis to take poffeffion of a fmall fortune to which he became entitled in right of his wife. He no fooner was inducted into the office of clergyman than he earneftly laboured from principle to difcharge the important duties incumbent on him. At twenty-five he was ordained prieft by Dr. Sherlock, bifhop of London; his family however increafing, he found the fcanty income of a curacy very inadequate to fupply his wants, and he opened a fchool and obtained confiderable encouragement; but in 1758, by the death of his father, he quitted the profeffion of an inftructor, and was elected his fucceffor to the curacy and lectureſhip of St. John the Evangelift, and in connection with this he engaged in private tuition, and gave leffons to the young ladies at Mrs. Dennis's boarding-fchool in Queen's fquare, and likewife in his leifure hours attended feveral young gentlemen in order to affift them in their claffical ftudies.

Such was the laudable conduct of this young man until he was twenty-feven years of age, when a total alteration took place in his general fyftem of conduct and behaviour in life. The anxiety arifing from domeftic infelicity unhinged his mind, though naturally of a firm texture, and feemed to give an entirely new bias to his difpofition. At this time the friendfhip between Churchill and Robert Lloyd, which had been formed at fchool, revived with all the glow of fenfibility and ardour of attachment characteriftic of men of ftrong paffions and of warm imaginations. Urged on by the fame motive, a reftlefs inquietude of mind, they hurried together into fcenes of diffipated conviviality. "The future, fays one of Mr. Churchill's biographers, is rarely facrificed to the prefent, without producing confequences of the moft diftreffing nature." A few months only had elapfed before the young man experienced, in the moft fenfible manner, the juftice of this obfervation. He found that by his extravagance and fondnefs for theatrical amufements he wantonly plunged himfelf into an abyfs of mifery, from which he had no hope of being ever able to extricate himfelf. At this critical and alarming juncture, Dr. Lloyd, father to his friend and companion, became his deliverer, and by his aid, Churchill was enabled to effect a compromife with his creditors, who upon receiving one fourth only of their feveral demands, fully liberated him from all the terrors of a prifon. He now ferioufly thought of exerting thofe talents which he well knew were latent in his mind; and his firft fubject was derived from the ftock of obfervation his habits of life had afforded him. The excellencies and defects of the actors in both houfes were the topics of his Rofciad, a poem publifhed in March, 1761, without his name. It was greatly admired, and was attributed to the moft celebrated names of the time; but a fecond edition declared the real author. Churchill was raifed to a confiderable fhare of eminence. As the characters he had drawn were public ones, the public at large became interefted in the difcuffion of their merits; and the feverity of the author's fatire was no impediment to the popularity of his work. Befides this, it had a very confiderable fhare of intrinfic merit. Equal energy and vivacity were difplayed in the delineations; the language and verfification, though not without inequalities, were fuperior to the ordinary ftrain of current poetry; and many of the obfervations were ftamped with found judgment and correct tafte. The theatrical performers increafed the celebrity of the piece by the impatience which many of them fhewed under its cenfure. The author juftified himfelf in a new piece of fatire, entitled the "Apology." Thefe works made him many enemies, but they brought him into the moft flattering notice among wits and men of pleafure. This produced its natural confequence of loofe and licentious manners. His nocturnal revels and frequent abfence from home rendered every return to it the more irkfome, and the frequent altercations between him and Mrs. Churchill, who poffeffed but little of the fpirit of conciliation, and whofe imprudence is faid to have kept too near a pace with that of her hufband, ended in February, 1761, in a total feparation. This circumftance, together with the general outcry raifed againft him by his parifhioners for the total difregard of his religious functions, and the unbecoming mode of his drefs, induced him to refign the curacy and lectureſhip of St. John's, which, but a few years before, had been conferred upon him, in confequence of the high character which he then poffeffed for learning and morality. He now totally renounced all claim to the clerical character, became a man of the town, and indulged in all the exceffes to which youth and unbridled licentioufnefs could prompt. To vindicate his conduct from the juft cenfure of the public, Churchill publifhed a poem, entitled "Night." The difgraceful impofture of the Cock-lane ghoft furnifhed him with another topic of perfonal fatire, which, however, did not greatly intereft the public.

In the year 1762, Churchill plunged deeper and more irrecoverably in the mire of debauchery and faction, by commencing an acquaintance with Mr. Wilkes, and by becoming a coadjutor in the North Briton, and it was given in evidence by the bookfeller, that the profits arifing from the fale of this publication were received by Churchill. He was included in the general warrant with Mr. Wilkes, and only efcaped, owing to the meffenger's ignorance of his perfon, and to the prefence of mind with which Wilkes addreffed him by the name of Thompfon. The political occurrences at the beginning of the prefent reign had infpired among the people a rancorous hatred againft the Scotch; and Churchill adminiftered food to this paffion by the "Prophecy of Famine," the materials of which were propofed to him as the fubject of a paper for the North Briton; but on more mature confideration, he determined on converting it into a poem, in which the powers of defcription are exhaufted in humorous exaggeration of the defects of the country, and acrimonious abufe of its inhabitants. The poem was received with avidity, and gave the author that precedence as a political fatyrift, which he long maintained at the expence of candour and decorum, and to the final debafement of his poetical as well as his moral character. Hogarth was the next victim immolated at the fhrine of party, on account of the attempts he had made to expofe the failings of the earls Temple and Chatham, and his coarfe caricature of Churchill himfelf. This epiftle was written in the author's beft manner, and is faid to have accelerated the death of the ingenious artift to whom it was addreffed.

Churchill now affected in his manners and drefs the appearance

pearance of a man of the town, and, in conformity to this exterior, he engaged in his illicit amours. He even proceeded to the fashionable vice of seduction, and enticed from her parents the daughter of a respectable tradesman in Westminster, for whom his passion subsided in less than a fortnight; during which short period she had full leisure afforded her for sorrow and repentance. Her father was induced to receive her again into his family: this instance of tenderness sensibly affected her, and her future conduct would probably have justified the lenient kindness of a father, had she not been continually exposed to the taunts and goadings of an elder sister, the bitterness of whose reproaches induced this unhappy young woman to apply once more to Churchill for protection, which he readily granted. While this transaction was fresh in the public mind, he published the "Conference," in which the emotions of a mind not hardened in guilt, and severely labouring under the pressure of self-conviction, are pathetically described, and several passages of that poem are strongly expressive of manly sentiment and acuteness of feeling. Accompanied by this young lady, he retired into Wales in the summer of 1763, the rusticity of whose inhabitants he has celebrated in his work, entitled, "Gotham." On his return to London, he found his friend, Lloyd, imprisoned in the Fleet, for whose liberation he made every possible exertion, but his efforts proved abortive. The rencontre between Wilkes and Martin gave rise to Churchill's next poem, entitled, "The Duellist," and he closed his poetical labours for the year 1763, with the "Author." The satire in this publication is of a general nature, and well directed. In 1764, he poured forth several new productions, inspired by no other muse than necessity, and accumulating all the faults, with few of the beauties of the former: these are entitled "The Candidate," "The Times," "Independence," and "The Journey." Towards the latter end of that year Churchill went over to France to pay a visit to Mr. Wilkes, then a refugee in that kingdom. At Boulogne he was seized with a fever, which soon threatened the fatal termination that took place on November 4th, 1764, which closed his short but animated career in his 34th year. His body was brought to Dover, where it was deposited in the old church-yard, with a stone over it, on which are inscribed his age, the time of his death, and this line from his own works:

"Life to the last enjoy'd here Churchill lies."

It is to his credit that he is much regretted by his particular friends, to whom he was endeared by a generosity of temper not unusually attending strong passions and unshackled manners. His poetical reputation seems to have been uniformly declining from the time of his death: a handsome edition of his works was, however, published in the year 1804, in two volumes, octavo, with explanatory notes, and an account of his life, to which this article is indebted. Churchill left two sons, Charles and John, the charge of whose education was generously undertaken by sir Richard Jebb, who sent the former to the university of Cambridge, with a handsome allowance. They neither of them proved worthy of this support. They inherited the faults, without the virtues and abilities of their father, and died, like him, victims to their disregard of temperance and prudence.

CHURCH-HILL, in *Geography*, a post and fair-town of Ireland in the county of Fermanagh. It is near Lough Erne, on the road from Enniskillen to Belleek, and is 89 miles N.W. from Dublin.

CHURCH-HILL, a village of America, in queen Anne's county, Maryland, at the head of S.E. creek, a branch of Chester river; N.W. of Bridge-town, and N.E. of Centreville eight miles, and 85 S.W. from Philadelphia. N. lat. 40° 9'. W. long. 75° 53'.

CHURCH-HILL *fort*, called also *Prince of Wales's fort*, a fort in New North Wales, at the mouth of Seal river, on the coast of Hudson bay, constructed in 1715. N. lat. 58° 55' 30". W. long. 94° 50' 45". The temperature of 12 months, from Sept. 1768 to the end of August 1769, was 24°.7. Phil. Trans. for 1770, vol. LX. p. 148, &c.

CHURCH-HILL *river*, a river of New South Wales, which runs north-easterly into the west side of Hudson bay, at Church-hill fort. N. lat. 58° 47' 32". W. long. 94° 7' 30".

CHURCHING *of women after child-birth*, took its rise from the Jewish rite of purification. In the Greek church it was limited to the fortieth day after delivery; but in the western parts of Europe no certain time is observed. There is an office in the liturgy for this purpose.

CHURCH-TOWN, in *Geography*, a village of America, in the N.E. part of Lancaster county, Pennsylvania, about 20 miles E.N.E. of Lancaster, and 50 W.N.W. of Philadelphia. It has 12 houses, and an episcopal church; and in the environs are two forges, which manufacture about 450 tons of bar-iron annually.

CHURCO, a town of Asiatic Turkey, on the coast of Caramania, about 46 miles from the isle of Cyprus.

CHURGE, in *Ornithology*, the name given by Buffon to the Indian bustard; he terms it *churge ou outarde moyenne des Indes*. See OTIS *bengalensis*.

CHURLE, CEORLE, or CARL, in *Saxon Times*, signified a tenant at will, who held of the thanes on condition of rent and service. They were of two sorts: one rented the estate like our farmers: the other tilled and manured the demesnes, and were called ploughmen.

CHURN, in *Rural Economy*, the name of a vessel in which cream is coagulated by agitation. There are various constructions or sorts of churns, but those which are of the upright or Dutch kind, and barrel churns, have been by much the most generally employed. Dr. Anderson observes that he should prefer the simplest which he has seen as the best; merely because they admit of being better cleaned, and of having the butter more readily separated from the milk than any others; these are the old-fashioned upright kinds, which have long handles with feet to them, perforated with holes for the purpose of beating the cream by means of being moved upwards and downwards by the hand. But though, for these reasons, he may prefer this form of churn, other persons may choose that which they like best, as all the sorts under skilful management will perform the business perfectly well. Indeed, where the cream has been properly prepared, the process of churning will be so easy, he thinks, as to render those utensils, in general, the most commodious which can be most easily emptied.

According to the author of the "Agricultural Survey of Cheshire," the churns in common use there are mostly of the upright sort, and have in some cases a lever applied to them, in which case, one end of it, which is supported by an upright frame, is connected to the end of the churn staff, and the other end of it by the means of a rod to the crank of a toothed wheel, and is wrought by a pinion fixed upon the axle of a common winch. By this simple contrivance, the operation of churning is performed by a single person with the greatest facility. But in large dairies, churns are frequently wrought by means of a horse, and on such farms as have threshing mills, they may be very conveniently attached to and wrought by them. But in whatever way the business of churning may be performed, the size of the churn should always be suited to the quantity of cream

cream intended to be churned, as without attending to this point, much lofs may frequently be incurred by the cream being forced out of the churn, as well as other caufes.

Several improvements have lately been made in this fort of machinery. Mr. Harland, by an alteration in the manner of working thefe utenfils, has in a great meafure obviated the inconvenience of the vertical motion of the common churn, and the awkward rotatory motion of the barrel churn; which is fupplied by a very eafy mufcular exertion, refembling in its nature that of a common pump-handle; and by affixing a fly-wheel, the agitation is performed in a more equable manner, and on that account the butter is more perfectly feparated from the whey. The effect of the fly-wheel in regulating motion may eafily be made evident by ceafing to work the handle, on which the churn, by a regular diminution of motion, continues to act for fome time without any moving power being applied. At *fig.* 3. *Plate* VIII. of *Agriculture*, is fhewn the common barrel-churn, thus improved, moved by the intervention of a multiplying-wheel, to moderate its over-violent motion. The head of the crank moving in the mortife in the handle, caufes the rotatory motion of the barrel with great facility. From fome experiments that have been made it would appear that if the barrel be fixed, and the axis in the infide, to which the dafhers are attached, be made to turn, that the forming of the butter will be much fooner completed than when the contrary is the cafe.

Churns with this fort of alteration have been likewife conftructed by the fame ingenious mechanic.

At *fig.* 4. is an improvement in communicating the vertical motion to the common churn. The fly-wheel and crank are applied as in the other inftance, and with the fame equable effects; which, from the vertical motion of the common churn being fo intolerably fatiguing, is a very valuable application. The limits of this vertical motion are obvioufly double the length of the crank whofe end is inferted in the mortife of the handle. The fame apparatus may be applied for making different quantities of butter by placing larger or fmaller churns on the fame platform.

Other improvements in thefe utenfils have been introduced by Mr. Rawntree, the principal advantages of which are, that the cream is more effectually agitated than in the common churns; that, by taking off the covers, the infide can be perfectly cleaned without any difficulty, and that by leaving them off, the churn will be kept fweet, when not in ufe, by the current of air paffing through it. A churn of this improved kind as fhewn in *fig.* 5, is compofed of two cylinders of tin plate (or, in large churns, of wood,) A, B joined together in an angle; thefe are ftrengthened by two bars of wood on each fide, covered with iron plates D, D, to which the centre pins *d*, that the churn turns upon, are affixed; the iron plates D, D, project beyond the wooden bars, and have holes through them to receive each end of a clamp *e*, which has a fcrew through the middle of it: the end of this fcrew preffes againft the middle of the cover E, fo that when the fcrew is releafed the clamp *e* can be taken away, and the cover removed. Each of the cylinders contains a beater, compofed of three circular boards, *fig.* 6, with holes through them, which boards are kept at the proper diftances from each other by a wooden rod fixed to them; *n n* is a fmall pipe extending from near the outer end of each cylinder to their junction where it connects with a fmall upright pipe; thefe anfwer the purpofe of the vent-peg, and can always be kept open without throwing out the cream. When this churn is ufed, one of the beaters muft be put into its cylinder, and its cover put on and fcrewed faft; the churn muft be then held by one perfon, fo that the clofed cylinder is nearly vertical, (as in the figure) while another pours the cream in at the other end, which is left open; the other beater is then put in and the cover fcrewed on. The operation of churning is performed by a perfon taking hold of any part of the churn, and moving it up and down on its centre pins, fo that the elevated cylinder is a little above the horizontal line, (large churns are put in motion by a pendulum affixed to the end of one of the centre pins). By this means the cream is alternately poured out of one cylinder into the other, and dafhed againft the beaters with great violence. When the butter is made, the butter-milk is drawn off by a peg in one of the covers, and the butter is taken out by removing the covers. And an improvement of his on the upright churn is exhibited at *fig.* 7, by which the operation of churning is faid to be executed with much greater eafe and expedition.

The *pendulum churn* conftructed by Mr. M'Dougall has been found to anfwer admirably well, and fave much labour in Mr. Curwen's dairy in Cumberland.

As the improvements of Mr. Harland render the expences of churns confiderably higher, it may not be unufeful to ftate the addition which is thus created. A barrel-churn, which will make four dozen of butter, ufually cofts about 3*l.* 10*s.*, but, with the improvement, five guineas; the common upright churn, with the additional apparatus, will coft two guineas, when for making eight pounds at a time; and three guineas for making twelve pounds, and fo on in proportion to the fize. Thefe churns may be had of the manufacturer in Fenchurch-Street, London.

Churn-*owl*, in *Ornithology*. The common European goatfucker has obtained the name of churn-owl in many parts of England; and it is alfo called the goat-owl and fern-owl. Ray defcribes it in his Synopfis under the name of churn-owl; and Willughby under the two latter. At this time it is pretty generally known to be of a diftinct genus from the owl tribe; it is the *Caprimulgus europæus* of modern naturalifts. See article Caprimulgus.

CHURNET, in *Geography*, a river of England, which runs into the Dare in Staffordfhire.

CHURNING, in *Rural Economy*, the operation of procuring butter by the agitation of cream in a veffel of the churn kind. It has been well noticed by Dr. Anderfon, that in the management of this procefs much greater nicety is requifite than has been commonly fuppofed; as a few hafty irregular ftrokes given by the dafhers may render the whole of the butter of that churning ufelefs in its original intention, and of little or no value for any other purpofe, which, but for that circumftance, would have been of the firft quality. It is therefore conceived that the proprietors of extenfive dairies fhould be particularly attentive to the execution of this part of the bufinefs, and be very careful in providing a proper perfon for the conducting of it.

The moft fuitable conductors of operations of this nature are thofe of cool, fedate, fober difpofitions, and no others fhould ever be permitted to take any fhare in the performance of this fort of bufinefs without a conftant attention to the manner in which it is executed, as without fuch care much lofs and inconvenience may often be fuftained by the dairy farmer.

And, it is added, that to thofe who have been in the habit of feeing cream churned that has not undergone a proper preparation, it may perhaps be thought that it muft be hard labour in a confiderable dairy to be executed by one perfon; but that nothing is more eafy, fo far as bodily labour is concerned, than the procefs of churning butter where the cream has been prepared in a fuitable manner.

Mr. Headrick made the following chemical experiment as to the procefs of churning, which is recorded in the Report of of Mid-Lothian. "From the fwelling and foaming of the liquor during this procefs, he was led to conclude that gafes were evolved from it."

And "to afcertain that point, a glafs tube was faftened in a plug of cork, fixed in the funnel of a patent churn belonging to Mr. Robertfon at Granton. The lower extremity of the tube was immerfed in water, and the joints of the funnel and cork luted, fo as to prevent the accefs of external air and caufe the gafes emitted by the liquor to pafs through the tube into an inverted glafs jar, previoufly filled with water.

"To their great furprife, no gafes whatever were (he fays) emitted during the procefs; and the water in the bafon conftantly rofe in the glafs tube; which fhewed that the atmofpheric air was rufhing into the liquor inftead of gafes rufhing from it, as they expected, into the atmofphere."

The conclufion which feems to follow from this experiment is, he thinks, "that in churning, the faccharine part of the milk combines with the oxygen of the atmofphere, by which it is converted into acid, and precipitates the oil, or butyraceous part." He adds, that "this experiment might give rife to many important obfervations concerning the nature and management of milk; but it fhould be previoufly repeated, with varied circumftances, in order more fully to afcertain the facts."

It has been fuggefted by fome, that the procefs of churning might be greatly expedited by having recourfe to the ufe of acids, fuch as diftilled vinegar, towards the latter part of the operation; but it is probable that fuch additions can never be made without confiderably injuring the quality of the butter. Befides, nothing feems to be neceffary to the eafy and expeditious execution of the bufinefs, but a due temperature and ftate of acidity in the cream, the manner of attaining which is fully explained in fpeaking of the nature and management of the dairy. See DAIRYING.

For various methods of churning or making butter among the ancients and in the Eaft, fee BUTTER.

CHURR-WORM, in *Entomology*, a name given by fome to the *Gryllotalpa*.

CHURRITUCK, in *Geography*, a county of America, in the ftate of North Carolina, and diftrict of Edenton.

CHURSEN, a town of Arabia; 32 miles N.E. of Chamir.

CHURWALDEN, a diftrict of Switzerland, in the league of the Ten Jurifdictions, purchafed of the houfe of Auftria in 1649. In this diftrict the hamlets are pleafantly difperfed about the vale and upon the fides of the mountains.

CHUSAN, CHEW-SHAN, or TCHEOU-CHAN, an ifland, or rather a groupe of iflands, fituate in the Eaftern fea, about 18 or 20 leagues from Ning-poo, between the province of Tche-tchiang, the eaftern coaft of China, and Japan. N. lat. 30°. E. long. 122°. At the harbour of the principal of thefe iflands the Englifh firft landed on their arrival at China; and this was formerly reckoned the utmoft boundary of European navigation. The fea from thence, for about 10° of latitude and 6° of longitude, was utterly unknown before the late embaffy, the fquadron of which touched at this ifland in 1793, except to thofe who dwelt in the neighbourhood of its fhores. Into this fea are received the waters of the great "Whang-ho," or Yellow river of China. See YELLOW *Sea*. Between the Queefan iflands and Chufan harbour, through a fpace of about 60 miles in length, and 30 in width, the number of iflands exceeds 300. The part of the harbour in which the Clarence, one of the fhips of the Britifh fquadron, anchored, was about half a mile diftant from a landing place, and the depth of water was five fathoms. In this fituation the four paffages into the harbour were fo fhut in, that none of them were vifible. It appeared like a lake furrounded by hills; the extent of the harbour, from north to fouth, is little more than a mile, and near three miles from eaft to weft. The rife and fall of the tides make a difference of about 12 feet. The time of high water, at the full and change of the moon, appears to be about 12 o'clock. The tides, however, are very irregular, and vary, according to the wind, and the eddies produced by fuch a multiplicity of iflands.

Among thefe numerous iflands there are almoft as many valuable harbours, or places of perfect fecurity, for fhips of any burden. This advantage, together with that of their central fituation, in refpect to the eaftern coaft of China, and the vicinity of Corea, Japan, Leoo-keo, and Formofa, attract confiderable commerce, efpecially to Ning-poo, a city of great trade in the adjoining province of Tche-tchiang, to which all the Chufan iflands are annexed. From one port in that province twelve veffels fail, annually, for copper to Japan.

Moft of the Chufan iflands confift of hills rifing with a regular flope, and rounded at top, as if any points or angles, exifting in their original formation, had been gradually worn off into a globular and uniform fhape. Many of thefe iflands, though clofe to one another, are divided by channels of great depth. They reft upon a foundation of grey or red granite, fome part refembling porphyry, except in hardnefs. They were certainly, fays fir G. Staunton (Embaffy, vol. i. p. 408), not formed by the fucceffive alluvion from the earth brought into the fea by the great river, at whofe mouth they are fituated, like the numerous low and muddy iflands at the mouth of the Po, and many others; but fhould rather be confidered as the remains of part of the continent thus fcooped and furrowed, as it were, into iflands, by the force of violent torrents carrying off, farther into the fea, whatever was lefs refiftible than the adjacent rocks. Some of them wore a very inviting afpect; particularly *Poo-too*, which fee.

CHUSARIS, or CHUSARUS, in *Ancient Geography*, a river of Africa, in the interior of Libya, according to Ptolemy.

CHUSII, or CISII, a people of Afia, in Sufiana, S.W. of the town of Sufa between this and Pafitigris.

CHUSIS, CHUZES, or CHISAS, an epifcopal fee of Africa, mentioned in the acts of the council of Carthage, held under Cyprian.

CHUSISTAN, or KHOSISTAN, in *Geography*, a province of Perfia, bounded on the north by the Irak Ajemi, on the eaft by Farfiftan, on the fouth by the Perfian gulf, and on the weft and fouth-weft by the Tigris, which feparates it from the Arabian Irak. This is the fame country with Cufh in Affyria, having preferved its ancient name with a Perfian termination, and correfponds to the ancient Sufiana. But the name is antiquated. Shuftec, or Toftac, is now the name of a large province. Loriftan, or Laureftan, is in Shuftec; and to the weft is the country of Havila, the Ahwaz of M. D'Anville. The country, thus denominated, is extenfive, but thinly inhabited. It produces corn, rice, cotton, fugar, tobacco, and dates. The northern part is mountainous, but the fouthern flat and marfhy.

CHUSKA, a town of Afia, in the country of Tibet; 25 miles W.S.W. of Tankia.

CHUTA-NAGPOUR, a town of Hindooftan, in the country of Bahar; 150 miles S. of Patna, and 190 W. of Calcutta.

CHUTÆI, in *Ancient Geography*, a people originally of Affyria or Sufiana. Salmanazar tranfported them into the country

country of Samaria, in the room of the Israelites; they were then idolaters, and he appointed priests to instruct them in the worship of the God of Israel; but they attempted to blend idolatry with the religion of the Hebrews. Under Alexander the Great they obtained permission to build a temple on mount Gerizim. Josephus.

CHUTE, in *Geography*, a river of England, which runs into the Avon, near Bath.

CHUWASCH, a town of Persia, in the province of Segestan; 70 miles S.E. of Zareng.

CHUZIS, in *Ancient Geography*, a town of Africa propria, placed by Ptolemy between the two Syrtes.

CHWASTOW, in *Geography*, a town of Poland, in the palatinate of Kiov; 40 miles S.S.W. of Kiov.

CHYDA, in *Ancient Geography*, a town of Asia Minor, in Lycia, according to Ptolemy.

CHYDAS, a river of Sicily. Ptol.

CHYLE, in *Anatomy*, is the fluid into which the food is converted in the small intestine. See DIGESTION.

CHYLE, in *Chemistry*. The food of animals, after it has undergone digestion in the stomach, passes into the duodenum (the first of the small intestines), and here a separation begins to take place, the *chyle*, or nutritive part of it, being absorbed by the *lacteals*, which are minute absorbent vessels which open within the cavity of the small intestine, whilst the other portion of the food passes down into the large intestines. Chyle, therefore, is the last change that food undergoes previous to its conversion into blood, for the lacteals convey it by a circuitous course into a common reservoir, the *thoracic duct*, which opens into the left subclavian vein not far from the heart. The chemical analysis of chyle would be scarcely less interesting than that of blood itself, could it be collected in sufficient quantity, but this is attended with great trouble, as it would be scarcely possible to collect from one animal a greater quantity of *healthy* chyle than what would be found in the thoracic duct when the animal was killed a few hours after making a hearty meal. Hitherto only a few desultory experiments have been made on pure chyle, which have been collected by Haller.

By these we learn that chyle is a milky white fluid, of an agreeable sub-saline taste, lighter than the serum of blood, and even than water, on the surface of which it swims like cream. It readily coagulates by rest and extravasation, and appears to be composed of water, of an oily substance, consisting of globules evident to the microscope, of a heavier matter, like cheese, which remains at the bottom after coagulation, and of some earth. Chyle readily turns sour by keeping, but when fresh it gives no signs of acidity. The nature of the aliment makes but little change in that of the chyle. Its colour is usually white, as is obvious by the whiteness and turgescency of the lacteals, if examined after digestion; but Dr. Fordyce found that indigo, introduced in fine powder into the stomach, was capable of giving a blue tinge to the chyle. For further observations as to the time and mode of its formation, see the article DIGESTION.

CHYLEMETH, in *Ancient Geography*, a river of Africa, in Mauritania Cesariensis, according to Ptolemy.

CHYLIFICATION, is the process by which the conversion of the food into chyle is effected. See DIGESTION.

CHYLONGO. See CHILONGO.

CHYLOSIS. See CHYLIFICATION.

CHYME, is that particular modification which the food assumes after it has undergone the action of the stomach. See DIGESTION.

CHYME, in *Chemistry*. All food is reduced in the stomach by the united action of the fibres of this organ and of the gastric juice into a white pulpy mass, in which all the digestible parts of the aliment are indistinguishably blended, and which is called *chyme*. It is probably after this period that the *chyle* begins to be separated. The formation of chyme is so intimately connected with the subject of *digestion*, that we shall refer our readers to this article.

CHYMISTRY. See CHEMISTRY.

CHYMOLOGI, among *Botanical Writers*, denote such as have employed their time in investigating the qualities and properties of plants from their taste and smell.

CHYMOSIS, in *Physiology*, formed of χυμος, *succus*, of χεω, *fundo*, *I melt*, the act of making or preparing *chyme*, which see.

CHYMOSIS, in *Surgery*. See CHEMOSIS.

CHYTLA, in *Antiquity*, a liquor made of wine and oil, and sometimes used in divination.

CHYTRACULIX, in *Botany*, Brown. Jam. See CALYPTRANTHES *chytraculix*.

CHYTRÆUS, DAVID, in *Biography*, a learned Lutheran divine, born at Ingelfing, in Suabia, in 1530, was distinguished for his application to theology and the belles lettres, of which he became a professor at Rostock. He died in 1600. He was a considerable author; but his principal piece was a "Commentary on the Apocalyse." His Latin chronology of Herodotus and Thucydides is also in some repute. All his works were collected and printed at Hanover, in 1604, in two volumes folio. His brother, Nathan, presided over an academy at Bremen: he acquired some reputation for his Latin poems.

CHYTRI, among the Athenians, a festival in honour of Bacchus and Mercury, kept on the 13th of the month Anthesterion.

CHYTRI, in *Ancient Geography*, a town of the island of Cyprus, according to Pliny and Steph. Byz., called by Ptolemy *Chytros*, which had been episcopal.—Also, a lake of Greece, in Bœotia, placed by Theophrastus in the canton called "Pelecania," between the rivers Melas and Cephisus.—Also, a place situated at Thermopylæ, in which were hot baths. Pausanias, who speaks of these baths, says, that the people of the country called them χυτρους γυναικειους, *chytres*, or *baths of females*.

CHYTRINUM, or CHYTRIUM, a place of Asia Minor, in Ionia, belonging to the inhabitants of the isle of Cos.

CHYTROPOLIA, a place of Asia, in the vicinity of the burgh of Telephe, supposed to be situated towards the Phasis in Armenia Major.

CHYTROPOLIS, a small country of Thrace. Steph. Byz.

CHYTRUS, CITRIA, a town of the island of Cyprus, at some distance from the northern coast, S. of Marcaria, and N.W. of Salamis.

CIA, or DIA, an island of the Ægean sea, near that of Crete. Pliny.

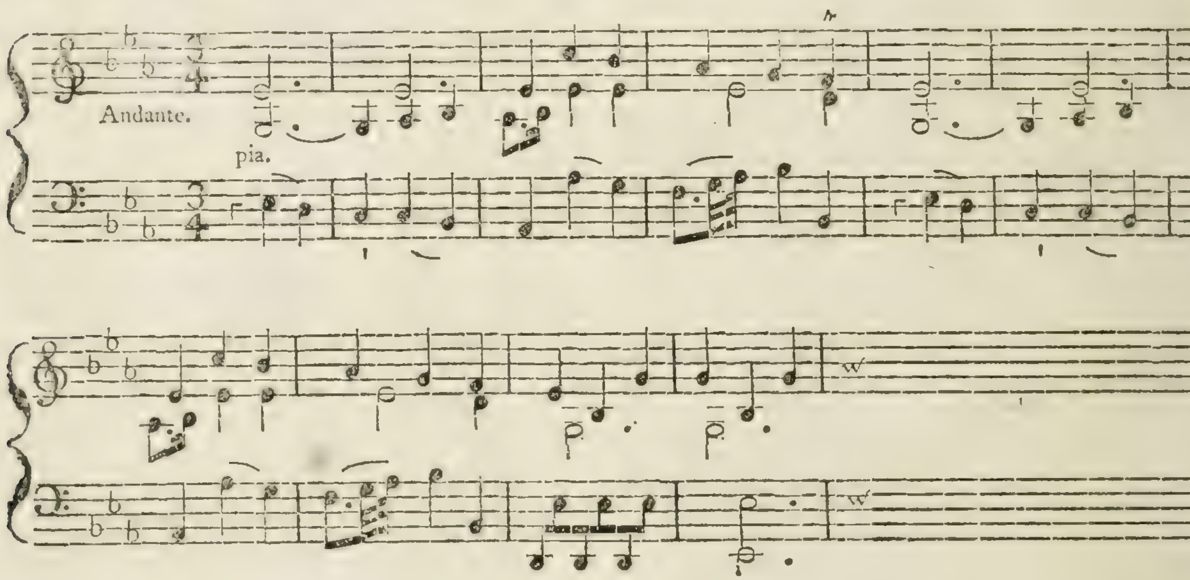
CIABRUS, CIAMBUS, CIAMBRUS, or CEBRUS, *Zibriz*, a river of Mœsia, dividing it into the higher and lower, running towards the north, and discharging itself into the Danube.

CIACA, a town in that part of Cappadocia, which was afterwards called Armenia Minor; situated in the Melitene, upon the right bank of the Euphrates, almost opposite to Pastona. Ptolemy calls it *Ciacis*.

CIACCONA, in *Music*, in Italian means the same thing, with *Chaconne* (which see) and is of so ancient an invention, that the origin of the term is disputed. Frescobalds has composed variations on the ciaccona; and a whimsical composer of Bergamo, Il Cavalier Tarquinio Merula, in a volume of his works published in 1635, has a composition which he calls "Duo sopra la Cieccona," on a grand base. Etymologists are doubtful whence the

the word *chaconne* or *ciacconna* is derived; it has been imagined in Italy by ſome that a *cieco*, or blind fidler, had invented the air, and that it had its name from that circumſtance. And we are able to give ſome weight to this conjecture, from recollecting, that in the "Hiſt. of Muſ. vol. ii." there is an account of a celebrated blind organiſt, who flouriſhed at Florence ſo early as the middle of the 14th century, and who was probably author of the air upon a ground, called the *cieccona*, or *ciacconna*. Philip Villani, the youngeſt of the Florentine hiſtorians of that name, in his "Vite d'Uomini illuſtri Florentini," has inſerted the life of Franceſco Cieco, the blind organiſt, who died in 1390. "Many," ſays this writer, "are the Florentines who have rendered themſelves memorable by the art of muſic; but all thoſe of former times have been far ſurpaſſed by Franceſco Cieco, who ſtill lives; and who, during childhood, was deprived of ſight by the ſmall-pox. He was the ſon of Jacopo, a Florentine painter, of great probity and ſimplicity of manners; and being arrived at adoleſcence, and beginning to be ſenſible of the miſery of blindneſs, in order to diminiſh the horror of perpetual night, he began in a childiſh manner to ſing; but advancing towards maturity, and becoming more and more captivated with muſic, he began ſeriouſly to ſtudy it, as an art, firſt by learning to ſing, and afterwards by applying himſelf to the practice of inſtruments, particularly the organ, which he ſoon played, without ever having ſeen the keys, in ſo maſterly and ſweet a manner, as aſtoniſhed every hearer. Indeed, his ſuperiority was ſoon acknowledged ſo univerſally, that, by the common conſent of all the muſicians of his time, he was publicly honoured at Venice with the laurel crown for his performance on the organ, before the king of Cyprus and the duke of Venice, in the manner of a poet laureat."

As the beautiful chaconne by Jomilli, which terminated a grand ballet at the Opera Houſe in 1772, and in which Mademoiſelle Heynel diſplayed her unrivalled powers of grace and execution, is not yet forgotten, we ſhall here inſert a few bars of it, as an admirable ſpecimen of the kind of movement ſo called.



CIACICA, in *Geography*, a juriſdiction or province of Peru, in S. America, ſubject to the archbiſhop of Plata; about 90 leagues N. of the city of Plata, and 40 from Paz. Its capital, which has the ſame name, and all the places ſituated to the ſouthward of it, belong to the archbiſhopric of Plata; but many of thoſe that lie to the north of it are in the dioceſe of Paz. The countries in this juriſdiction extend in ſome parts above a hundred leagues, and, of courſe, the temperature is various. Some parts are very hot, and produce abundance of *coca*, (which ſee,) affording a conſiderable commerce, and ſupplying all the mine towns from Charcas to Potoſi. The colder parts feed large herds of cattle; together with vicunas, guanacos, and other wild creatures. This province has alſo ſome ſilver mines.

CIACONIUS, Alphonso, in *Biography*, born at Baeça, in Andaluſia, about the year 1540. He entered the order of the Dominicans, and was afterwards ſent to Rome, where he was created titular patriarch of Alexandria. He wrote ſeveral works, ſome of which prove him to have been exceedingly credulous and ſuperſtitious, ſuch was his treatiſe to confirm the ſtory of the delivery of Trajan's ſoul from hell by the prayers of pope Gregory the Great. His moſt eſteemed work is entitled, "Vitæ et Geſta Rom. Pont. et Cardinalium," which he did not live to finiſh. It was completed by his nephew, and publiſhed in 1602. It abounded with errors, and the reviſion of it was committed to Jerome Alexander, and Vittorelli, and the corrected edition appeared in 1630. The laſt edition was greatly enlarged, and publiſhed in 4 vols. folio, at Rome, in 1676. Ciaconius left in MS. "An univerſal Library of Authors," which was edited, with additional notes, by Camuſat, and printed at Paris in folio, in 1732.

CIACONIUS, Peter, brother of the above, was employed by pope Gregory XIII. in reviſing an edition of the Bible, and of other works then printing at the Vatican. For ſuch an employment he is ſaid to have been admirably fitted, on account of the extraordinary facility which he had of reſtoring mutilated paſſages, and illuſtrating obſcurities. He is celebrated chiefly as a commentator, but he was engaged with Clavius in a correction of the calendar, and, after his death, were publiſhed a poſthumous work of his, entitled, "Kalendarii Romani veteris Explanatio," and ſome ſmaller pieces. He was connected with, and highly eſteemed by, the principal literati of his time, and was accounted

counted among the moſt learned men of the age in which he flouriſhed. He died at Rome in 1581. Gen. Dict.

CIÆNA, or CINNA, in *Ancient Geography*, a town of Aſia Minor, in Galatia. Ptolemy.

CIAGESI, or CIAGISI, an ancient people, who occupied one of the more ſouthern parts of Dacia.

CIAIS, a town of Mingrelia, near the Black Sea.

CIALIS, a country of Independent Tartary, with a capital of the ſame name; bounded on the N. by Eluth, on the E. by ſandy deſerts, on the S. by the Greater Tibet, and on the W. by Turkeſtan.

CIAMBERLANO, LUCA, in *Biography*, a painter and engraver, native of Urbino, whoſe prints bear date from 1609 to 1628. His engravings are executed entirely with the graver, in a neat but ſtiff manner: he drew the figure with tolerable correctneſs; but the effect in his prints is much injured by the lights being too much ſcattered, and of equal ſtrength; this, however, is the fault of the time when he lived. Many of his prints are from his own compoſition, and others from Raffaele, Polidor, Caracci, &c. Strutt. Heinecken.

CIAMBETTA, in *Ichthyology*, one of the ſynonymous names of the balance-ſhark, *Libella ciambetta*, Salvian, Aq. See SQUALUS *zygæna*.

CIAMPA, in *Geography*. See CHIAMPA and SIAMPA.

CIAMPELLI, AGOSTINO, in *Biography*, an hiſtorical painter, born at Florence about 1578. He became the diſciple of Santo di Titi, the moſt eminent Florentine painter of that time, and from him imbibed a ſufficiently correct and pure ſtyle of drawing, together with the gay colouring then in uſe among his countrymen. His pictures are, however, a little too red, and ſometimes rather hard. He neverthele ſs acquired ſufficient reputation to occaſion his being employed at Rome under Clement VIII. and his ſucceſſors, upon many large works in freſco, and in oil, which are enumerated by Baglione. The Sacriſty, and the chapel of S. Andrea, in the church of Geſu, are amongſt his beſt works in freſco; and a picture in oil by him at St. Stefano in Peſcia, repreſenting the meeting of Mary and Elizabeth, is conſidered little inferior to another by Tiarini, placed near it. Towards the latter part of his life, he was honoured by the ſuperintendance of the fabric of St. Peter's, the fatigue of which, however, is ſuppoſed to have contributed to his death, about 1640.

A very beautiful compoſition of Ciampelli, repreſenting the death of St. Antonio Abate, is engraved in the Etruria Pittrice. Baglione. Lanzi, Storia Pittorica. Orlandi.

CIAMPI, VINCENZO, an opera compoſer of conſiderable merit, who arrived in England in 1748, with a new company of comic ſingers brought hither from Italy by Signor Croza, for the firſt time. Theſe performers, conſiſting of Pertici, Laſchi, and Guadagni, then very young for the firſt ſerious man; Fraſi, and afterwards the Mellini, for ſerious woman; and the comic female characters by the wives of Pertici and Laſchi, the two beſt buffo actors we ever ſaw on any ſtage, formed a very good troop; and in the comic operas of "La Comedia in Comedia, Orazio, Don Calaſcione, Gli tre Ciciſbei ridicoli," &c. compoſed by Latilla, Natale Reſta, and Ciampi, who came over as maeſtro to the company, pleaſed the public, and filled the theatre, very ſucceſsfully, during the whole ſeaſon.

Ciampi remained in this country till the arrival of Cocchi in 1754, and compoſed ſeveral comic operas, as "Il Negligente," "Bertoldo," &c. and the ſerious operas of "Adriano in Siria," "Didone," and "Il Trionfo di Camilla." He likewiſe publiſhed ſix organ concertos, in which there were ſome maſterly movements; but though all ſuperior to the concertos of Filton, then in high favour, particularly in the country, being leſs familiar and common, they were never much noticed or performed in public. The productions of Ciampi ſtrike us now as they did fifty years ago: they are not without merit; he had fire and abilities, but there ſeems ſomething wanting, or redundant, in all his compoſitions; we never ſaw one that ſatisfied us, and yet there are good paſſages in many of them. "Adriano in Siria" was compoſed for ſecond-rate ſingers, and the muſic is of the ſame kind. The comic ſongs of "Il Negligente" are infinitely better than his ſerious ſongs; and convince us that the buffo ſtyle, for which he came over, was that in which nature beſt aſſiſted him.

CIAMPINI, JOHN-JUSTIN, born at Rome in 1633 was firſt engaged in the ſtudy of the law, with an intention of becoming advocate, but he afterwards attached himſelf ſolely to the practice of the apoſtolic chancery, in which he ſucceſſively occupied various poſts. He was much attached to the ſtudy of the belles lettres, which he promoted by various publications. He took a part in a literary journal commenced at Rome in 1668, and in three years he formed a ſociety for the ſtudy of eccleſiaſtical hiſtory. Under the protection of Chriſtina, then reſident at Rome, he founded, in 1677, an academy for phyſics and mathematics, which attained to conſiderable celebrity. He died in 1698, leaving behind him many works, which exhibit much learning, but they are deficient in method and purity of diction. His chief work is entitled "Vetera Monumenta, in quibus præcipue Moſaica opera, Sacrarum Profanarumque ædium Structura illuſtrantur," 2 vols. folio. This is a learned and curious treatiſe on the remains of ancient buildings and moſaics in Rome, illuſtrated with numerous engravings. The great object of this work is the elucidation of various points in eccleſiaſtical hiſtory. He was a collector of curious books, and well acquainted with their value.

CIANESUS, *Cianidzkhali*, in *Ancient Geography*, a river of Aſia in the Colchis territory. It flowed towards the W.S.W. and diſcharged itſelf into the Euxine Sea, N. of the mouth of the Phaſis.

CIANI, a denomination given by Livy to the inhabitants of the town of Cium, in Aſiatic Myſia.

CIANICA, a town of Aſia, placed by Ptolemy in the Melitene, a county of Leſſer Armenia.

CIANIS, a river which ran near the town of Cium in Aſiatic Myſia.

CIANO, in *Geography*, a town of Piedmont, in the Canaveſe; 12 miles S.E. of Jvrea.

CIANUS, SINUS, the *gulf of Cianus*, was formed by part of the waters of the Propontis, which extended towards the eaſt, between a peninſula that conſtituted northwards a portion of Bithynia, and ſouthwards part of the continent where Olympena was ſituated. It took its name from the town of Cius, ſeated at the bottom of the gulf.

CIASA, or CÆASA, an ancient town of Aſia, in Babylonia.

CIBALAS, CIBOLA, or CIVOLA, the ancient name of New Grenada, in Terra Firma, South America, and alſo of a town in this province. The country, though not mountainous, is cool; and the Indians, who inhabit it, are ſaid to be the whiteſt, moſt witty, moſt ſincere, and moſt orderly of all the aboriginal Americans. When the country was diſcovered, they had, each of them, only one wife, and were extremely jealous. They worſhipped water, and an old man that was a magician, whom they ſuppoſed to lie concealed under one of their lakes.

CIBALIS, or CIBALÆ, in *Ancient Geography*, a town of Lower Pannonia, whoſe name is ſtill preſerved in the obſcure

obscure ruins of Savilei; seated on the Save about 50 miles from Sirmium, the capital of Illyricum, and about 100 from Taurunum, or Belgrade, and the conflux of the Danube and Save. This town is famous for the first battle fought on the 8th of October, A.D. 315, between Constantine and Licinius; in which the latter, after a severe conflict, and the loss of more than 20,000 men, was obliged to retreat and make his escape, at the head of his cavalry, to collect a new army in Dacia and Thrace.

CIBAO, in *Geography*, a groupe of high mountains, occupying the centre of the island of St. Domingo; from which diverge three large chains, the longest stretching towards the east, and dividing that part of the island; another stretching to the north-west, [illegible]; and another, of less [illegible], [illegible] in the same direction, and terminating at Cape St. Mich. See St Domingo.

CIBARIA, a term which, in its general acceptation, signifies food, meat, victuals for man, cattle, fishes, &c. But in a *Military Sense* it denotes provisions, or what the French call *munitions de bouche.* Cicero says, that when a Roman army set out on a march, each soldier carried provisions with him for 15 days; and Titus Livius says for a whole month. The Greeks, who made but short campaigns, and seldom at a great distance from their own cities and territories, were not impeded in their marches and operations by great quantities of baggage or supplies, and always returned home to pass the winter.

CIBARITIS, or Cybaretis, in *Ancient Geography*, a country of Asia Minor, near the Mæander; supposed to be the territory of the town of Cibyra.

CIBBER, Colley, in *Biography*, an eminent actor and dramatic writer, was born in Southampton-street, London, on the 6th of November, 1671. His father was a statuary, a native of Holstein, who came to England about the time of the Restoration. In London are several specimens of his talents as an artist. Of these are the statues of the kings round the Royal Exchange, as far as king Charles, and that of sir Thomas Gresham in the piazza beneath. But his most capital works are the two figures of melancholy and raving madness, which were till lately in the front of Bethlehem. Colley bore the name of his mother; his first education was at the free-school at Grantham, whence his father hoped to get him elected into Winchester college, to which he had some claim, on account of his maternal descent from William of Wykeham; he was, however, disappointed. He would then willingly have sent him to the university in order that he might have been brought up to the church; but in this also his schemes were baffled. At length the young man pursued his own inclination, and, at eighteen, entered as a performer at Drury-lane theatre. His encouragement was at first small, it being several months before he was allowed ten shillings a week salary. As an actor he excited attention by performing the part of lord Touchwood in the "Double Dealer," to which he had been recommended by Mr. Congreve, who was fully satisfied with his manner of acting; and in consequence of his recommendation his salary was doubled. His father settled on him twenty pounds per annum; and being in his twenty-second year he married a lady, with whom he had some fortune. He gained considerable reputation by performing the part of Fondlewife in the "Old Bachelor:" and in 1696 he appeared as a dramatic writer, and his comedy of "Love's last Shift," or the "Fool of Fashion," was pronounced by lord Dorset, then lord chamberlain, the best first play he had ever known. He himself acted the principal character, to which his talents were well adapted. In some other productions Cibber was by no means so happy; his "Woman's Wit" was ill-received, and his "Xerxes" existed but a single night. The comedy of "Love makes a Man," though not original, proved beneficial to him; but his principal comedy was the "Careless Husband," which extorted praise from Pope, who never was the friend of Cibber, and who afterwards became his severe satirist. This comedy, which has been said to contain the most elegant dialogue, and the most perfect knowledge of persons in real life that has appeared in any language, is by no means a perfect play. It possesses scarcely any plot, and its success depends chiefly upon smart conversation, scenes, and the display of some lively and rattling characters, with which the stage at that time abounded. Its professed object is the reclaiming of a libertine husband; yet the virtuous wife is far from being properly displayed, and every superiority is given to an agreeable rake. Without enumerating the several pieces brought forward by Cibber, it is sufficient to say, that his importance as an actor continued to increase; and in 1711 he became manager and joint patentee of Drury-lane theatre; his brother managers were Wilks and Doggett. At the accession of George I. a new patent was granted; but instead of Dogget the names of Booth and Steele were inserted. The necessities of sir Richard Steele were not satisfied with the common profits, and he withdrew from the management; this led to a chancery suit, in which Cibber pleaded his own cause so successfully, that a decision was given in favour of himself and his brother managers.

In 1717, Cibber brought forward his comedy of "The Nonjuror," levelled at the Jacobite party. It had a great run, and was acted for eighteen succeeding nights: on account of its tendency, the author received two hundred pounds from the king, and the office of poet laureat. He soon after gave up his share in the theatre, and withdrew from the business of the stage, coming forward only on particular occasions, as an actor, when he had fifty guineas per night as a salary. At the age of seventy he professed himself the humble admirer of Mrs. Woffington, and was delighted to act with her in the play of the "Old Bachelor." In 1740 Cibber published an apology for his life, which included an historical view of the stage during his own time. The ease and sprightliness with which this was written, together with the numerous anecdotes which it contains, rendered it a very popular work, and its reputation is supported to the present time. In 1745, when he was turned of seventy-four, he appeared in the character of Pandulph, the pope's legate, in his own tragedy, entitled "Papal Tyranny in the Reign of King John;" and notwithstanding his advanced years, performed the part with great spirit and vigour. In 1747 he published "Remarks on Middleton's Life of Cicero," a work to which it will be generally admitted he was by no means competent; it was of course short-lived, and is now almost wholly forgotten. Cibber finished a long and active life on Dec. 12, 1757. His man-servant, with whom he had conversed, in apparently good health, at six in the morning, found him dead at nine, lying on his pillow, just as he had left him. He had entered his eighty-seventh year. He left two children. Theophilus adopted his father's professions of actor and dramatic writer, but with very inferior success. He was a mean and depraved character, and finished a life of distress and infamy by shipwreck in his passage to Ireland, in 1758. His daughter, Mrs. Clarke, was also on the stage, which was one only of the many parts she acted in life, and few women ever passed through a greater variety of adventures and occupations. When she quitted the theatre she kept a shop in Long-acre; then became mistress of a puppet-show; afterwards in man's cloaths she ap-

peared

peared as a valet to a nobleman: ſhe was afterwards a ſort of pork-butcher; and nine years of her life were ſpent in the occupation of a ſtrolling-player in the country. In Wales ſhe was a farmer and a paſtry-cook; at Briſtol the corrector of the preſs for a printer. She at length found means to take a public-houſe at Iſlington, where ſhe died in great diſtreſs in 1760. To return, however, to Cibber; he was a man of great vivacity, good-humour, and benevolence; his chief failing was vanity, the preponderance of which, and the liberties which he took with the characters of other perſons, without any ill-intention, produced him many enemies, by whom, and by Pope in his "Dunciad," in particular, he was attacked with much more ſeverity than he deſerved. Their attacks, though often very pointed and malignant, made but little impreſſion upon him, and he was even ready to acknowledge his foibles with frankneſs. As an actor he poſſeſſed great merit; but his judgment as a manager was not always to be depended upon: his behaviour to young authors was not always candid, and ſometimes inſolent and overbearing. His own pieces are generally of a moral tendency, and his comedies are entitled to praiſe. He collected and publiſhed his pieces in two volumes 4to. and they have ſince been re-publiſhed in five volumes 12mo. Biog. Brit.

Cibber, Mrs. Susannah Maria, the ſiſter of Dr. Arne, has been juſtly celebrated as a great tragic actreſs; but as ſhe firſt appeared on the ſtage as a ſinger, in her brother's opera of Roſamond, written by Addiſon, and afterwards ſung in Handel's oratorios of Sampſon and the Meſſiah, the firſt time they were performed, both in England and Ireland, and for whom he compoſed his two beſt oratorio airs: "Return, O God of Hoſts," and "He was Deſpiſed and Rejected;" which, with a feeble voice, and little knowledge of muſic, by a natural pathos, ſhe ſung in a more affecting manner, than much finer ſingers have ever done; theſe conſiderations, and perhaps, the ſtimulus of friendſhip, incline us to give her an article here, for her vocal powers. As an actreſs, ſhe was thought moſt excellent in tender parts, till, during the rebellion, ſhe appeared in the character of Conſtance in Shakeſpear's King John, in which ſhe manifeſted not only the maternal tenderneſs of a Merope, but ſuch dignity, ſpirit, and paſſion, as perhaps, have never been exceeded, if equalled, on any ſtage. Handel himſelf was exceedingly partial to her, and took the trouble of teaching her the parts expreſsly compoſed for her limited compaſs of voice, which was a mezzo ſoprano, almoſt, indeed, a contralto, of only ſix or ſeven notes, with all the drudgery of repetition neceſſary to undergo, in teaching perſons more by the ear than the eye. He and Quin uſually ſpent their Sunday evenings at Mrs. Cibber's, where wit and humour were more frequently of the party, than Melpomene, Euterpe, or Orpheus.

With reſpect to the effect of Mrs. Cibber's ſimple, but pathetic, ſtyle of ſinging, it ſeems to demonſtrate, that expreſſion in muſic is the ſoul, and mere ſounds the corporeal part. The moſt beautiful and affecting air of an oratorio or ſerious opera, if ſung without expreſſion, becomes a vapid and unintereſting pſalmody: *notes et rien que des notes*, as Rouſſeau ſays, notes and nothing but notes. But this expreſſion muſt be ſuited to the language in which the air is ſet. The ſongs which Handel expreſsly compoſed for Mrs. Cibber's limited powers, were never half ſo touching when ſung by a Monticelli, a Guarducci, or a Guadagni, great ſingers as they were, as by our countrywoman, though, comparatively, ignorant of muſic, and poſſeſſing but a thread of a voice. However, from the excellence of her underſtanding, knowledge of our language, and the natural pathos in the tone of her voice, ſhe never failed to penetrate into the inmoſt receſſes of the ſoul of every hearer of feeling in ſinging theſe airs, as much as ever ſhe did in the moſt tender and diſtreſsful ſcenes of declamation.

CIBDELOPLACIA, in *Natural Hiſtory*, the name of a genus of ſpars. The word is derived from κίβδηλος, *impure*, and πλὰξ, *a cruſt*. The bodies of this genus are terrene ſpars, that is, are compoſed of ſpar, debaſed by a very large admixture of earth, and are not, therefore, of the leaſt brightneſs or tranſparence; and are found formed into thin cruſts, coating over vegetable and other extraneous bodies in form of incruſtations. Of this genus there are five known ſpecies, ſome of them uſed in medicine, and diſtinguiſhed by particular names.

CIBDELOSTRACIA, the name of a genus of ſpars. The word is derived from κίβδηλος, *fouled* or *adulterated with extraneous matter*, and ὄστρακον, *a cruſt* or *ſhell*.

The bodies of this genus are cruſtaceous ſpars, ſo highly debaſed with earth, that they appear to the naked eye mere earths; they are deſtitute of all brightneſs or tranſparence, and are formed into thin plates, and uſually found incruſting over the ſides of fiſſures of ſtone. Of this genus there are ſeven known ſpecies.

CIBELIANA, *in Ancient Geography*, an epiſcopal ſee and town of Africa.

CIBERIS, a town of the Thracian Cherſoneſus, which was re-built and re-peopled by Juſtinian, after having been ruined; and in which he conſtructed baths, hoſpitals, and other edifices.

CIBILITANI, a people placed by Pliny in Luſitania.

CIBORIA, in *Antiquity*, the large huſks of Egyptian beans, which are ſaid to have been ſo large as to ſerve for drinking cups; whence they had their name, *ciborium* ſignifying *cup* in the Egyptian language.

CIBORIUM, in *Eccleſiaſtical Antiquity*, the covering for the altar of a church being an inſulated edifice, conſiſting of four columns ſupporting a dome.

This name was originally given to the huſks of Egyptian beans (ſee the preceding article), and thence by an eaſy tranſition came to denote a dome of the ſame form. The ciborium was in general uſe during the lower and middle ages, but was at length ſupplanted by the baldaquin, an object of the ſame nature, but in the form of a canopy. The application of a ciborium was not ſtrictly confined to the covering of an altar, they were alſo erected over the tombs of ſaints or martyrs, and the Italians call any inſulated tabernacle ciborio; thus there were ſometimes ſeveral in a cathedral, but in general there was only one placed over the great altar, and the ſpace which it occupied was called the ſanctum-ſanctorum.

The moſt magnificent ciborium ever known was that erected by Juſtinian in the church of St. Sophia at Conſtantinople. Four large columns, of a fine red marble, ſupported a ſilver dome, on the ſummit of which was placed a globe of maſſy gold, which weighed 118 pounds; lilies of gold ſurrounded the globe, and fell in feſtoons; they weighed 116 pounds, and in the middle was placed a croſs of 75 pounds, of the ſame metal, and covered with the moſt rare and precious jewels.

CIBOTUS, in *Ancient Geography*, a name given by Strabo to a port which had been formed near the town of Alexandria in Egypt.

CIBOULS, or Chibouls, in *Botany*, the Welſh onion. See Allium *fiſtuloſum*.

CIBSAIM, in *Ancient Geography*, a town of Judæa, in the tribe of Ephraim. It was given to the Levites of this tribe, who belonged to the family of Caath, the firſt of the Levites;

Levites; and is mentioned in the book of Joshua and the first book of Chronicles.

CIBULON, in *Geography*, a town of Asia, in the country of Tibet; 8 miles N.E. of Zuenga.

CIBUS Castrensis, the food or nourishment which the Roman soldiers took in their camps, which consisted chiefly of bread, bacon, vegetables, and cheese. Their drink or beverage was a sort of oxicrat, or a mixture of water and vinegar. They were not permitted to go to their meals without a signal or order for the same.

Cibus *ferialis*, in *Antiquity*, an entertainment peculiar to a funeral; for which purpose, beans, parsley, lettuce, bread, eggs, lentils, and salt were in use.

CIBYRA, in *Ancient Geography*, called the *Great*, a town of Asia Minor, situated on the confines of Phrygia, Caria, Lycia, and Pisidia. It is called *Cibyrrha* by Ptolemy. This town was watered by a river which, according to Pliny (l. v. c. 28), descended from the mountains called "Cibyratarum Juga," and after passing through the territory of Cibyra, discharged itself into the river Calbis. Cibyra, as Strabo informs us (l. xiii.), was an ancient colony of Lydians, who took possession of Cabatia, a country in the vicinity of Lycia; and in process of time, the Pisidians removed this town to a more advantageous situation, and built a new town, 100 stadia in circuit. The inhabitants, who were very numerous, spoke four different languages, viz. the Lydian, Pisidian, Lycian, and Greek. The town, situated in a fertile district, acquired great celebrity by the excellence of its laws and the mildness of its government, and thus attained to a very high degree of prosperity. The dominions of this town extended from Pisidia and Milyuda to Lycia, and the coast over against the isle of Rhodes, and they were able to raise 30,000 foot and 2000 horse. When the consul Cneius Manlius was commissioned, in the year of Rome 565, to reduce the Galatæ in Asia Minor, he passed near Cibyra, and obtained from Moagetes, the governor of this town, 100 talents in silver, and 10,000 measures of corn, who thus prevented the pillage of the country, and the threatened siege of the capital. Polybius says, this town was subjugated by the prætor L. Muræna, and its territory reduced to a province, in the year of Rome 671. Cibyra maintained its dignity and splendour under the Roman government, and became the capital of an extensive department, which contained 25 towns, and which Pliny (l. v. c. 25.) calls "Conventus Cibyraticus." This department remained, for several years, a part of the government of Cilicia. At the commencement of the civil war between Cæsar and Pompey, the departments of Cibyra, Pisidia, and Lycia, were detached from the province of Cilicia, and annexed to that of Asia. Tacitus (Annal. l. iv. c. 17.) reports, that Cibyra had sustained considerable damage by an earthquake; and Tiberius issued a decree of the senate, that it should not pay tribute for three years. This epocha was the year of Rome 776. Accordingly this emperor was considered by the inhabitants as the founder of their city, and in order to perpetuate the remembrance of it, they caused the series of years, inscribed in their annals and engraved on their monuments, to be reckoned from the epocha of the revival of their city. Cibyra took a distinguished part in the public rejoicings occasioned by the victories of Gordian; it offered solemn sacrifices and celebrated public games, as may be seen on an urn, which was engraved on a medal struck in honour of Gordian, in the year 289 of his æra, or 242 of Christ. Strabo speaks in terms of high commendation of the vines that grew in the vicinity of this place, and of the excellent wines which they afforded; and he adds, that Cibyra derived a large revenue from its iron mines, and that its inhabitants carried on a considerable commerce in hams. Apollo had a temple at Cibyra, and Mars was probably its principal and tutelary divinity, represented on its public monuments. Cibyra was at first governed by its own princes, but after it became subject to the Romans, by a senate under a chief magistrate. About the year 705 of Rome, Cibyra obtained from the Romans the privilege of being governed by its own laws and by its own magistrates, whose names appear on the ancient medals. It had also the privilege of coining money, which it retained for many ages under the Roman emperors. It further obtained from the emperors and the senate, the honour of placing on its monuments the title of Cæsarea, probably in honour of Tiberius, its restorer, adopted by Augustus into the family of the Cæsars. After the proconsular province of Asia was divided into several parts by Dioclesian, the town of Cibyra was comprehended within the province of Caria. Upon the division of Constantine the Great, Cibyra was referred to the department of the Thracesians and of Anatolia. In the first ages of the church, the city of Cibyra was erected into an episcopal see in the ecclesiastical province of Caria, under the metropolis of Aphrodisias.

Cibyra, a town of Asia Minor, in Pamphylia. It was situated in the interior of the country, S.E. of Aspendus. Its territory extended along the sea-coast, between the valley of Sidé and the river Melas, according to Strabo, l. xiv. Ptolemy places it in Cilicia Trachæa.

CIBYRATICA, one of the principal governments of Asia Minor, the capital of which was Cibyra of Phrygia.

CICACOLE, a circar of Hindoostan, on the N.W. coast of the bay of Bengal; 150 miles long, and from 15 to 30 broad.—Also, a town in this circar; 150 miles N.E. of Rajamundry, and 308 E. of Hydrabad. N. lat. 18° 16′. E. long. 84° 8′.

CICADA, in *Entomology*, a genus of the hemipterous order, possessing, according to the Linnæan arrangement, the following characters. Antennæ inflected, or bent, inwards under the breast; antennæ setaceous; the four wings membranaceous and deflected; legs in most formed for leaping, or as in the maniferæ for walking or creeping.

Linnæus, in order to comprehend the various natural tribes, or families, of insects, which he includes under the general head of cicada, found it necessary to distribute them into several distinct sections, some of which, in the entomological arrangements of more modern writers, constitute, and with much propriety, so many different genera. The *foliaceæ* family of the Linnæan cicadæ, consist of those in which the thorax is compressed, membranaceous, and larger than the body. The *cruciatæ*, those which have the thorax armed on each side with a horn or spine. The *maniferæ*, those which have the feet formed for creeping or walking instead of leaping. The *ranatræ*, those having the posterior feet formed for leaping. And the *deflexæ*, those whose wings are wrapped round the sides of the body.

Scopoli divides the cicadæ into three different sections, according to the substance and texture of the wing-cases; the first containing those cicadæ which have the whole of the wing-cases coriaceous; the second, those coriaceous from the base to the extent of half their length; and the third, such as have those parts entirely membranaceous.

In the Fabrician system of entomology, the Linnæan cicadæ are divided into several genera; in one of the latest and most comprehensive works of that author, his "Entomologia Systematica," they are divided into four genera, membracis, tettigonia, cicada, and cercopis, and this final arrangement is retained in his "Supplementum," published since, with this difference only, that his former genus, cicada, is divided into two genera,

genera, one of which he names flata, and the other cicada, as before. A new genus, delphex, comprehending two of Panzer's species of cicada, is likewise added, so that Fabricius may be considered as having constituted six distinct genera of those insects, which Linnæus would have united in his single genus cicada. Gmelin has endeavoured to reconcile the Linnæan and Fabrician arrangements, by making the genera of the latter subservient to the sections of Linnæus: the last Fabrician genera were, however, unknown to Gmelin.

The cicadæ live on various kinds of plants; the larvæ are entirely destitute of wings, which in the pupa begin to appear; but both in the larva and pupa state, they resemble the perfect insect, except in being destitute of wings. The larvæ, especially those of the Linnæan family ranatræ, discharge a kind of froth from the vent and pores of the body, under which they conceal themselves; they are furnished with six feet, and are very active. The males of the perfect insect, in general, chirp like the cricket; and some of the larger kinds of the tettigonia family possess two peculiar drum-like organs, which emit a loud and incessant noise at the pleasure of the insect, as is particularly exemplified in some of the Chinese and North American cicadæ. (See Donov. Inf. China, cicada atrata, &c.)

The following species of this extensive genus are described by Linnæus, Scopoli, Geoffroy, Fabricius, Donovan, and others.

Inflata. Thorax foliaceous; the membrane inflated, testaceous and reticulated. *Membracis inflata*, Fabr. A native of Cayenne.

The membrane of the thorax is large, inflated; on each side seven black dots; body yellowish; wing-cases hyaline, and dusky on the thinner margin.

Rhombea. Foliaceous, the membrane rhombic and broader behind. *Cicada rhombea*, Linn. Phil. Tranf. A.D. 1765. Inhabits South America.

Foliata. Thorax foliaceous, rounded, yellow, with a black band and spot. *Cicada foliata*, Linn. *Membracis foliata*, Fabr. A native of South America.

Lunata. Thorax foliaceous, rounded, black; with three white lunules. *Membracis lunata*, Fabr. From Cayenne; cabinet of V. Rohr.

Fasciata. Thorax foliaceous, rounded, and black, with two bands, the anterior one fulvous, posterior white. *Membracis fasciata*, Fabr. Inhabits Cayenne. Same country as the last.

Bracteata. Thorax foliaceous, green, and immaculate. *Membracis bracteata*, Fabr. An insect of small size, from the same country as the preceding.

Squamigera. Thorax foliaceous, acute before and behind, and grey. Linn. Inhabits South America.

Hastata. Horn of the thorax projecting above the head, compressed, and carinated; body grey. *Membracis hastata*, Fabr. A native of South America; size small.

Lanceolata. Horn of the thorax projecting above the head, and incurvated; body black, with two white dorsal spots. *Membracis lanceolata*, Fabr. Inhabits Cayenne.

2-Maculata. Horn of the thorax compressed, extending beyond the head; brown, with a yellow marginal spot each side. *Membracis 2-maculata*, Fabr. *Cicada 2-pustulata*, Gmel. Inhabits America. Described from the cabinet of Bosc.

Spinosa. Thorax three-horned, and produced behind to the length of the wings. Fabr. Inhabits India.

Acuminata. Thorax three-horned; the middle horn longest and compressed. Fabr. Inhabits Pennsylvania. Banksian cabinet.

Planata. Thorax flat, produced each side, and acute; body greenish. Fabr. Inhabits the East Indies.

Aurita. Thorax two-eared; shield of the head dilated and rounded anteriorly. *Cicada aurita*, Linn. Found in Europe.

Flexuosa. Thorax two-horned, and blue: horns depressed and black. *Membracis flexuosa*, Fabr. A native of the East Indies.

Marginata. Thorax two-horned, and longer behind than the abdomen; margin yellowish. *Membracis marginata*, Fabr. Inhabits China.

Horrida. Thorax two-horned, produced behind, with two large tubercles, and the tip three-spined. *Membracis horrida*, Fabr. Inhabits Cayenne.

Trifida. Thorax four-horned, hairy, produced and trifid behind; the divisions subulate. *Membracis trifida*, Fabr. A native of Cayenne.

Punctata. Thorax two-horned, spotted with white, and lengthened behind, beyond the abdomen. *Membracis punctata*, Fabr. Described from the Banksian cabinet. Inhabits Brasil.

Cornuta. Thorax two-horned, black; behind subulate, and as long as the abdomen; wings fuscous. *Cicada cornuta*, Linn. An European species. Donov. Brit. Inf.

Bubalus. Thorax two-horned, and long as the thorax behind; abdomen greenish; head and abdomen fulvous; wings hyaline. *Membracis bubalus*, Fabr. Inhabits North America. Helwig.

Taurus. Thorax two-horned, fuscous, filiform behind, and as long as the abdomen; horns arched. *Membracis taurus*, Fabr. Inhabits the East Indies. Koenig.

Vitulus. Thorax two-horned and green, with a white curve and line; posterior part produced as long as the abdomen; wings white. *Membracis vitulus*, Fabr. Inhabits America.

2-Punctata. Thorax nearly unarmed, produced behind, and shorter than the abdomen; wing-cases with a black spot at the base. *Membracis 2-punctata*, Fabr. A native of New Holland. *Cicada binotata*, Gmel.

Bonasia. Thorax two-horned, and lengthened behind, with white margin; at the base of the wings a white spot. *Membrasis bonasia*, Fabr. An American species described from the Hunterian Collection.

Convoluta. Thorax unarmed, greenish, with yellow margin, and length of the abdomen behind. *Membracis convoluta*, Fabr. Inhabits Brasil. Banksian Cabinet.

Mutica. Thorax unarmed, ferruginous, carinated, and length of the abdomen behind. *Membracis mutica*, Fabr. A native of North America.

Inermis. Thorax unarmed, greenish, length of the abdomen behind, and subulate. *Membracis inermis*, Fabr. Same country as the preceding.

Genistæ. Thorax unarmed, fuscous, and half the length of the thorax behind. Fabr. Inhabits France, Geoffroy; and England, Lee.

Sinuata. Thorax foliaceous; back in the middle broad, emarginate; body brown. *Membracis sinuata*, Fabr. An American species.

Emarginata. Thorax foliaceous; back broad, emarginate; body black, with a few whitish streaks; legs white. *Membracis emarginata*, Fabr. Inhabits Carolina. Bosc.

Fuscata. Thorax foliaceous, rounded, and fuscous, with a narrow white streak anteriorly, and a broad white band behind. *Membracis fuscata*, Fabr.

Inhabits the East Indies. The wings are fuscous, and the tip of the thorax sharp-pointed and black.

Rupicapra. Thorax three-horned; the middle one somewhat longer, and recurved wing-cases dusky hyaline. *Membracis rupicapra*, Fabr.

Inhabits India, Daldorff. This is small, general colour fuscous; the lateral thoracic horns thickest, obtuse, and somewhat dentated; wings white.

Tarandus. Thorax two-horned; horns arched; wing-cases hyaline. *Membracis*, Fabr. Inhabits the East Indies. In size and appearance this resembles *cicada cornuta*. The body is dusky, on the back fuscous; the horns on the thorax are compressed and vaulted; thorax subulate, and lengthened behind; wing-cases hyaline, veined with fuscous; wings whitish; legs ferruginous.

Capra. Thorax two-horned, short behind, and emarginate; body fuscous. *Membracis capra*, Fabr. Inhabits India.

Minuta. Thorax nearly unarmed, scabrous, and length of the abdomen behind; wing-cases whitish, at the base black. *Membracis minuta*, Fabr. A very small species is found in the East Indies.

Fasciata. Thorax nearly unarmed, behind as long as the abdomen; wing-cases dusky, with a yellow band at the base. *Membracis fasciata*, Fabr. Inhabits American islands. Bosc.

Obs. This, and the seven preceding insects, are new species, described in the Supp. Ent. Syst. of Fabricius.

* Section *Mannifera*, (legs not formed for leaping) Linn. Genus *Tettigonia*, Fabr.

Indica. Black; thorax with a yellow stripe, and towards the extremity of the abdomen an orange band; wing-cases brownish olive, with red veins. Donov. Inf. India.

A new species, and unquestionably the most striking and magnificent insect of the genus hitherto described. A single specimen only was discovered in Bengal about seven or eight years ago, and which is now deposited in the Imperial Cabinet at Vienna. The description and figure in Donov. Insects of India is taken from that individual and unique specimen.

Grossa. Thorax green, with a few black lines; wings white, with a yellow spot at the base of the posterior ones, Fabr. Inhabits Brasil. Banksian Cabinet.

Fasciata. Head and thorax black, spotted with rufous; wing cases black, with an abbreviated white band, Fabr. A large species, and inhabits Java. *Cicada javana* of Gmelin.

Grisea. Grey; wing-cases pellucid as water; posterior margin dotted with black; rib white on the anterior part. Fabr. A native of America.

Limbata. Thorax dilated at the margin, and acute; lower wings black, with white posterior margin. Fabr. An American species in the Banksian Cabinet.

Dilatata. Thorax dilated at the margin, and black; wings whitish. Fabr. Found in Jamaica.

Spinosa. Thorax armed each side with a single spine, and fuscous; wing cases dusky, with a macular black streak. Fabr. Inhabits Sumatra.

Vaginata. Testaceous; wing-cases whitish, with a black rib. Fabr. Same country as the last.

Tibicen. Scutel emarginate; wings with a greenish rib. *Cicada tibicen*, Merian. Linn. Inhabits South America.

Septendecim. Black; wing-cases white, with a yellow rib. Linn. Inhabits America.

Variegata. Black; thorax variegated with testaceous; wing-cases hyaline, with two black spots. Fabr. A native of Carolina.

Catena. Thorax variegated; wing-cases hyaline, with punctured nerves on the anterior part, and two undulated fuscous streaks behind. Fabr. Inhabits the Cape of Good Hope.

Maculata. Black; thorax, wing-cases, and wings, spotted with yellow. Drury. Inf. A native of China.

Cantans. Head and thorax black; wings at the base white. Fabr. A native of Barbary. Desfontaines.

Æstuans. Black; two spots on the thorax, and side of the abdomen beneath pale. Fabr. Same country as the preceding.

Pustulata. Black; head and thorax spotted with red; upper wings with darker bands at the base; veins testaceous. Fabr. A large species, and inhabits South America.

Stridula. Villous; wing-cases greyish; wings yellow, with the margins hyaline. Linn. &c. *Cicada catena*, Drury. *Cicada capensis* of Linnæus is supposed to be a variety only of his *Cicada stridula*.

Cingulata. Thorax spotted; wing-cases hyaline; rib and spot fuscous; abdomen black, with yellow bands. Fabr. Inhabits New Zealand. Described from a specimen in the Banksian Cabinet.

Villosa. Thorax fuscous and green, varied; breast white and villose. Fabr. A native of the Cape of Good Hope.

Cruentata. Thorax variegated; wing-cases hyaline; rib yellowish; abdomen black, with sanguineous bands. Fabr. A native of New Zealand.

Conspurcata. Black; wing-cases spotted with yellow at the base; tail yellow. Fabr. Inhabits India.

Hæmatodes. Black; incisures of the abdomen, and nerves of the wings sanguineous. Linn. A native of the south of Europe.

Plebeja. Scutel bidentated at the tip; wing-cases with four anastomoses, and six ferruginous lines. Linn.

Inhabits Africa and Italy, and is presumed to be, with the next species, the cicada of the Greek and Roman poets. See Notes on *Cicada atrata*. Donov. Inf. China.

Orni. Wing-cases with six concatenate dots within the margin, and the inner anastomoses brown. Linn. Inhabits the same country as *Cicada plebeja*.

Repanda. Wing-cases with a flexuous line; margin of the wings hyaline. Linn. A native of India.

Reticulata. Grey, with a white line on the thorax; wing-cases reticulated with white.

Kæmpferi. Wing-cases fuscous, with hyaline bands; wings black, with the margin hyaline. Fabr. Sent by Kæmpfer from Japan and preserved in the British Museum.

Picta. Thorax black, with testaceous spots; wing-cases veined, with white at the base; rib black. Fabr. Inhabits Provence. Bosc.

Atrata. Black; wings white, at the base black; veins testaceous. Fabr. Donov. Inf. China.

Australasiæ. Testaceous; margin of the thorax dilated; wings hyaline. Donov. Inf. New Holland.

A new species, of considerable size; the general colour testaceous.

Testacea. Black; abdomen sanguineous; wing-cases and the wings testaceous, veined with black. Stoll. Inhabits Tranquebar.

Flavescens. Yellowish-green; posterior shanks armed with a single tooth. Fabr. Inhabits Guinea. Ifert.

Olivacea. Olivaceous; head pale, with a transverse black spot on the snout, and another on the crown; posterior shanks armed with a single tooth. Fabr. A small species, and like the former, inhabits Guinea.

Sangui-

Sanguinolenta. Black; mouth, two ſpots on the thorax, and abdomen ſanguineous. Drury, Donov. Inſ. China, &c.

Splendidula. Wing-caſes golden-fuſcous; anterior ſhanks thick, dentated, and rufous. Fabr. Donov. Inſ. China.

Ephemera. Wing-caſes hyaline, with fuſcous ſpots. Stoll. Inhabits Surinam.

Muta. Wing-caſes hyaline; rib ſanguineous; abdomen with a ſanguineous dorſal line. A ſmall ſpecies, deſcribed by Fabricius from a New Zealand inſect in the Bankſian Cabinet.

Violacea. Violet; wings fuſcous at the tip. Linn. Muſ. Lud. Ulr.

Minuta. Livid; dorſal line on the thorax, and nerves of the wing-caſes yellowiſh.

8-Guttata. Thorax behind black, with a large, trifurcated, teſtaceous ſpot; wing-caſes black, with four white ſpots on each. *Tettigonia 8-guttata.* Fabr.

Inhabits Cayenne. This and the following tettigoniæ are new ſpecies deſcribed in the Fabrician Supp. Ent. Syſt.

Costalis. Black; wing-caſes hyaline, with a fulvous rib. Inhabits Philadelphia. Boſc.

Punctata. Thorax black behind, with three ferruginous lines; wing-caſes hyaline, with a white ſtigma, and two ſtreaks of fuſcous dots. A native of Ruſſia. An inſect of moderate ſize.

Hyalina. Black; thorax with a ferruginous ſtreak in the middle, and two ferruginous little lines; wing-caſes hyaline; ſtigma black. Inhabits the ſame country as the laſt, but is ſmaller.

Brunnea, Brown; anterior part of the thoracic lobe with three yellow ſpots on each ſide; wings hyaline.

Inhabits the iſle of France. The head is black, deepeſt in front; thorax duſky brown; ſcutel yellow; abdomen brown with the margin of the ſegments yellow.

* *Cicada,* Linn.

Genus *Flata,* Fabr. Suppl. Ent.

Perspicillata. Black; wings with an ocellated white hyaline ſpot; abdomen yellow at the tip. Fabr. An Indian ſpecies.

Ocellata. Wing-caſes compreſſed, aſcending, green, with ocellar ferruginous dots. Fabr. Inhabits Tranquebar. Koenig.

Limbata. Wing-caſes deflected, green, with red margin, the inner baſe dotted with black. Fabr. *Cicada æquinoctialis,* Gmel. An African inſect.

Candida. Snowy; wing-caſes deflected, with two ſmall yellow lines. Fabr. Suppl. A large ſpecies from the Iſle of France. Cabinet of Billardiere.

Fuscata. Wing-caſes deflected, black, hyaline and immaculate. Fabr. Inhabits Tranquebar. Lund.

Phalænoides. Whitiſh; wings deflected, patulous; anterior part of the wing-caſes dotted with black. Linn. Found on plants in America.

Bipunctata. Whitiſh; wing-caſes deflected; thorax with two impreſſed dots on the anterior margin. Linn. Same country as the preceding.

Retusa. Whitiſh, and immaculate; head retuſe. Fabr. A native of Cayenne.

Grisea. Grey; wing-caſes deflected; a black dot on the tip of the head. Fabr. A native of America.

3-Punctata. Wings deflected, green, with three whitiſh dots. Fabr. An African ſpecies.

Viridа. Green; wing-caſes deflected; wings white; front conic. Fabr. Inhabits American iſlands.

Minuta. Wings deflected, green; back ſcabrous; poſterior margin of the head, and dorſal line on the thorax ſanguineous. Fabr. Deſcribed a New Holland inſect in the Bankſian Cabinet.

Marginata. Yellow; wing-caſes deflected, and duſky; lateral line yellow. Linn. Inhabits American iſlands.

Pygmæa. Wing-caſes deflected, and immaculate; body yellowiſh. Fabr. Inhabits South American iſlands.

4-Punctata. Wing-caſes deflected, grey, with a pair of black dots on each. Fabr. &c. Same country as the laſt.

Viridana. Green; wing-caſes deflected, with two white ſpots near the baſe, and two pale bands towards the apex; wings white. Donov.

This, with the two following inſects, are new ſpecies of the Fabrician genus *flata;* natives of Botany, and deſcribed in Donovan's Hiſtory of the Inſects of New Holland.

Modesta. Pale; wing-caſes deflected, with two orange ſpots at the baſe, the inner one marked on the ſide with a black dot. Donov.

Pustulata. Whitiſh-green; wing-caſes deflected, with numerous red ſpots; poſterior angle pointed, and brown. Donov.

* Section *Cicada,* Linn.

Genus *Cicada,* Fabr. Ent. Syſt.

Cunicularia. Wings deflected, hyaline; with a ſtreak, band, and dots of brown; tail woolly. Linn. A native of India.

Lanata. Wing-caſes black, with blue dots; front red at the ſides; tail woolly. Linn. Inhabits India and China. Donov. Inſ. China.

Tomentosa. Wing-caſes deflected, green, with two interrupted fulvous bands; wings ſnowy-white, with two black bands. Fabr. Inhabits the Eaſt Indies. Muſ. Tottianum.

Barbata. Fuſcous; abdomen greeniſh; tail covered with ſnowy wool. Fabr. Deſcribed from a New Holland inſect in the Bankſian Cabinet.

Atrata. Black; thorax with four grey ſpots; margin of the abdomen yellow, with ſnowy ſpots. Fabr. A native of Cayenne.

Striatula. Above rufous, with black ſpots, beneath yellowiſh. Fabr. Inhabits Cayenne. Boſc.

Nigripennis. Black; margin of the head and thorax yellowiſh, with black dots. Fabr. Country unknown.

Ferruginea. Head, thorax, and ſcutel dotted with black; wing-caſes rufous; wings white. Inhabits the Cape of Good Hope, Fabr. Bankſian Cabinet.

Undata. Head and thorax cinereous, teſtaceous, and black, varied; wing-caſes duſky rufous, with a greeniſh lateral ſpot, and hyaline tip. Fabr. Inhabits Carolina.

Irrorata. Fuſcous; wing-caſes with the rib, baſe, and ſpeckling fulvous. Fabr. Inhabits Carolina.

Obtusa. Black; wing-caſes cinereous, hyaline at the tip. Fabr. Inhabits Cayenne.

Aurulenta. Head and thorax rufous; wing-caſes fuſcous, with cinereous tip. Fabr. Same country as the laſt.

Myopa. Head and thorax golden fuſcous, varied with black; wing-caſes hyaline, with a duſky tip, and a gold ſpot. Fabr. This alſo inhabits Cayenne.

Villosa. Green; wing-caſes deflected, whitiſh; tail woolly. Fabr. A native of South America. *Cicada Rohrii.* Gmel.

Elongata. Thorax red, with yellow lines; wing-caſes

 very

very long, and dotted with black. Fabr. Inhabits New Holland.

Histrio. Linear, flesh-coloured, with black lines. Fab. Muf. Lund. Country unknown.

Suturalis. Linear, testaceous; head with two elevated black dots, and future of the wing-cases fuscous. Fabr. Country unknown.

Nigripes. Blackish; wing-cases fuscous; nerves white, with black dots. Fabr. Inhabits Brasil.

Vittata. Yellow; wing-cases with a double longitudinal repandate and dentated ferruginous stripe. Linn. Inhabits gardens in Europe.

Lateralis. Black; wing-cases white at the sides. Linn. Panzer. Inhabits Europe.

Variegata. Above black; scutel, two yellow spots on the back, and exterior margin of the wing cases yellowish, Fabr. From the Banksian Cabinet. A native of Brasil.

Fenestrata. Above black; head and scutel yellow; margin of the wing-cases hyaline. Fabr. Inhabits the Pacific Ocean.

Flavipes. Black; head and legs yellow; wing-cases hyaline at the tip, and striated with black. Fabr. Found in Rotterdam Island.

Interrupta. Wing-cases yellow, with a double black, interrupted, longitudinal line. Linn. An European species.

Lineata. Pale; head and thorax dotted with black; wing-cases lineated with black. Fabr. Inhabits Saxony. *Cicada lyneri*, Gmel.

Acuminata. Black; wing-cases fuscous, striated, and barred with white. Fabr. *Cicada acuminalis*, Gmel. Inhabits Germany.

Abbreviata. Yellowish; wing-cases cinereous, with a black abbreviated stripe. Fabr. Inhabits Europe.

Flavicollis. Black; posterior margin of the head with the thorax yellow. Linn. Found on grass in Europe.

Viridis. Wing-cases green; head yellow, with black dots. Linn. Fn. Suec. Inhabits Europe, and is found in England. Donov. Brit. Inf.

Læta. Above black and polished, with bluish dots. Fabr. Inhabits Cayenne.

Atomaria. Golden; wing-cases obsoletely speckled with white. A native of Italy. Fabr.

Prasina. Green; wing-cases white, and hyaline at the tip. Fabr. Inhabits Italy.

Argentata. Head yellow, with black band between the eyes; thorax and wing-cases silvery, striated with fuscous. Fabr. Inhabits France.

4-Guttata. Wing-cases reddish, with two green spots and hyaline tip. Fabr. A South American insect.

Marginella. Black; head, thorax, and wing-cases edged with scarlet. Fabr. Same country as the last.

Lanio. Green; head and thorax flesh-colour. Linn. Panzer. An European insect.

Striata. Yellowish, polished; head, thorax, and wing-cases striated with white. Fabr. Inhabits France.

Ignita. Greenish, polished; head, scutel, and abdomen fulvous. Fabr. Inhabits Cayenne.

Festiva. Yellow; head and thorax with two black dots; wing-cases with three black spots. Fabr. A native of Germany.

Mixta. Yellow, variegated with black; wings black. Fabr. Inhabits Paris. Bosc.

Bicolor. Above yellow, beneath black; wing-cases pale, fuscous at the tip. Fabr. A small insect found in Denmark. *Cicada bicolorata*, Gmel.

Turca. Black; abdomen yellow; wings fuscous at the tip, with a hyaline lunule. Fabr. Inhabits South America.

Matura. Black; breast and abdomen sanguineous. Fabr. Donov. Inf. New Holland. Inhabits New Holland. Described from the Banksian Cabinet.

Nebulosa. Black; wing-cases hyaline, with the base fuscous. Fabr. An African insect. Same country as the former.

Hyalina. Fuscous; wing-cases with an abbreviated band; and posterior margin hyaline. Fabr. A native of the East Indies.

Pellucida. Grey; with a hyaline stripe in the middle of the wing-cases. Fabr. Donov. Inf. New Holland.

Cynosbatis. Fuscous; wing white and hyaline, with a margin of fuscous dots. Fabr.

Clavicornis. Fuscous; wing-cases hyaline, with a fuscous streak behind; antennæ compressed, and margined. Fabr. A native of France.

Serratulæ. Yellow; wing-cases white, with a dot, and two bands of black. Fabr. Found on thistles in England.

Nervosa. Wings fuscous hyaline; nerves white, dotted with black. Linn. Fn. Suec. Inhabits Europe.

Varia. Black, varied with green; wings hyaline, with three costal black dots. Fabr. Found in Germany.

Lyncea. Front and thorax glaucous, with four ocellar dots; wing-cases hyaline, with yellowish margin. Fabr. A native of the East Indies.

Picta. Head and thorax yellowish, with black spots; wing-cases pale; stripe and two dots black. Fabr. Inhabits Germany.

Brunnea. Yellow; thorax grey; wing-cases testaceous, and without spots. Fabr. A native of Germany.

Grisea. Grey, immaculate; wing-cases flat. Fabr. *Cicada plana*, Gmel. Inhabits Italy.

2-Guttata. Pale, golden rufous, with four white dorsal dots. Fabr. Found in Germany.

4-Notata. Greenish; head yellow, with four black dots; wing-cases whitish. Fabr. Inhabits France.

4-Verrucata. Yellow, with four black dots on the head; wing-cases glossy-golden. Fabr. Inhabits Italy.

Fulgida. Yellow; wing-cases golden fuscous. Fabr. Inhabits England.

Diadema. Head yellow, with two abbreviated black bands; wing-cases fuscous hyaline. A native of Germany.

Reticulata. Fuscous-green: wing-cases fuscous, and somewhat reticulated with white. Inhabits South-American islands.

Punctata. Wing-cases yellowish, with fuscous dots. Geoffroy. An European insect.

Rosæ. Yellow; wings white; tip striated with fuscous. Linn. Found on the leaves of the rose.

Maculata. Grey; wing-cases with fuscous dots and tip; wings white, and at the tip fuscous. Fabr. Found on plants in Europe.

2-Pustulata. Yellow; head with two frontal rufous dots; wing-cases testaceous and hyaline. Inhabits Germany.

Aurata. Yellow; wing-cases marked with fulvous, and four black dots, gilt behind. Linn. Inhabits Sweden.

Ulmi. Wings yellowish-green; tips black, and glossed with golden. Linn. Geoffroy. Inhabits Europe.

Triangularis. Testaceous, spotted with yellow; wing-cases at the base whitish. Inhabits Denmark.

Nitidula. Wing-cases pale golden; wing-cases hyaline, with two brown bands. Donov. Brit. Inf. &c. Inhabits Europe.

I

Virescens.

Virescens. Greenifh; wing-cafes whitifh, and immaculate. A native of Germany. Fabr. *Cicada viridans*, Gmel.

Flavescens. Pale yellow, immaculate; wing-cafes and wings white and hyaline. Fabr. Same country as the preceding.

Cuspidata. Grey; head flat, depreffed, and fufcous at the tip. Fabr. A fmall infect, and inhabits England.

Quercus. Yellowifh; wing-cafes fanguineous, with a brown fpot at the tip. Fabr. An European infect found on the oak.

Spinosa. Front retufe, yellow; wing-cafes green, with three whitifh bands; eyes fpinous. Fabr. Suppl. Inhabits the ifle of France.

Orbona. Head and fcutel fulvous, reticulated with black; wing-cafes black, with the tip dufky cinereous. Fabr. Suppl. Inhabits America.

Dænais. Green; wing-cafes hyaline, with the tip black. Fabr. Suppl. Country unknown. Cabinet of Weber.

Graminea. Green; head fomewhat elevated, with a black dot at the tip. Fabr. Suppl. Inhabits Italy.

Cruenta. Above fcarlet, variegated with black. Fabr. Suppl. Inhabits Cayenne.

Festiva. Black; head and thorax with a broad dorfal fnowy ftripe; wing-cafes black, with two fcarlet fpots. Fabr. Suppl. A fmall infect, found in Cayenne.

Parvula. Dufky; wing cafes black; dot in the middle, and tip hyaline. Fabr. Suppl. Found in Cayenne. Cabinet of Richard. A minute fpecies.

* *Cicada*, Panzer.

Genus *Delphex*, Fabr. Suppl.

Crassicornis. Pale; wing-cafes white, varied with teftaceous. A native of Germany.

Clavicornis. Fufcous; wing-cafes hyaline, with a fufcous ftreak behind. Inhabits France.

* *Cicada*, Linn. &c.

Genus *Cercopis*, Fabr.

Gigas. Head and thorax pale, with four ferruginous lines; wing-cafes fufcous, with a band and three dots of white. Fabr. Suppl. One of the largeft infects of the genus *Cercopis*. Defcribed from a fpecimen in the cabinet of M. Dymeril. Found in Cayenne.

Bicolor. Black; wing-cafes teftaceous; future, and daub behind black. Fabr. A native of the Cape. Size of the laft.

Transversa. Head and thorax black, with yellow band; wing-cafes pale and immaculate. Fabr. Suppl. Found on plants in Europe.

Lateralis. Black, with a narrow line, and fpeckling of yellow; margin of the wing-cafes fanguineous. Fabr. Suppl. Inhabits Carolina.

Albipennis. Pale; thorax fufcous; wing-cafes white, with a fpot at the bafe, and an oblique ftreak of fufcous. Fabr. Inhabits France.

Grossa. Wing-cafes fufcous-grey, with a marginal, fulvous, and cinereous fpot. Fabr. Inhabits Africa, and is a large fpecies. *Cicada afra*, Gmel.

Marginata. Black; wing-cafes with a marginal fanguineous ftripe on each fide. Fabr. *Cicada atra*, Gmel. Inhabits America.

Maculata. Thorax black, with a fulvous band; wing-cafes fulvous, fpotted, and tipped with black. Fabr. *Cicada maculofa*, Gmel. An African fpecies.

Coccinea. Red, immaculate; pofterior fhanks fingle toothed. Fabr. Found in the American iflands.

Rubra. Sanguineous; wing cafes with two obfolete fufcous fpots. Fabr. Inhabits Senegal.

Sanguinolenta. Black; wing-cafes with two fpots, and a band of fanguineous red. Linn. Donov. Brit. Inf. Inhabits Europe.

Analis. Black; wing-cafes fanguineous, with a whitifh fpot in the anal angle. Fabr. Inhabits the Cape of Good Hope.

Obscura. Deep black; wing-cafes dufky black. Fabr. A native of Guinea.

Schach. Black; wing-cafes fufcous, with an interrupted fanguineous band. Defcribed from the Hunterian Cabinet. Fabr. An American fpecies.

Cruentata. Rufous; wing-cafes black, with two yellow bands. Fabr. *Cicada rubra*, Linn. Inhabits Surinam.

Versicolor. Black, gloffy; wing-cafes with two white fpots at the bafe, and a fingle rufous one in the middle. Fabr. Inhabits Tranquebar.

Atra. Black, gloffy; wings whitifh. Fabr. Inhabits the fouth of Europe. *Cicada nigra*, Gmel.

Viridis. Green; wing-cafes with an outer hyaline margin. Fabr. A native of American iflands. *Cicada virens* of Gmelin.

Nebulosa. Yellowifh; wing cafes fufcous with an oblique band, nnd two daubs of yellowifh. Fabr. Inhabits the Eaft Indies. *Cicada nebula* of Gmel.

Carnifex. Sanguineous; fpot on the thorax, and two ftripes on the wing-cafes black. Fabr. Inhabits New Holland. Donov. Inf. New Holland.

Varia. Head and thorax greenifh; wing-cafes fufcous with two fpots at the bafe, and ftripe behind yellow. Fabr. Inhabits Cayenne.

4-Fasciata. Yellow, with four fufcous bands. Linn. Inhabits Surinam.

Spumaria. Fufcous; wing-cafes with two whitifh lateral fpots. Linn. Inhabits Europe.

Pellucida. Greyifh, with a hyaline band acrofs the wing-cafes. Donov. Inf. New Holland.

Maura. Black; breaft and abdomen fanguineous. Donov. Inf. New Holland.

Aurata. Cinereous, golden, gloffy, and without fpots. Fabr. Inhabits Cayenne.

Marginella. Black; head, thorax, and wing-cafes margined with white. Fabr. Inhabits Europe.

Leucophthalma. Black; eyes white. Linn. Inhabits the north of Europe.

Leucocephala. Head and thorax at the bafe yellowifh. Linn. Found in Sweden, and other parts of Europe.

Striata. Black, two yellow bands on the head; wing-cafes ftriated with white. Fabr. Found on plants in Germany.

Lineata. Yellowifh; wing-cafes with three black ftreaks. Fabr. Inhabits Germany.

Vittata. Above cinereous, with a black ftripe. Fabr. Inhabits France.

Coleoptrata. Wing-cafes entirely coriaceous, and covering the wings, grey, with a fufcous dot in the middle. Fabr. Inhabits Germany and France.

Angulata. Black; above pale; wing-cafes with a fmall line at the bafe, and two fufcous ftreaks uniting at the exterior margin. Fabr. Inhabits Sweden.

Præusta. Cinereous; fcutel at the bafe black; wing-cafes fufcous at the tip. Fabr. Same country as the preceding.

Immaculata. Dufky, and without fpots; wing-cafes ftriated. Fabr. Inhabits Italy.

Aptera. Fufcous; wing-cafes coriaceous and pellucid; no wings. Fabr. A fmall fpecies found on the coaft of Barbary.

Grylloides. Yellowifh; wing-cafes coriaceous, varied with fufcous; no wings. Fabr. An Italian fpecies.

Pedestris. Wing-cafes coriaceous, abbreviated; tail fetaceous; no wings. Fabr. Inhabits Europe.

Rustica. Grey, immaculate; wings white. Fabr. An European fpecies, found on plants.

Gibba. Black; wing-cafes fpotted with white. Fabr. Inhabits Denmark.

Biguttata. Black, fpotted with yellow; wing-cafes fufcous; marginal fpot white. Fabr. A native of Germany.

Ruficollis. Black; thorax rufous; wing-cafes varied with rufous, and fufcous. Fabr. Inhabits Italy.

Variegata. Head and thorax black, with a yellowifh ftreak; wing-cafes yellow, ftriated with yellow.

Fasciata. Yellowifh; wing-cafes dufky; band and two fpots of white. Fabr. Inhabits Europe.

Unifasciata. Cinereous; wing-cafes with an oblique fufcous band. Fabr. Inhabits Italy.

2-Fasciata. Yellowifh; wing-cafes fufcous, with two whitifh bands. Linn. Found in Sweden.

Capitata. Black; head teftaceous; a black band beneath. Fabr. Inhabits Paris. Bofc.

3-Fasciata. Black; thorax, and two bands on the wing-cafes whitifh. Inhabits Paris.

Striatella. Fufcous; head and thorax with a greenifh band; wing-cafes with many greenifh lines. Fabr. Inhabits Paris.

Histrionica. Black; head and thorax yellow, variegated; wing-cafes ftriated with paler, and a fufcous ftreak behind.

Populi. Clouded; two dots on the crown, and bafe of the abdomen black. Linn. Found on plants in Europe.

Reticulata. Wing-cafes varied with pale, and ferruginous; difk reticulated with black. Fabr. Found on plants in Europe.

CICÆ, in *Ancient Geography*, ifles of the ocean, fituated, according to Pliny, on the weftern coaft of Spain. Ptolemy calls them "Deorum Infulæ." They are the ifles of Bayonne. M. D'Anville marks them in his chart on the coaft of the Callaici, oppofite to a fmall gulf, N.W. of Tyde.

CICATRICULA, in *Natural Hiftory*, a little whitifh fpeck, or veficle, in the coat of the yolk of an egg; wherein the firft changes appear towards the formation of the chick. The *cicatricula* is what is otherwife called the eye of the egg.

CICATRIX, in *Surgery*, is fynonymous with a fcar or feam in the fkin, which remains after the healing of a fore, &c. This word is derived from the Latin *cicatrico*, to heal up, and was formerly fpelt cicatrice, after the French. The older furgeons fancied they had the power of cicatrizing wounds at pleafure, and that certain remedies poffeffed the faculty of producing good cicatrizations; but we have learned to be much more diffident of our abilities in this refpect, on obferving that it is wholly a procefs of nature, and that the furgeon is not able to do any thing towards producing it, although he may eafily prevent the formation of a cicatrix.

It is evident that cicatrices differ in their texture and compofition from true fkin, becaufe they ufually have neither blood-veffels nor nerves; and, in brute-animals, this new-formed fubftance will feparate, fo as to leave holes in the fkin, on its being fubmitted to the operation of tanning. We know of no author who has treated fo amply, and (for the moft part) fatisfactorily on the formation of a cicatrix, as Mr. James Moore, in a differtation printed A.D. 1789, by order of the Lyceum Medicum Londinenfe. He fays, as cavities are filled up in a different manner, during the adhefive and fuppurative inflammations, there is likewife fome diftinction in the formation of cicatrices during thefe different ftates.

When a wound is healed by the adhefive inflammation, the fkin, as well as the parts more deeply feated, throws out the inflammatory exfudation, and the whole is united by this exfudation and extravafated blood.

Upon the furface of the fore a dry cruft is formed; this confifts partly of the extravafated blood, and partly of an exfudation from the wound, which after coagulation hardens by the evaporation of the watery parts. This cruft or fcab adheres to the lips of the wound; if it is removed it gives fome pain; the fore is then obferved moift with a tranfparent fluid, and there generally follows an oozing of blood, fome of the new veffels of the uniting medium being torn. The cruft does not become organized, but remains like dead foreign matter. Immediately under it, and on a level with the cutis, the new fkin forms, and covers the uniting medium. This new fkin is a fine delicate membrane; but it gradually becomes thicker and ftronger. The cruft, at firft, adheres to it fo ftrongly that if it is attempted to be removed the cicatrix will be torn off with it. But when left to itfelf the cruft becomes hard, dry, and fhrivelled; gradually loofens from the cicatrix and then drops off. The fcar now appears red; but foon acquires a brown colour, and at laft changes to nearly the fame appearance as the old fkin, though rather more white and gliftening.

When a wound or fore heals by the fuppurative inflammation, the cicatrix does not begin to form until the granulations have arifen to the furface of the old fkin, or nearly fo.

When the healing is moft favourable, the granulations arife exactly to the level of the fkin; if they fhoot much higher no cicatrix will form, until the exuberancy is removed by an internal procefs, or by the furgeon's art; and if the granulations are much too low, the cicatrix likewife does not form. A mathematical exactnefs, however, is not required; for cicatrization generally takes place when the granulations are nearly of the fame height, although ftill a little higher or lower than the old fkin.

The formation of the cicatrix begins from the edges of the old fkin. The rednefs which exifted during the inflamed ftate abating, the fwelling fubfiding, and the edges of the fore uniting with the rifing granulations. The margin then acquires a bluifh white or pearly colour, which gradually extends itfelf to the centre till the whole fore is covered with new fkin. It fometimes happens in broad fores, that cicatrization takes place, not only from the circumference, but likewife from one or two points in the centre; thefe appear like iflands in the midft of a fea of granulations; they are of the fame colour as the healing margin; and they become larger by extending in every direction. In confequence of cicatrization going on from different central parts, it happens not unfrequently during the progrefs of healing, that one broad fore is divided into two or three fmaller ones; and when this happens the cure muft go on fafter. There is always more or lefs of a cuticular covering upon the cicatrix, which being conftantly constantly moistened by the discharge from the granulations is soft and pulpy, and occasions that whitish colour observable on the edges of healing sores. I have sometimes removed this cuticular substance, and have observed underneath the real new skin, which seems a very fine membrane of a red colour, the granulations shining through it.

When a suppurative sore is nearly healed, if it is not kept moist by some application, a scab is apt to form in the same manner as in those wounds which are healed by the first intention. This crust consists of pus dried by the evaporation of the watery parts; the new skin forms under it, and it soon after falls off.

From the surface of the cicatrix there is no secretion; there are only the perspirable vessels. While it is forming, it is kept moist by the discharge from the uncovered granulations; but when completely formed, the cicatrix is as dry as any other skin.

It appears that the new skin at first cannot form a good cuticle and rete-mucosum, for there is always a succession of scales falling off for some time; at last this ceases, and the new skin is covered with a good cuticle and rete-mucosum, like other parts. The cicatrix changes successively from a reddish colour to a brown; and lastly it becomes whiter, and of a more shining appearance than the original skin. This is a curious circumstance and merits some attention.

The cutis, as every anatomist knows, is not a smooth polished membrane, but is full of eminences, which are named papillæ. These, in some parts of the body, run in waving rows, and form in others irregular lozenges and triangles. The rete-mucosum and cuticle, which lie immediately over the cutis, are marked with furrows analogous to the eminences of the cutis. The cuticle is of a light colour, and semi-transparent. The rete-mucosum is white, yellowish, brown, or black, in men of these various colours. And the cutis is extremely vascular; the blood contained in these vessels shines through, and gives the florid fleshy tint to the body. The colour of the skin, then, depends partly upon the rete-mucosum, and partly upon the blood which circulates in the cutis. In white men the cuticle and rete-mucosum, which cover cicatrices, appear similar to that which covers other parts; but there is a great difference in the quantity of blood which circulates in the old and new skin. For the new is far less vascular than the old; or, at least, the greater number of its vessels are of a much smaller diameter, and admit a lesser quantity of the red globules of the blood. It happens in consequence of this, that cicatrices are of a whiter colour than the original skin. In negroes, the reverse takes place, their scars being generally blacker than other parts, owing to a darker rete-mucosum forming in them upon scars, than upon the old skin.

Besides the difference of colour, a cicatrix has a glossy, shining look, which the skin does not possess: this is owing to the scar being a smooth polished membrane without hair, or any of those papillæ which are upon the cutis; both the papillæ and hair are parts which are formed in the first organization of the body, and are never afterwards produced.

As scars are less vascular than the old skin, it is probable that they have fewer nerves; for blood-vessels and nerves are generally in proportion to each other. But as nerves can hardly ever be traced to the surface of the body, we can only judge of their number there, by the degree of sensibility; and this is considerably weaker in cicatrices than in the old skin. This indeed might naturally be expected, for scars have no papillæ, which are supposed to be the principal seat of the sense of feeling in the skin. It is observed, that scars are generally far less moveable than the original skin; the latter being commonly attached by a loose cellular membrane to the deep seated parts; whereas the scar forms itself immediately upon the granulations, and is so intimately connected, as to make the same substance with them. This is the reason, likewise, that although a scar is, at first, exactly level with the skin, yet after a certain period, it often is very much depressed. For during the healing of a sore, particularly if the discharge is great, the fat and neighbouring flesh are considerably wasted by absorption. But when the whole is healed, the internal parts recover their bulk, and the fat is regenerated. The skin being attached loosely, readily yields and accommodates itself to this increase; whereas the cicatrix adhering closely, and being, as it were, tacked down to the parts upon which it is formed, appears depressed.

It sometimes happens that a cicatrix, instead of being depressed, rather projects above the skin, owing to the exuberancy of the granulations upon which it is formed; and very often the scar has an irregular unseemly appearance, from the granulations rising to unequal heights.

Its appearance is so different from real skin, that although every one agrees that it is not the same, yet there are very different opinions with respect to what it really is.

Some authors assert that it is a distinct membrane; others, that it is only the cellular membrane condensed; or, as one or two French writers have termed it, an exsiccation of the surface of the sore. Mr. Bell of Edinburgh, in his excellent System of Surgery, says, "That a dry pellicle of a scarf-skin forms over wounds."

But it is certain that, upon every cicatrix there is both a cuticle or scarf-skin, and likewise a rete-mucosum, which may be raised by a blister in the living body; or may be removed in a dead body by maceration. After these membranes are taken away, there is discovered underneath a smooth polished surface, which is, properly speaking, the new skin. If it is attempted to dissect this from the deep seated parts, there is found no line of separation, no distinction of parts, but all is uniform. The operator, therefore, if he persists in his attempt, does not know whether to cut to the depth of the fourth, eighth, or tenth of an inch; the substance of the whole, except the smooth external surface, being similar.

It is, therefore, a mere dispute of words to contest whether there is a new membrane or not. If it is said that there is one, it must be allowed to be so intimately attached to the parts upon which it is formed, that no separation can be observed. And if there is said to be no new membrane, it must be granted that the surface of the sore loses its extreme vascularity, the power or disposition of secreting pus, and becomes smooth, polished, and able to form a cuticle and rete-mucosum.

The substance of the new skin is, then, exactly (or, in many respects) of the same nature with the new flesh upon which it forms; and although it has by no means the same elasticity as the old skin, yet it is nearly as strong and able to resist mechanical violence. It is, therefore, a good substitute for the other.

The difference in its appearance from the original skin is at first striking; this dissimilarity gradually lessens with time, but never vanishes entirely. For as the scar cannot acquire the papillæ, or the same degree of vascularity with the cutis, it continues distinguishable during life; as is proved by the wound of even the finest lancet in bleeding.

But in superficial cuts, in those small abscesses called pimples, and other slight ulcerations, and in the mild species of the small-pox, where the surface of the cutis only is affected, and where it is not pierced through, no lasting scar is left Because in these cases an entire portion of new skin is not required,

quired, as fome of the old remains, from which the roots of the papillæ and hair fhooting up, the temporary fcar difappears and the part regains its former appearance. But when the puftules of the fmall-pox, or other ulcerations, corrode fo deep as to deftroy the cutis or papillæ, the cicatrix or fcar never difappears; as is often cruelly exemplified in the bad fpecies of fmall-pox. The puftules fometimes heal with a depreffion or pit, as it is called; and fometimes where no pit is left, but all is level, a gliftening white mark remains for ever. For papillæ once deftroyed never again fpring up; for which reafon the cicatrix never acquires an equal degree of vafcularity with the original fkin.

Some ingenious remarks occur likewife on the fubject "*Of Skinning*," in Mr. John Hunter's book upon inflammation and wounds, chap. viii.

CICATRIZE, to heal with new fkin. See CICATRIX.

CICCA, in *Botany*, Linn. Mant. I. p. 17. Schreb. 1417. Juff. 385. Mart. Clafs and order, *monœcia tetrandria*. Nat. ord. *Euphorbiæ*, Juff. Gen. ch. Male. *Cal.* Perianth four-leaved; leaves roundifh, concave. *Cor.* none. *Stam.* four, briftle-fhaped; anthers fomewhat globular, the length of the calyx. Female. *Cal.* and *Cor.* as in the male. *Pift.* Germ roundifh; ftigmas four, two-parted, awl-fhaped, the length of the germ; ftigmas acute, permanent. *Peric.* Berry four-celled. *Seeds* folitary.

Eff. Ch. Calyx compofed of four roundifh leaves. Pericarp a four-celled berry. Nearly allied to Phyllanthus, but differs in the number of parts, and having a berry for the fruit.

Sp. 1. C. *difticha*, Linn. Mart. 124. Mart. Lam. Encyc. Illuft. Pl. 757. fig. 6. "Male and female flowers in feparate racemes on the naked part of the branches." A tree with long fimple branches. *Leaves* in two alternate rows on fhort petioles; the lower ones rounded, egg-fhaped, fmaller; upper ones ovate-lanceolate, acuminate; entire, very fmooth. *Flowers* proceeding from the lower part of the branches, after the falling of the leaves, and occupying their places. A native of the Eaft Indies. The younger Linnæus has fuppofed this plant to be the averrhoa acida of his father; but whatever it may be, it certainly is not an averrhoa. See AVERRHOA. 2. C. *nodiflora*, Lam. Encyc. Illuft. Pl. 757. fig. 2. "Flowers aggregate, axillary." A fhrub. *Leaves* on fhort petioles, egg-fhaped, acute, fmooth, entire, fometimes almoft round, with a fmall point at their fummit. *Flowers* extremely fmall. *Fruit* a globular berry; with four fmall, permanent, expanding ftyles. A native of the ifland of Java.

Loureiro has a fpecies which he calls C. racemofa, the terme of Gærtner, who has preferved its Japanefe name. He defcribes it as a middle-fized tree, with afcending branches. Leaves egg-fhaped, fomewhat acuminate; quite entire, fmooth, alternate, petioled, in two rows. *Flowers* in compound, fhort, nearly terminal racemes; males and females on different branches. He afferts, that what Linnæus calls the calyx is properly a bell-fhaped, four-cleft corolla; the fegments egg-fhaped, fpreading, red, dotted with white; filaments fhorter than the corolla; anthers two-celled. *Fruit* a roundifh berry, half an inch in diameter, pale, fmooth, acid, eatable. *Seeds* four, egg-fhaped. A native of Champava. Cultivated, but rarely, in the capital of Cochinchina. See TERME.

Profeffor Martyn has given averrhoa acida of Linnæus, as a fynonym to C. racemofa of Loureiro, but he afterwards doubts their identity.

CICCIONE, ANDREA, in *Biography*, a Neapolitan fculptor and architect of great eminence of the 14th and 15th centuries; he was the difciple of Mafuccio the fecond. Amongft his beft works in architecture, are the famous monaftery and church of Monte Oliveto, and the beautiful palace erected for Bartolommeo du Capua, prince della Riccia, at St. Biagio de Librari; and the third cloifter, of the Ionic order, at S. Severino. His greateft work of fculpture is the monument, erected, in the church of St. Giovanni, by order of Giovanna, then queen of Naples, to the memory of her brother the young king Ladiflaus, who died 1414. It is all of white marble; four figures, reprefenting Temperance, Fortitude, Prudence, and Magnanimity, are introduced in place of pilafters to fupport the fabric; over thefe, under a great arch, are feated two figures reprefenting Ladiflaus and his fifter; on the top of the arch is a fepulchral urn, ornamented with baffo relievos, upon which lies the refemblance of the dead king, difcovered to the fight by two angels who draw afide a curtain; above this the monument rifes in a pyramidical form, completed with a cornice, where the figure of Ladiflaus is once more reprefented, with a martial deportment, feated on horfeback, in complete armour. Ciccione died, much regretted, at a very advanced age in the year 1455. Domenici, Vita del Pitt. Scul. & Arch.

CICELY, in *Botany*. See SCANDIX *odorata*.

CICER, Linn. gen. 875. Schreb. 1189. Juff. 361. Vent. 3. 420. Gært. 872. Clafs and order, *diadelphia decandria*. Nat. ord. *Papilionaceæ*, Linn. *Leguminofæ*.

Gen. Ch. *Cal.* one-leaved, five-cleft, as long as the corolla; the four upper fegments incumbent on the ftandard; the fifth fmaller, placed under the keel. *Cor.* papilionaceous; ftandard roundifh, larger than the other petals; wings approaching each other rather obtufe; keel fhorter than the wings. *Stam.* filaments ten, diadelphous, afcending; anthers fimple. *Pift.* germ fuperior, egg-fhaped; ftyle afcending; ftigma obtufe. *Peric.* legume rhomboidal, turgid, inflated. *Seeds* two or more, almoft globular, with a fmall point at their bafe.

Eff. Ch. Calyx five-cleft, the length of the corolla; four upper fegments incumbent on the banner. Legume rhomboid, turgid.

Sp. 1. C. *arietinum*, Linn. Sp. Pl. Willd. 1358. Mart. Lam. Illuft. pl. 632. Gært. tab. 151. (C. fativum, Bauh. Pin. Tourn. cl. 10. gen. 2. Ciche. Lam. Encyc.) Common cich or ciches. "Leaves unequally pinnated; leaflets ferrated; legumes two-feeded." Lam. *Root* annual. *Stem* from a foot to eighteen inches high, erect, leafy, branched, fpreading, angular. *Leaves* compofed of about eight pairs of leaflets with an odd one, egg-fhaped, finely ferrated, hairy. *Flowers* fmall, purple or white; peduncles axillary, folitary, one-flowered, bent, furnifhed with a fhort thread near the angle. *Seeds* one or two, fometimes nearly globular, with a fhort beak at the navels, fometimes angular, with a fancied refemblance to a ram's head, whence the trivial name. A native of the fouth of Europe, where it is cultivated like other pulfe for agricultural purpofes. It is cut feveral times in the fpring, and given green to fheep and lambs, to whom it is efteemed peculiarly nourifhing. It is alfo faid to increafe the milk of cows, who eat it with avidity. Its feeds are eaten in its native climate, both raw and boiled, but do not always agree with delicate ftomachs, efpecially when cultivated in a colder climate. They are fometimes ufed as a fubftitute for coffee, when roafted to blacknefs, pulverized and boiled in water. In warm and dry weather there is fecreted from the tips of the hairs of the leaves, a tranfparent acid liquor which corrodes the fhoes and ftockings of thofe who walk over the fields where it is fown, and which, according to Deyeux (Journ. de Phyf. Flor. An. 6.) is a pure oxalic acid. 2. C. *nummularifolium*,

rifolium, Lam. Encyc. (Elatines folio ſubrotundo; folliculis hirſutis turgidis, Pluk. Amalth. tab. 389. fig. 5.) "Leaves ſimple, inverſely egg-ſhaped, quite entire, hairy; legumes generally more than two-ſeeded." Lam. *Stems* ſlender, about a foot and half long, hairy, branched, leafy. *Leaves* alternate, ſomewhat egg-ſhaped, or roundiſh, entire, hairy. *Flowers* two or three, reſembling thoſe of the preceding ſpecies, but rather ſmaller; peduncles lateral, axillary, hairy. *Legumes* ſomewhat egg-ſhaped, inflated. *Seeds* ſomewhat heart-ſhaped. A native of the Eaſt Indies; communicated to La Marck by Sonnerat. La Marck pronounces it to be perfectly diſtinct from glycine monophylla of Linnæus, and aſſerts that, notwithſtanding its difference in habit, its fructification is properly that of cicer; but Juſſieu doubts whether it ought not rather to be referred to crotalaria.

Cicer *lens*, Willdenow. See Ervum *lens*.

Cicer *ſylveſtre*, *foliis oblongis hiſpidis*, *majus*, Bauh. Pin. 647. See Astragalus *cicer*.

Cicer *foliis oblongis hiſpidis minus*, Bauh. Pin. 347. See Astragalus *microphyllus*.

Cicer *montanum lanuginoſum erectum*, Bauh. Pin. 347. See Astragalus.

Cicer *piloſus ſylveſtre latifolium triphyllum*, Bauh. Pin. 347. —— *ſylveſtre tertium*. Dod. Pempt. 525. —— *ſylveſtre verius*, Lob. Ic. 2. p. 73. See Ononis *rotundifolia*.

Cicer *pedunculis biſloris*, Hort. Upſ. 224. Savag. Monſ. 233. Hort. Clif. 370. See Ervum *lens*.

CICERA, Dod. Pempt. See Lathyrus *cicera*.

CICERELLUS, in *Ichthyology*, a name given by Boccone and ſome others to the fiſh called in England the ſand-launce, *ammodytes tobianus* of Linnæus.

CICERI *ſylveſtri minori affinis*, Bauh. Pin. 347. See Astragalus *Glaux*.

CICERO, Marcus Tullius, *in Biography*, was born on the third of January, in the year of Rome, 647, about 107 years before Chriſt. His birth, if Plutarch is to be believed, was attended with prodigies, foretelling the future eminence of his character. But theſe are to be aſcribed to the credulity or invention of a writer, who wiſhes to excite curioſity by the appearance of what is marvellous. The name Marcus, which he derived from his father and grandfather, was properly perſonal, equivalent to that of baptiſm with us, and impoſed with ceremonies analogous to the chriſtian on the ninth day, called the luſtrical or day of purification. Tullius was his family name, which in the old Latin, as apparently derived from the oriental term דלל *dalal*, ſignified a *flowing ſtream*, ſuggeſted, it is probable, from their ſituation at the confluence of two rivers. As Tullius, the family name, was ſuggeſted by the ſituation of the farm; ſo Cicero, the ſirname, was borrowed from the *vetches*, which were chiefly raiſed and cultivated in it. Agriculture was regarded by the Romans as the moſt liberal employment; and thoſe families, who reſided on their farms in the country, as the moſt honourable. Pliny in his Nat. Hiſt. 18. 3. 1, aſſures us, that all thoſe names which diſtinguiſhed any ſpecies of grain, ſuch as the Fabii, Lentuli, &c. were acquired by the reputation of being the beſt cultivators of that ſpecies. The grain *cicer*, which gave our author the appellation of *Cicero*, was held in all ages of the republic in great eſteem by the Roman populace, as it conſtituted a principal article of thoſe bounties beſtowed upon them by the rich, and was ſold every where in the ſtreets, and prepared for immediate uſe by being ready parched or boiled.

Moſt great men owe much of their early improvement, and conſequently of their future celebrity, to maternal education. But to this general fact Cicero appears an exception, unleſs we ſuppoſe him to have been no leſs deſtitute of filial gratitude than he was of affection. Of his mother, whoſe name was Helvia, a name noticed in hiſtory, and found on old inſcriptions among the honourable families of Rome, no mention is made in any part of his writings; though the little incident of domeſtic management, recorded by his brother Quintus, ſhews that ſhe was equally entitled to the attachment of her children and the imitation of her neighbours. But the indifference or averſion, which induced our author to omit the tribute of veneration due to the memory of his mother, betrays itſelf in the very unpardonable levity with which, in a letter to Atticus, he notices the death of his father.

His paternal family, though not ennobled by any of the great offices of the republic, was yet ancient and honourable, of the firſt diſtinction in that part of Italy in which it reſided, and of equeſtrian rank from its firſt admiſſion to the freedom of Rome. And though he could not with truth boaſt of the ſplendour of his anceſtors, he ſpeaks of them, when occaſion required, with great complacency and frankneſs, as having lived content with their paternal fortunes, and the private honours of their own city, without the ambition of appearing on the public ſtage of Rome. It is for this reaſon that we find him ſo often called a new man; not that his family was new or ignoble, but becauſe he was the firſt of it who ever ſought and obtained the public magiſtracies of the ſtate.

The place of his birth was Arpinum, a city anciently of the Samnites, now part of the kingdom of Naples; which upon its ſubmiſſion to Rome acquired the freedom of the city and was inſerted into the Cornelian tribe. It had the honour alſo of producing the great Caius Marius, which induced Pompey to ſay on a public occaſion, that Rome was indebted to this corporation for two citizens, who had each in his turn preſerved it from ruin. It may juſtly, therefore, claim a place in the memory of poſterity for giving life to ſuch worthies, who exemplified the character which Pliny gives of true glory, "by doing what deſerved to be written, and writing what deſerved to be read," and thus making the world the happier and the better for their having lived in it. The family ſeat was about three miles from the town of Arpinum, in a ſituation extremely pleaſant and well adapted to the nature of the climate. It was ſurrounded with groves and ſhady walks leading from the houſe to a river called Fibrenus, which was divided into two equal ſtreams by a little iſland covered with trees, and a portico contrived both for ſtudy and exerciſe, whither Cicero was uſed to retire when he had any work upon his hands. The clearneſs and rapidity of the ſtream murmuring through a rocky channel, the ſhade and verdure of its banks, planted with poplars, the remarkable coldneſs of the water, and, above all, its falling by a caſcade into the noble river Liris, a little below the iſland, give us the idea of a moſt beautiful ſcene. The houſe, as Cicero deſcribes it, was but ſmall and humble in his grandfather's time, according to the ancient frugality, like the Sabine farm of old Curius, till his father beautified and enlarged it into a handſome and ſpacious habitation. But there cannot be a better proof of the delightfulneſs of the place than that it is now poſſeſſed by a convent of monks, and called the villa of St. Dominic. Strange revolutions, adds Dr. Middleton, to ſee Cicero's portico converted to monkiſh cloiſters! the ſeat of the moſt refined reaſon, wit, and learning, to a nurſery of ſuperſtition, bigotry, and enthuſiaſm. What a pleaſure muſt it give theſe Dominican inquiſitors to trample on the ruins of a man, whoſe writings, by ſpreading the light of reaſon and liberty through the world, have been one great inſtrument to obſtruct their unwearied pains to enſlave it!

The firſt care of his father Marcus, whoſe wiſdom and learning recommended him to the principal magiſtrates of the republic, was to give his ſon the beſt education which Rome could afford, in hopes to excite in him the ambition of aſpiring to the higheſt offices of the ſtate. Accordingly he was brought up under the direction of L. Craſſus, a man of the firſt dignity as well as the firſt eloquence in Rome. The Romans were careful and exact in the education of their children; their attention to it began from the time of their birth, when they committed them to the care of ſome reputable matron, whoſe buſineſs it was to form their firſt habits of acting and ſpeaking, to watch their growing paſſions, and direct them to their proper objects, to ſuperintend their ſports, and to prevent any thing indecent or improper from entering into them, that the mind, preſerved in its native innocence, might be at liberty to purſue whatever was laudable, and apply its whole ſtrength to that profeſſion in which it deſired to excel. This formed a part of that domeſtic diſcipline in which our author was trained, and of which he often ſpeaks. But as ſoon as he was capable of a more liberal inſtruction, his father brought him to Rome and placed him in a public ſchool under an eminent Greek maſter, as the moſt eligible method of educating one who was deſigned to appear on the public ſtage, and who, as Quintilian obſerves, "ought to be ſo bred as not to fear the ſight of men, ſince that can never be learned in ſolitude which is to be produced before crowds." Here he gave the firſt ſpecimens of thoſe ſhining abilities, which rendered him afterwards ſo illuſtrious; and his ſchool-fellows carried home ſuch ſtories of his extraordinary talents, that their parents were often induced to viſit the ſchool, for the ſake of ſeeing a youth endowed with ſuch ſurpriſing faculties.

Encouraged by the promiſing genius of his ſon, the father ſpared no expence in improving it by the help of the ableſt maſters. Among the inſtructors of his youth, was the poet Archias, who, with a high reputation for learning and taſte, opened a ſchool in the family of Lucullus, when Cicero was only five years old. Notwithſtanding this early age, he applied himſelf under this maſter to poetry, and made ſuch a proficiency in it, that, while he was ſtill a boy, he compoſed and publiſhed a poem, called "Glaucus Pontius," which, though now loſt, was extant in the days of Plutarch. Having finiſhed his youthful ſtudies, he laid aſide the habit of the boy for that of the man, and aſſumed what was called the *manly gown*, or the robe of the citizen. This ſeaſon, which was about the 17th year in the ancient republic, though probably ſomewhat earlier in the caſe of Cicero, was a period of great joy to the young men; who, by this change, paſſed into a ſtate of greater liberty and enlargement from the reſtraint of their tutors, and aſſumed the dignity and independence of manhood.

Cicero being then introduced into the Forum, a place calculated to call forth all the enthuſiaſm of his talents, as there the popular aſſemblies were convened, the magiſtrates harangued from the roſtra, and judicial proceedings were uſually tranſacted, was placed under the auſpices of Q. M. Scævola, the augur, and at the ſame time the principal lawyer and ſtateſman of that age, all whoſe remarkable ſayings and leſſons of wiſdom he carefully treaſured up in his memory. After his death, he applied to Scævola, the high prieſt, a perſon of the ſame family, and of equal probity and ſkill in the law, though not a lawyer by profeſſion. Under theſe maſters he acquired a complete knowledge of the Roman laws, a qualification uſeful and ornamental in all countries, but in Rome of ſuch conſequence, that one of the common exerciſes, allotted to boys in ſchool, was to learn by heart the laws of the twelve tables, as they did their poets and claſſic authors. Before he was yet called to the bar, he had ſtudied this ſubject even in its moſt intricate and complex branches with ſuch accuracy and comprehenſion, as to be able to ſuſtain a diſpute on any queſtion with the moſt diſtinguiſhed profeſſors of that age; and once, in pleading with his friend Sulpicius, he declared, by way of raillery, what he was probably able to make good in fact, that, if he provoked him, he would, in the courſe of three days, profeſs himſelf a lawyer.

The profeſſion of the law, next to that of arms and eloquence, was a ſure recommendation to the honours of the republic, and for that reaſon was preſerved, as it were, hereditary in ſome of the nobleſt families of Rome, who, by giving their advice gratis to all that wanted it, attained the favour of their fellow-citizens, and acquired great authority in all the affairs of ſtate. But Cicero's ambition aſpired to much higher attainments. Aiming at being an univerſal patron, not only of the fortunes, but of the lives and liberties of his countrymen, he wiſhed to become an accompliſhed orator, or pleader of cauſes, whoſe profeſſion, as deſcribed by himſelf, was to ſpeak aptly, elegantly, and copiouſly on every ſubject which could be offered to him, and whoſe art, therefore, included all other arts of the liberal kind, and could not be acquired to any perfection without a competent knowledge of whatever was great and laudable in the univerſe. This was his own idea of the character he had undertaken, and his ambition was to illuſtrate the juſtice of his deſcription by his own attainments and eloquence. For this purpoſe, while he ſtudied the law under the Scævolas, he uniformly attended the pleadings at the bar and the public ſpeeches of the magiſtrates, and at the ſame time ſpent a portion of every day in reading and writing at home. It was his conſtant practice to take notes and make comments on what he read, and he was fond, when very young, of an exerciſe, recommended by ſome of the great orators before him, of treaſuring in his memory the ſubſtance of what he read in verſe or proſe, and then expreſſing the ſame ſentiments in different, but the moſt elegant, words that occurred to him. But finding that the moſt eligible terms were already employed, and becoming by a growing confidence in himſelf leſs diſpoſed to tread in the footſteps of others, he laid aſide this practice, and tranſlated into Latin the ſelect ſpeeches of the beſt Greek orators, a method which gave him the command of the moſt elegant words in his own language, and at the ſame time furniſhed him with an opportunity of enriching it with new terms, formed in imitation of the Greek. Nor did he yet neglect his poetical ſtudies; for Aratus "On the Phenomena of the Heavens," he tranſlated into Latin verſe, fragments of which are ſtill extant, and alſo compoſed an heroic poem in honour of his countryman C. Marius, of which, unfortunately, only a ſmall ſpecimen is preſerved, deſcribing a memorable omen given to Marius from the oak of Arpinum, which, from the ſpirit and elegance of the deſcription, renders it probable, that his poetical genius, if cultivated with the ſame diligence, would ſcarcely have been inferior to his eloquence. He moreover publiſhed another poem called "Limon," of which the ſubject was uncertain, but which, if we may conjecture from the title, was a collection of various flowery pieces. While he was employed in theſe juvenile exerciſes, for the improvement of his ſtyle and invention, he applied himſelf with no leſs induſtry to the ſtudy of philoſophy. Among his firſt maſters was Phædrus, the Epicurean, of whom he was then very fond, and for whom he always retained a particular eſ-

teem,

teem, on account of his learning, humanity, and politeneſs; though a more enlarged experience and more critical judgment of things, led him ſoon after wholly to abandon, and ſtrenuouſly to oppoſe the principles of that ſect.

When the tranquillity of Rome was diſturbed by what writers call the *Italic* or *Marſic* war, begun by a confederacy of the principal cities of Italy, to ſupport their demand of the freedom of Rome; Cicero firſt directed his attention to the art of war, in the diſcipline of which all young men of diſtinction were trained, as neceſſary in an empire raiſed and ſupported by the force of arms. In this war he followed the camp of Sylla, who, deſirous to ſignalize his military talents, and to eclipſe the fame of his rival, Marius, as the ſureſt way of obtaining the conſulſhip to which he was aſpiring, gained many conſiderable victories. The example of this general inſpired our author with the love of glory; and he was no leſs diligent in the army than he was in the Forum, to obſerve every thing that paſſed; and he always contrived to be near the perſon of the chief commander, that no action of moment might eſcape his notice. During the enſuing diſſenſions between Marius and Sylla, in which the greateſt cruelties were perpetrated by both parties, Cicero appears to have taken no active part, but to have reſumed the ſtudy and practice of eloquence: and being now about the age of twenty-one, compoſed thoſe rhetorical treatiſes, which, though unworthy of his maturer judgment, are ſtill preſerved, and are generally conſidered as the ſame with thoſe on the ſubject of invention. At this time he commenced the ſtudy of philoſophy under Philo, a diſtinguiſhed diſciple of the Academic ſchool, who, together with many of the principal Athenians, fled to Rome to eſcape the fury of Mithridates, now maſter of Greece. While he was cultivating the academic philoſophy under the direction of this celebrated profeſſor, he received from Diodotus, the Stoic, lectures in logic, which Zeno uſed to call "a cloſe and contracted eloquence," and eloquence, "an enlarged and dilated logic," comparing the one to the fiſt or the hand doubled; the other to the palm opened. Yet with all his attention to logic and philoſophy, he never ſuffered a day to paſs without ſome exerciſe in oratory, in which he was aſſiſted by the ſkill and direction of Molo, the Rhodian, who, about this time, had eſtabliſhed at Rome a ſchool of rhetoric, and was one of the principal orators, as well as the moſt celebrated teacher of eloquence, in that age. Under his auſpices, with the advantages of talents and induſtry peculiar to himſelf, he hoped ſoon to rival the fame of Hortenſius, who then made the chief figure at the bar, and whoſe praiſes fired him with ſuch ambition of acquiring the ſame glory, that he allowed himſelf ſcarcely any reſt from his ſtudies either day or night. His principal exerciſe in this department was that of declaiming, which he generally performed with his fellow diſciples M. Piſo and Q. Pompeius, two young noblemen, with whom, though a little older than himſelf, he had contracted an intimate friendſhip. With theſe he declaimed occaſionally in Latin, but more frequently in Greek, becauſe the ſuperior copiouſneſs of this language furniſhed a greater variety of elegant expreſſions, and an opportunity of introducing them into his own tongue; and becauſe the Greek maſters, who were far the beſt, could not correct and improve them, unleſs they declaimed in that language.

Thus did he paſs through all that courſe of diſcipline, which he lays down as neceſſary to form the complete orator; a character to which, according to his own deſcription, none ſhould pretend, without being previouſly acquainted with every thing in art and nature; whoſe profeſſion it is to ſpeak upon every ſubject that can be propoſed to him, and whoſe eloquence, without the knowledge of what he ſpeaks, would be but the unmeaning prattle of children. Having learnt the rudiments of grammar and languages from the beſt teachers, gone through the ſtudies of polite letters under the moſt diſtinguiſhed poet, inſtructed in philoſophy by the principal profeſſors of each ſect, acquired a perfect knowledge of the law from the greateſt lawyers, as well as the greateſt ſtateſmen of Rome; having received lectures on oratory from the moſt eloquent maſters of Greece, continually compoſed at home, and declaimed in the Forum under their direction; having, finally, attained all the graces of polite converſation by continued intercourſe with ladies, as well as men of refinement and literature, eſpecially with the daughter of Lælius, and Mucia, wife of the great orator Craſſus, who excelled all others of their ſex, in the delicate uſe of the Latin tongue; with all theſe accompliſhments, he offered himſelf to the bar about the age of twenty-ſix. This was the age in which Demoſthenes began to diſtinguiſh himſelf at Athens. The firſt ſpecimen, which he gave the public of his eloquence, as ſome have ſaid, was in defence of S. Roſcius, who was acquitted to the great honour of his patron. His courage and addreſs in the conduct of the defence being applauded by the whole city, he was from this time conſidered as an advocate of the firſt claſs, and equal to the moſt arduous cauſes. As by this defence he acquired great reputation in his youth, ſo he reflects upon it with pleaſure in his old age, and recommends it to his ſon as the ſureſt way to true glory and authority in his country, to defend the innocent in diſtreſs, eſpecially when they happen to be oppreſſed by the power of the great: "as I have done," ſays he, "in other cauſes, but particularly in that againſt Sylla himſelf in the height of his power." A noble leſſon to all young advocates to apply their talents to the protection of innocence and injured virtue, and to make juſtice, not profit, the rule and end of their labours!

At the age of eight and twenty years, he left the forum, and went to Greece and Aſia, the faſhionable tour of thoſe who travelled for curioſity or improvement. His firſt viſit was to Athens, the chief ſeat of arts and ſciences. Here, under Antiochus, the principal philoſopher of the old academy, he renewed thoſe ſtudies, to which, as he aſſerts, he had been devoted from his earlieſt years, and formed with T. Pomponius, who, from his predilection for Athens and his reſidence there, was called *Atticus*, that memorable friendſhip, which ſubſiſted between them through life, and has been tranſmitted to poſterity as the faireſt model of conſtancy, diſintereſtedneſs and affection. From Athens he paſſed to Aſia, and wherever he went, he collected about him the principal orators of the country, who accompanied him the reſt of his voyage, and with whom he diſputed in every place where he made any ſtay. The chief of his aſſociates was Menippus of Stratonica, the moſt eloquent of all the Aſiatics; alſo Dionyſius of Magneſia, Æſchylus of Cnidos, and Xenocles of Adramyttus, the firſt rhetoricians in all Aſia. "Not content with theſe (adds he) I went to Rhodes; and applied myſelf again to Molo, whom I had heard before at Rome, who was an experienced pleader and a fine writer, and particularly expert in obſerving the faults of his ſcholars, as well as in his method of teaching and improving them. His greateſt trouble with me was to reſtrain the exuberance of a juvenile imagination, always ready to overflow its banks, within its proper channel." At Rhodes he devoted part of his time to the ſtudy of philoſophy, under Poſidonius, the ſtoic, whom he often mentions with reſpect, not only "as his maſter, but his friend."

Having finiſhed the circuit of his travels, he returned to Italy after an abſence of two years, extremely improved, and changed, as it were, into a new man; the vehemence of his voice and action was moderated, the redundancy of his ſtyle and fancy corrected, his lungs ſtrengthened, and his whole conſtitution confirmed. From this voyage, indeed, he muſt have received the greateſt benefits. His education had qualified him for deriving all the advantages from whatever he could ſee or hear in a tour the moſt delightful which the ancient world could furniſh. By his previous knowledge of the laws of Rome, he was able to compare them with thoſe of other cities, and to bring back with him whatever he found uſeful either to his country or to himſelf. He was entertained, wherever he came, in the houſes of the great and of thoſe who were diſtinguiſhed by their knowledge and eloquence, as well as by their birth and fortune, men honoured in their reſpective communities, as the principal patriots, orators, and philoſophers of the age. Theſe, that he might not loſe the opportunity, even on the road, of profiting by their advice and experience, he made the conſtant companions of his travels. No wonder, then, that from ſuch a voyage he ſhould derive every accompliſhment which could improve or adorn a man of ſenſe.

Soon after his return, while Cotta and Hortenſius, his rivals in eloquence and honour, ſtood candidates, the former for the conſulſhip, the latter for the ædileſhip, Cicero claimed the quæſtorſhip; and had the ſatisfaction before all his competitors of being choſen by the unanimous ſuffrage of the tribes, in the thirty-firſt year of his age, and the very firſt in which he was eligible by law. The quæſtors were treaſurers of the republic, and their office formed the firſt ſtep in the aſcent of public honours, and after its expiration opened an immediate door to the ſenate, and an actual admiſſion into it during life. Choſen annually by the people, the quæſtors formed the regular and ordinary ſupply of the vacancies of the ſenate, by which excellent inſtitution, the road to the higheſt offices in the ſtate was laid open to the virtue and induſtry of every private citizen, and the dignity of this ſovereign council maintained by a ſucceſſion of members, whoſe diſtinguiſhed merit had firſt recommended them to the notice and favour of their country.

The provinces of the quæſtors being diſtributed to them by lot, the iſland of Sicily fell to the ſhare of Cicero. This, from the quantity of corn annually raiſed and exported, was called the granary of the republic, and the quæſtor's chief employment in it was to ſupply proviſion for the uſe of the city. The ſcarcity peculiar to this year at Rome made the people clamorous, and gave the tribunes an opportunity of inflaming them the more eaſily, by aſcribing it to the loſs of the tribunitian power, and to their being by that means left a prey to the oppreſſions of the great. To appeaſe the public mind, it was neceſſary, therefore, to export from the iſland large and ſpeedy ſupplies, by which it was likely to be drained, ſo that Cicero had the difficult taſk of furniſhing what was ſufficient for the city, without, at the ſame time, being oppreſſive to the poor natives; yet he managed the matter with ſo much addreſs, that he made very great exportations without any burden upon the province, ſhewing great courteſy to the dealers, juſtice to the merchants, generoſity to the inhabitants, humanity to the allies, and, in ſhort, doing all good offices to every body, by which he gained the love and admiration of the Sicilians, who decreed greater honours to him at his departure, than they ever had before done to any of their chief governors. In the hours of leiſure from his provincial affairs, he employed himſelf very diligently, as he uſed to do at Rome, in his rhetorical ſtudies, agreeably to the rules which he conſtantly inculcates, never to let one day paſs without ſome exerciſe of that kind; ſo that on his return from Sicily, his oratorical talents, according to his own judgment, were in their full maturity and perfection. Before he left Sicily, he made the tour of the iſland, to ſee every thing in it that was curious, and eſpecially the city of Syracuſe, which had always made the principal figure in its hiſtory. Here his firſt object was to diſcover the tomb of Archimedes, of which the inhabitants were ignorant; but knowing it to be engraved with a cylinder, as an emblem of his mathematical genius, and remembering the words inſcribed upon the grave, he diſcovered in a ſpot over-grown with briars, a ſmall column, whoſe head juſt appeared above the brambles, marked with the memorable inſcription; and he left the place with ſaying, that one of the nobleſt cities of Greece, and once likewiſe the moſt learned, had known nothing of the monument of its moſt deſerving and ingenious citizen, if it had not been diſcovered to them by a native of Arpinum. At the expiration of his year, he took leave of the Sicilians by a kind and affectionate ſpeech, aſſuring them of his protection in all their affairs at Rome; in which he was as good as his word, and continued ever after their conſtant patron to the great benefit and advantage of the province. He came away well pleaſed with his own adminiſtration, and flattering himſelf that the public were celebrating his praiſes. But no ſooner had he landed at Puteoli, than awaking from his dream of imaginary applauſe, he found the majority of the people equally ignorant of the quæſtor and his province. The diſcovery mortified his ambition, or rather taught him to apply it with more ſucceſs; for, according to his own account, it made him reflect "that the people of Rome had dull ears, but quick eyes, and that, therefore, it was his wiſdom to keep himſelf always in their ſight, and to make them ſolicitous, not ſo much to hear, as to ſee him; ſo that from this moment he reſolved to continue on the forum, and perpetually to live in the view of the city, without permitting either his porter or his ſleep to debar any man's acceſs to him."

He was now in his 37th year, the proper age for being choſen ædile, which was the firſt public office properly called a magiſtracy; the quæſtorſhip being only a place of truſt without any juriſdiction in the city. Theſe ædiles, as well as all the interior officers, were elected by the people voting in their tribes, a mode of election free and popular, in which he was declared ædile, as he had been before inveſted with the quæſtorſhip, by the unanimous ſuffrage of the tribes, in preference to all his competitors. After his election, but before his entrance on that office, he undertook the famed proſecution of C. Verres, the late prætor of Sicily, charged with many flagrant acts of injuſtice, rapine, and cruelty, during his tyrannical government of that iſland. Verres, guilty and corrupt as he had been in the adminiſtration of his province, was ſupported by the moſt powerful families of Rome, and defended by Hortenſius, who was the reigning orator at the bar, and uſually ſtiled the king of the forum; yet the difficulty of the cauſe, inſtead of diſcouraging, ſerved only to animate him the more, by the greater glory of the victory. The reſult was, that Verres was condemned, and the reputation of Cicero both for abilities and integrity greatly increaſed, as of one whom neither money could bribe, nor power terrify, from proſecuting a public oppreſſor; and the Sicilians ever after retained the higheſt ſenſe of his ſervices, and on all occaſions teſtified the utmoſt zeal for his perſon and intereſt.

After this impeachment, Cicero entered on his ædileſhip, of the duties of which he gives us in one of his ſpeeches an account, and which, however important they might be deemed by him, muſt appear contemptible to a modern reader; "I am now choſen ædile," ſays he, "and am ſenſible of what is committed to me by the Roman people. I am to exhibit with the greateſt ſolemnity the moſt ſacred ſports to Ceres, Liber, and Libera; I am to appeaſe and conciliate the mother Flora to the people and city of Rome, by the celebration of the public games; and to furniſh out thoſe thofe ancient fhows, the firft which were called Roman, with all poffible dignity and religion, in honour of Jupiter, Juno, and Minerva." Of thefe games the people were paffionately fond; and as their gratification in this refpect was the fureft road to popularity, many perfons of wealth, when in office, were ruined by thefe diverfions. Cicero, in the execution of this undertaking, avoided the extravagancies into which other magiftrates had plunged, adopting the middle courfe, "fo as neither to hurt his character by a fordid illiberality, nor his fortune by a vain and oftentatious magnificence; fince the one, by making a man odious, deprived him of the power of doing good, the other, by making him neceffitous, puts him under the temptation of doing ill."

After the ufual interval of two years from the time of his being chofen ædile, he ftood candidate for the prætorfhip, the office of which was to prefide and judge in all caufes, efpecially of a public and criminal nature; and it fell to Cicero's lot to fit upon actions of extortion and rapine, brought againft governors of provinces; in which, as he tells us himfelf, he had acted as an accufer, fat as a judge, and prefided as a prætor. In this office he acquired great reputation for integrity, by condemning L. Macer, a perfon of prætorian dignity, and great eloquence, who would have made an eminent figure at the bar, if his abilities had not been fullied by the infamy of a vicious life. Though fully employed in public affairs as prætor, he found time ftill to act as an advocate, as well as a judge, and not only to hear caufes in his own tribunal, but to plead them alfo at the tribunals of the other prætors; and what furnifhes the moft remarkable proof of his induftry is, that, during his prætorfhip, though he was in the conftant habit of exercifing his eloquence, yet he frequented the fchool of the celebrated rhetorician Gnipho, with the defign, if not to learn fomething new, at leaft to prevent any ill habit from infenfibly growing upon him, by exercifing himfelf under the obfervation of fo judicious a mafter. At the expiration of his prætorfhip, he declined to accept any foreign province, the ufual reward of that magiftracy, and the chief advantage which the generality of prætors looked for from the office. Cicero had no love of money, nor genius for arms, fo that thofe governments had no charms for him. The glory which he purfued was to fhine in the eyes of the city, as the guardian of its laws, and to teach the magiftrates how to execute, and the citizens how to obey them.

But the great object of all his hopes was the confulfhip, to fue for which he now began to prepare; and his chief folicitude was to obtain it in its proper year, and without a repulfe. The affection of the city, fo fignally declared for him in all the inferior fteps of honour, afforded him flattering hopes of fuccefs in his prefent pretenfions to the higheft: but he had reafon to apprehend great oppofition from the nobility, who looked upon the public dignities as a kind of birthright, and could not brook the claims of *new men;* and, therefore, he refolved to put it out of their power to fruftrate him, by taking the pains, required of a candidate, to vifit and folicit all the citizens in perfon. On the day of election, therefore, he mixed with the crowd, affembled in the field of Mars, careffing and familiarly faluting each individual by name. In the vacation from the forum, which was ufually in Auguft, he alfo vifited the towns and colonies of the Cifalpine Gaul, a province which, from its numerous votes, had great influence in the election. Amongft his competitors was the famous Catiline, now returned from the government of Africa, where, to fupply his boundlefs extravagance, he had practifed rapine and extortion. In order to defeat the claims of this formidable rival, the friends of Cicero appear to have prefented againft him the charge of mal-adminiftration, and hence in a letter to his friend Atticus he thus expreffes himfelf: "As to Catiline, I am then only fure of him as a competitor, when his judges fhall decide that the fun never fhines at noon day." It was ufual with the Roman lawyers to defend the moft infamous criminals, if recommended by birth and fortune. Of this practice Cicero expreffes his repeated difapprobation; yet we find that his principles, however fair and honourable, when they interfered with his intereft, in any affair of moment, were facrificed to his ambition. Catiline applied to our orator to fhield him by his eloquence, from the vengeance of the law. The refult of this unexpected application we learn from a fubfequent letter to Atticus; "I am now," writes he, "preparing to defend my competitor Catiline. If he fhould be acquitted, I am in hopes that he will the more cordially concur in promoting my election; but if it fhould prove otherwife, I fhall endeavour to bear it with patience." Yet in a fpeech which fome time after he made againft the criminal, he addreffes him, "Wretch, not to fee, that thou art not acquitted, but referved only to a feparate trial, and heavier punifhment."

As the election of confuls approached, Cicero's intereft appeared to be fuperior to that of all the candidates: for the nobles themfelves, though always envious and defirous to deprefs him, yet, out of regard to the dangers which threatened the city from many quarters, began to think him the only man qualified to preferve the republic, and to break the cabals of the defperate by the vigour and prudence of his adminiftration. The method of choofing confuls was not by open votes, but by *ballots*, or little tickets of wood, diftributed to the citizens, with the names of the candidates feverally infcribed upon each: but in the cafe of Cicero, the people were not content with this fecret way of teftifying their inclinations, but before they came to any fcrutiny, loudly and univerfally proclaimed Cicero the firft conful, fo that, as he himfelf declares, in his fpeech after the election, "he was not chofen by the votes of particular citizens, but the common fuffrage of the city, not declared by the voice of the crier, but of the whole Roman people." He was the only new man, who had obtained this fovereign dignity, or, as he expreffes it, "had forced the entrenchments of the nobility for forty years paft, and the only one who obtained it in its proper year, and without a repulfe."

Cicero, being thus arrived at the higheft honour, which a citizen could defire, or the people beftow, employed his talents with extraordinary fuccefs in adminiftering the affairs of the republic; and, according to the unanimous teftimony of all ancient writers, Rome never ftood in greater need of the fkill and vigilance of an able conful than in this very year. His firft policy was to conciliate his colleague Antonius, by affigning to him the beft province, at the expiration of their year; and having by this facrifice fecured his concurrence, he made it the firft object of his adminiftration to unite the equeftrian order with the fenate; and it was the authority of his confulfhip that firft diftinguifhed and eftablifhed the former into a third order of the ftate. About the time of his inauguration, the tribune P. Servilius Rullus propofed to the fenate an *agrarian law*, the object of which was to appoint ten commiffioners, with abfolute power for five years, over the revenues and lands of the republic. The promulgation of a law fo pernicious, however gratifying to the populace, the new conful oppofed; and in a fpeech delivered from the roftra, he gave fuch a turn to the inclination of the people, that they rejected it with as much eagernefs, as they had before evinced to receive it; affuring them of his fixed determination not to fuffer the ftate to be injured, or its liberties impaired, while the adminiftration continued

tinued in his hands. This was a ftriking inftance of the influence which his eloquence obtained over the paffions of men; and the following is a ftill more memorable proof of his afcendancy in fwaying the public mind. Otho, who had propofed a law for the affignment of feparate feats to the equeftrian order, appearing foon after in the theatre, was univerfally hiffed by the people, while from the knights he received the loudeft applaufe. A tumult enfued, and Cicero, informed of it, repaired to the theatre, and the confequence of his addrefs was, that the people vied with the knights in applauding the man whom they before had hiffed; and it is fuppofed, not without fome colour of truth, that the conduct of Cicero on this occafion gave birth to the beautiful comparifon of Virgil in Æn. i. 152. 157. About this time, a formidable confpiracy was formed in the bofom of the republic: of this the chief author was Catiline, and with him concurred a number of young men of diftinction, who had facrificed their fame to their vices, and who fought to repair their ruined fortunes by the diforders of the ftate. The conful detected and defeated their plans, and claimed, by his fuccefs, the proud appellation of the faviour of his country. See the article CATILINE. In this year was born *Octavius*, firnamed Auguftus, an event, which, though infignificant in itfelf, ferved by a concurrence of aufpicious circumftances to open a new æra in the annals of Rome: and it has been noticed as an inftance of the infcrutable ways of Providence, and the fhort-fighted policy of man, that, in the very year in which Cicero faved the republic from deftruction, appeared an infant, who in a fhort time effected what Catiline had in vain attempted, and deftroyed both Cicero and the republic. Having attained the pinnacle of public honours, he did not derive from his elevation that fame, influence, and popularity, which he expected to enjoy. At the expiration of his office, he defired no foreign government, no command of armies; his province was the fenate and the forum; for the purpofe of guarding, as it were, the palladium of the empire, and directing all its counfels to their proper end, the general good; and in the advanced poft of a *confular fenator*, the character which he chiefly coveted, as in a watch tower of the ftate, to obferve each threatening cloud and rifing ftorm, and to give the alarm to his fellow citizens from what quarter it was coming, and by what means its effects might be prevented. In this honourable ftation he excited the envy of the nobles, and the malignity of the profligate: and the fplendour of the nobleft conful whom Rome ever beheld, was foon followed by the difgrace of a voluntary banifhment. The caufes which more immediately led to this extraordinary event, claim, from their importance, a place in this narrative.

About this time J. Cæfar returned from the government of Spain, and Pompey from the Eaft, both celebrated by their far-famed victories. The former fought the confulfhip, while the latter endeavoured to obtain of the fenate the honour of a triumph: but not fucceeding to the extent of their ambitious views, they united with L. Craffus, a rich and turbulent citizen, who hoped to raife himfelf by the authority of Pompey and the talents of Cæfar. The object of this coalition, which was called the *firft triumvirate*, and which terminated in the diffolution of the republic, was to extort that power by violence and bribery which was denied by law, and as a neceffary ftep to this end, to detach Cicero, the bulwark of the ftate, from the intereft of the fenate. In the mean while P. Clodius, a young man of noble birth, and great talents, but of abandoned morals, had an intrigue with Pompeia, Cæfar's wife. But, as he could not eafily gain accefs to her, he took the opportunity, while fhe was celebrating the myfteries of the goddefs *Bona Dea* at her own houfe, to enter difguifed in a woman's habit. While he was waiting in one of the apartments for Pompeia, he was difcovered by a maid-fervant of Cæfar's mother, who immediately giving the alarm, he was driven from this female fociety with great indignation. The ftory was prefently known, and excited general abhorrence on account of the profanation of rites held the moft facred. The citizens and the priefts demanded the punifhment of this bold impiety, and Cicero, concealing fome political motives under the veil of religion, took the lead in the profecution. It was the conftant belief of the populace, fays he, "that if any man fhould ever pry into thefe myfteries, he would be inftantly ftruck blind. But it was not poffible to know the truth of it before, fince no man befides Clodius was bafe enough to make the experiment; though it was now difcovered that the blindnefs of the eyes was converted to that of the mind." Clodius, though fo obvioufly guilty, as, in the words of Hortenfius, to be deftroyed with a fword of lead, was yet acquitted by his corrupt judges; and to revenge the chief author of the profecution, he adopted effectual means for his deftruction. Cæfar and Pompey, in order to remove the chief obftacle to their ambition, and to render dependent upon them the illuftrious object of their envy, though profeffedly friends to Cicero, yet in reality concurred in the faction againft him, and by the adoption of Clodius, a nobleman, and therefore by birth incapable of being elected tribune of the people, into a plebeian family, caufed him to be invefted with that office. In this capacity, in order to gain the public favour, and to humble his rival, he promulgated many laws, which, as they were advantageous to the people, Cicero was advifed not to oppofe. By thefe means, in which he difplayed talents and perfeverance worthy of a better caufe, Clodius unravelled the grand plot of the play he was acting, obtaining a fpecial law, that whoever had taken the life of a citizen uncondemned, and without a trial, fhould be prohibited from fire and water. Cicero, though not named, was known to be the perfon intended by the law. His reputed crime was the putting Catiline's accomplices to death, which, though not done by his fingle authority, but by a general vote of the fenate, was alleged to be illegal, and contrary to the liberties of the people. Thus reduced to the condition of a criminal, Cicero changed *his habit*, as was ufual in the cafe of a public impeachment, and appeared about the ftreets in a fordid mourning gown, to excite the compaffion of the citizens; whilft Clodius, at the head of his mob, contrived in feveral places to meet and infult him, reproaching him with cowardice, and pelting him with ftones. But he was refcued from danger, though not protected from infults, by the zeal of his friends. The whole body of the knights, the young nobility to the number of twenty thoufand, and the greater part of the citizens changed their habits, and attended him about the city to implore the protection and affiftance of the people. But thefe humiliating meafures were premature, and the faction gained, from the dejection and precipitate fears of Cicero, that triumph which it would have loft by a more manly and determined oppofition. His enemies by their fuccefsful attacks increafed in number and ftrength. The tribune Metellus, the confuls, Pifo and Gabinius, were among his open foes. Cæfar, though unfeen, was the principal agent in the plot, and the protection of Pompey was implored in vain. In this extremity he fummoned a council of his friends with intent to act agreeable to their advice; and propofed the queftion, Whether it was beft to ftay in the city, and defend himfelf by force, or to prevent the effufion of blood by retreating till the ftorm fhould be over? Lucullus advifed the firft, but Cato and Hortenfius warmly urged the laft expedient, which, fanctioned by the authority of Atticus, and the entreaties of his

family,

family, induced him to leave the field in the possession of his enemies, and submit to a voluntary exile. The mind of Cicero, however elevated by superior genius, was, in seasons of danger, abject, timid, and undetermined. He wished indeed to prevent the effusion of blood, but there is reason to believe that the blood which by his precipitate retreat he desired principally not to shed, was his *own:* and when the hardships of banishment rendered him sensible of his cowardice, he bitterly reproached himself, in his letters to Terentia and Atticus, for not having taken up arms, and resolutely withstood the violence of Clodius. With his prosperity Cicero lost his dignity, and there is no period of his life in which his character appears less respectable than in his afflictions. The letters which he addressed to his friends, and which convey the only knowledge we have of him during his banishment, are filled with bitter complaints of the insincerity of his friends, his own misconduct, and regret that he did not put an end to his life. "Your advice," says he, in one of his letters to Atticus, "has restrained me from doing violence to myself. But your encouragements have not been able to reconcile me to the course I have followed, and to the life I lead. For what is there for which I should now desire to live, especially if I am disappointed in the hopes I carried with me out of Rome. I will not, indeed I will not, recount all the miseries into which I have fallen, through the unexampled wickedness of the men who envied, rather than of those who hated me, lest I should awake to all the horrors of my condition, and you to a sense of my sorrows. One thing I affirm, never was a man oppressed with such a weight of calamity; never had a man more reason to implore death. But the time is irrecoverably past, when I might have died with glory. The remainder of my days cannot repair, they can only finish my miseries." His friend used every means to console and support him, reproves his abject lamentations, and expresses his apprehensions that his understanding was impaired by excessive grief. To this he replies, "You often accuse me with being too much dejected under my misfortunes; but you ought to forgive me this weakness: for you never saw, you never heard, of any so distressed as I am. You tell me that my sufferings have affected my understanding. This is not true; and I wish my judgment had been equally clear and sound at the time I united with those hostile and cruel traitors, whom I imagined to be the best friends to my person and welfare; those who, when they saw me indisposed from apprehension to accord with their views, had recourse to all the arts of perfidy as means to effect my ruin." Lib. iii. 14.

In the mean time Clodius proceeded against him with unabated fury, caused a law to pass that no one should receive him, or make any motion for recalling him, under pain of death, plundered his magnificent villas, and, after destroying his house in Rome, consecrated the spot to the perpetual service of religion, and upon it built a temple to the goddess Liberty. Emboldened by these successes, he now began to act without the consent of, and even in opposition to, his chief supporters. The implacable resentment of Clodius towards a fallen adversary, or the dread of his power, now grown formidable, induced Pompey at length to espouse the cause of Cicero; but unwilling to take any step for his restoration, without the concurrence of Cæsar, he sent Sextius with dispatches to Spain to solicit his consent and influence. Metellus, now advanced to the consulship, from fear of offending Pompey, no longer acted with open hostility, and Lentulus, his colleague, was the active and decided friend of Cicero. Vigorous, though indirect and partial, measures were now adopted to effect his recal. The honest citizens were invited to Rome from all parts of Italy, and entertained with public shows. The senators held him upon all public occasions as the saviour of their country; plays were acted with pointed reference to the illustrious exile, and the tragedian Æsopus, in the character of the banished Telamon, was received with enthusiastic applause. After repeated efforts, defeated by the skill and vigilance of Clodius, the law for his restoration was ratified, in the most numerous assembly of citizens which Rome ever contained: and this ratification was probably the last act of justice and freedom, which the republic ever exercised.

The day of his return to Rome was the 4th of August, after an inglorious absence of 18 months. As he approached the city, multitudes from all parts flocked to see and to congratulate him. All the towns of Italy decreed him public honours, and sent him a deputation of their chiefs to testify their joy at his return, and it has been emphatically said of him by Plutarch, that he was carried back upon the shoulders of Italy. "That one day," says he, "was worth an immortality, when, on my approach towards the city, the senate came out to receive me followed by the whole body of the citizens, as if Rome itself had left its foundations, and marched forward to embrace its preserver."

His first act, after being restored to his rank, though not to his property, was, in eloquent and affecting speeches to thank the senate and the people for the active part which they took in his restoration. Gratitude in the heart of Cicero was a principle of refined sensibility, which knew no restraint from reason, or any limitation from the duties, which he owed to the interests of the Republic. To Lentulus, now governor of Cilicia, he evinced his sense of obligation by endeavouring with unwearied efforts to authorise him, with the consent of the senate, to restore Ptolemy, a profligate and cruel prince, to the throne of Egypt. The great concourse of citizens in Rome from the different parts of Italy, had occasioned a temporary scarcity, which was severely felt by the common people: and in order to restore plenty to the city, he proposed that Pompey should be invested with an absolute power over all the public stores of the empire. The motion passed into a law; and Pompey was authorised for five years to superintend all the provisions of the Republic, with the power of choosing fifteen officers to act as his deputies. Cæsar, who was now in the full career of victory in Gaul, sent the senate a request that money might be decreed him for the payment of his army, and his command be prolonged five years more. The demand, though exorbitant, was supported by Cicero, who alleged that the course of his victories ought not to be checked by the want of necessary supplies, while he was so gloriously extending the bounds of the empire, and conquering nations, whose names had never before been heard at Rome. His object no doubt was to conciliate Cæsar, and more fully to evince his devotion to Pompey. But his conduct was an evident deviation from his own principles; and the patriots, his former friends, charged him with apostacy, who, with Cato at their head, appear now to have formed a party against him. In a letter addressed to the pro-consul Lentulus, he justifies himself with great ingenuity and elegance. "It appears to me," says he, "to be the dictate of sound policy, to act in accommodation to particular conjunctures, and not inflexibly to pursue the same unalterable scheme, when public circumstances, together with the sentiments of the best and wisest members of the community, are evidently changed. In conformity to this notion, the most judicious reasoners on the great art of government have universally condemned an obstinate perseverance in one uniform tenor of measures. The skill of the pilot is shewn in weathering the storm at least, though he should not gain his port, but if shifting his sails, and changing his direction, ſhould infallibly carry him with ſecurity into the intended harbour, would it not be an inſtance of moſt unreaſonable tenaciouſneſs to continue in the more hazardous courſe, wherein he began his voyage? Thus (and it is a maxim I have often had occaſion to inculcate) the point we ought all of us to keep in view in our adminiſtration of the commonwealth, is the final enjoyment of an honourable repoſe. But the method of ſecuring to ourſelves this dignity of retreat, is by having been invariable in our intentions for the public welfare, and not by a poſitive perſeverance in certain favourite modes of obtaining it. To repeat, therefore, what I juſt now declared, had I been abſolutely uninfluenced by every motive of friendſhip, I ſhould ſtill have purſued the ſame public meaſures in which I am now engaged. But when gratitude and reſentment both conſpire in recommending this ſcheme of action to me, I cannot heſitate a moment in adopting it, eſpecially ſince it appears moſt conducive to the intereſts of the republic in general, as well as to my own in particular. To ſpeak freely, I act upon this principle, ſo much the more frequently and with the leſs reſerve, not only as my brother is lieutenant under Cæſar, but as the latter receives the ſlighteſt action or even word of him in his favour with an air, that evidently ſhews he conſiders them as obligations of the moſt ſenſible kind. And, in fact, I derive the ſame benefit from that popularity and power which you know he poſſeſſes, as if they were ſo many advantages of my own. The ſum of the whole in ſhort is this, I imagined that I had no other method of counteracting thoſe perfidious deſigns, with which a certain party were ſecretly contriving to undermine me, than by thus uniting the friendſhip and protection of the men in power, with thoſe internal aids which have never yet been wanting to my ſupport." With equal ſeverity and truth it has been remarked, that the principles by which Cicero attempts to juſtify himſelf in this epiſtle are ſuch as will equally defend the moſt abandoned proſtitution and deſertion in political conduct. Perſonal gratitude and reſentment; an eye to private and particular intereſt, mixed with a pretended regard to the public good; an attention to a brother's advancement and farther favour; a ſenſibility on being careſſed by a great man in power; a calculation of the advantages, derived from the popularity and credit of that great man to one's own perſonal intereſt, are very weak foundations indeed to ſupport the ſuperſtructure of a true patriot's character. Yet theſe are the principles which Cicero here avows and defends.

The ambitious chiefs, Pompey and Cæſar, whoſe union was cemented only by views of intereſt, began at length to be at variance; an event accelerated by the death of Julia, who was tenderly beloved by both. The ſenate, in general, were in the intereſt of Pompey, who, confiding in the name and authority of ſo great a leader, were determined to humble the pride and ambition of his rival, by re-calling him from his government; whilſt Cæſar, on the other hand, relying on the fidelity of his troops, reſolved to keep poſſeſſion of his power, in defiance of the ſenate. This was the commencement of the civil war, which terminated in the deſtruction of the commonwealth, and in the final misfortunes of Cicero. In this poſture of affairs, Cicero was induced to accept the government of Cilicia, a character which he never before ſuſtained, and which he was anxious to decline, or, at leaſt, not to prolong, though in the eſtimation of reaſon it comprehends the moſt honourable period of his life. He formed the generous reſolution of practiſing in his provincial command thoſe admirable rules which he had previouſly drawn up for his brother, and from an employment to which he ſeems totally averſe, of gaining freſh acquiſition of glory and ſatisfaction, by leaving his adminiſtration as a model of juſtice and integrity to all ſucceeding proconſuls. To his friend Atticus, he tranſmitted a minute account of his proceedings, and it would be injuſtice to his memory not to make a ſhort extract of his detail. "I perceive that my moderation and diſintereſtedneſs give you pleaſure; but how would it be enhanced, had you been here in perſon? Many cities had the whole of their debts cancelled; many were greatly relieved, while all of them, being judged by their own laws and in their own forms, recovered their ſpirits by thus recovering their conſtitution. I have given thoſe cities a power of keeping themſelves free of debt, or making their debts very eaſy by two means; the one, that, during the whole time of my government, I have not put them, and I ſpeak without a figure, to one farthing of expence, I repeat it, not to a ſingle farthing. It is incredible how many cities have diſcharged their debts from this ſingle circumſtance. The other mean was the following: They were greatly plundered by thoſe among the natives, who, for ten years paſt, had been their magiſtrates, and who did not ſcruple to acknowledge the fact; and, therefore, to prevent a public cenſure, with their own hands returned the money to the people. By theſe means, the ſubjects, without any difficulty, have paid to our farmers of the revenue all the land tax for this term, of which, till then, they paid nothing, and their arrears of the laſt. In all the other departments of my government, I proceeded with ſimilar addreſs, and my clemency has been joined to unexampled affability. In giving my audiences, I have laid aſide the formalities adopted by other provincial governors. I ſuffer no application to be made to my dependents, but directly to myſelf. Before day-break, I walk about in my houſe, as I uſed formerly to do, when I ſtood for public offices. This condeſcenſion ſecures me popularity and influence, and I was formerly ſo accuſtomed to it, that it gives me as yet no pain." How many millions of human beings would have been rendered happy if all the governors of the provinces could, with equal truth, have given a ſimilar account of their adminiſtration! His conduct in this, as well as in many other reſpects, proves that Cicero was naturally diſpoſed to be on the ſide of the people, and a foe to oppreſſion; that he delighted in acts of juſtice and beneficence, and that, however deſirous of diſtinction, he had more pleaſure in communicating happineſs to others than in accumulating to an immoderate extent the means of happineſs to himſelf; and that he never deviated from the true intereſts of his country, or ſupported the claims of ambition, but when allured by the ſplendid accompliſhments, or aided by the high authority, of the claimants. As a commander, he made a leſs enviable figure. Nature did not intend Cicero for a ſoldier; yet, by ſome ſucceſsful movements againſt the Parthians, and ſome advantages over the inhabitants of Mount Amanus, and of the town Pandeniſſum (a name which, however ſtrange to Atticus, meant only *a city on the hill*, and conveys the ſame meaning with Penthinas in Celtic, or Βουνουδιναξια in Greek), he received the title of "Imperator," and returned home with laurelled lictors, claiming the honour of a triumph, and ſoliciting a decree of *thankſgiving*. When the queſtion for this decree was diſcuſſed in the ſenate, Cato roſe and expreſſed his opinion, that the military achievements of the commander little deſerved notice, but that his diſintereſted conduct as a governor was ſuch, that if triumph were decreed to virtues as well as to victories, he merited a thouſand. Of this fine compliment, beſtowed by ſo great a man, Cicero was in-

formed,

formed, and he thus fpeaks of it to Atticus; "The man who oppofed that meafure did me more honour than triumphs can beftow."

The civil war, the fparks of which began to appear before his departure, was now fully kindled on his return to Rome; and the firft wifh of his heart was to extinguifh the flame between the contending parties, thinking, as he himfelf expreffes it, that "peace between citizens, however unfavourable the terms, was more advantageous than the moft juftifiable war." But his hopes of accommodation, while Cæfar folicited his interference for that purpofe, were fruftrated by the ftubbornnefs of Pompey, who expreffed his determination either to conquer or to die in the caufe of liberty, though he afterwards acted with a precipitation which forfeited all confidence either in his fkill or his courage. Supported as he was by the fenate, the patriots, by all the virtuous citizens and the united forces of the republic, he left Italy with its municipal towns, Rome with all its treafures, to be the prey of Cæfar, which he feized with the rapacity and fwiftnefs of a vulture. His unaccountable conduct in this refpect induced him to charge Pompey with inability; and regarding him as one who had been guilty of failing out of harbour without a rudder, and committing himfelf to the mercy of the ftorm, he long hefitated to follow him beyond fea. Yet he was too much attached from gratitude and from principle to the caufe of Pompey, however he might waver, finally to abandon it. This leader, indeed, Cicero knew was tyrannical in his views, and too prone to imitate the profcriptions of Sylla; but, upon the whole, he confidered him as the champion of public liberty, or, at leaft, the country had lefs to dread from his cruelties than from the ambition of his rival. On the other hand, Cæfar he confidered as a bold defperate citizen, who wifhed to fubvert the civil conftitution, and to accumulate in himfelf the whole powers of the ftate. "Poffeffed," fays he to Atticus, "of a powerful army, multitudes joining him from hopes and promifes: his ambition grafps every object. Such is the man to whom Rome, deprived of the means of defence, but ftored with riches, has been furrendered. What have we not to apprehend from one who looks upon Rome, with all her edifices, public and private, not as his country but his prey? Miftaken wretched man! infenfible to every idea of true glory! He pretends that all he does is to maintain his dignity. But can dignity exift without virtue? Is it compatible with virtue to continue at the head of his army, without the voice of the people to authorize him, and to feize cities inhabited by Romans, that he may open to himfelf a more eafy paffage to the heart of his country? Not to mention the cancelling of the national debts, the recal of the banifhed, and a thoufand crimes that are yet to be perpetrated, before he can rear the temple of tyrannic power, the only deity he worfhips. I do not envy his greatnefs. I had rather fpend one day with you in the funny walks of Lucretum, than be a monarch over innumerable kingdoms acquired by guilt like his. I had rather die a thoufand deaths than harbour fuch an idea at the expence of my country. You think, you will fay, for yourfelf. And is there a wretch who is not at liberty to think? But I repeat it, I think the man who acts in this manner is more miferable than the wretch who lies extended on the wheel. There is but one mifery beyond it, and that is fucceeding in the attempt."

Thefe fentiments have their proper place affigned them in the Cato of Addifon, but are too much coloured by paffion to correfpond with the real features of truth; and in the letters which he fent to Cæfar, he fpeaks of him in terms fo different, that they brought upon him the imputation of adulation and fervility. Contrary to the general apprehenfion, Cæfar behaved with uncommon clemency; and Cicero himfelf, notwithftanding his petulance, experienced his forbearance. Having triumphed over Italy by his humanity, he, about a year after, defeated his rival at Pharfalia. Cicero was not prefent at the battle, having, from indifpofition or chagrin, ftayed behind at Dyrrhachium. He refolved to give the ufurper no farther oppofition, but to devote, in retirement, the remainder of his days to letters and philofophy. He was advifed by Atticus to addrefs an epiftle to Cæfar, in commendation of his clemency and his military achievements, directing him, at the fame time, in the ufe of his victories and the adminiftration of the empire. This letter was compofed, but, for fear of giving offence to fome of Cæfar's dependents, was never fent. It appears to have been written in a ftyle of uncommon elegance, and the manly freedom with which he addreffed the tyrant, would, if preferved, have reflected great honour on his memory. What he fays to Atticus in refpect to it is well deferving of being tranfcribed; "You are no ftranger to thofe perfuafive addreffes which were made to Alexander by men of eloquence and learning. They addreffed a young prince, fired with the love of the trueft glory, and panting for thofe counfels which lead to the fummit of unperifhable fame. Eloquence is not wanting, when it is infpired by a fubject truly glorious. This in Cæfar I do not poffefs. Neverthelefs, from the untowardly materials of the oak, I have carved, if not the image of true glory, yet fomething that bears the refemblance of it, and becaufe fome features in it are wrought with more exactnefs than thofe ufually delineated, they are cenfured."

He rejoiced in the affaffination of Cæfar by Brutus and Caffius, though he had no previous knowledge of the confpiracy. The hope of faving the country induced him again to take an active part in public affairs, and by his eloquence and authority he prevented Antony from fucceeding to the empire. But betrayed by Octavius, whofe caufe he had efpoufed, he was delivered up to the vengeance of his rival. The triumvirs agreed to divide the empire among themfelves, and to place Cicero at the head of the profcription. This at firft was kept a fecret; but before it tranfpired, it was confidentially imparted to him while with his brother and nephew at his Tufcan villa. He firft fled towards Aftura, with the intent of croffing the fea, but after embarking, the wind proving contrary, and the fea tempeftuous, he landed at Circæum, in order to repofe in his Formian villa, weary of life, and declaring that he would die in that country which he had fo often faved. His fervants, anxious for his prefervation, prevailed upon him to be conveyed away in the morning. As foon as he was gone, the foldiers fent in purfuit of him, arrived at the houfe, and perceiving that he was fled, they haftened towards the fea-coaft, and overtook him in a wood, where they cut off his head and hands, and in triumph returned with them towards Rome. Antony ordered the head to be fixed on the roftra between the two hands, and rewarded Popilius, the leader of the foldiers, with the honour of a civic crown, and the fum of eight thoufand pounds. The whole city lamented the cruel fate of this eminent man, and wept at the fight of thofe members, once glorioufly exerted in defence of the laws, the liberties, and the fortunes of the Roman people, but now ignominioufly expofed in that very place, to the fcorn of fycophants and traitors. His death occafioned univerfal forrow; it was confidered as the final triumph of defpotifm, and his blood as cementing the perpetual flavery of Rome. The writers of the Auguftan age have paffed over this cruel deed with inglorious filence, and fought to draw over the cruelty of of Antony and the perfidy of Octavius, the veil of eternal oblivion. Yet Paterculus could not refrain from the following beautiful expostulation: "Thou hast done nothing, Antony; hast done nothing, I say, by setting a price on that divine and illustrious head, and by a detestable reward procuring the death of so great a consul and preserver of the republic. Thou hast snatched from Cicero a troublesome being, a declining age, a life more miserable under thy dominion than life itself; but so far from diminishing, thou hast but increased the glory of his deeds and sayings. He lives, and will live, in the memory of all ages; and as long as this system of nature, whether formed by chance or providence, which he of all others best comprehended in his mind, and illustrated by his eloquence, shall remain unchanged, it will perpetuate the praises of Cicero; and posterity, while they will admire his writings against thee, will curse thy deed against him."

About the time of his consulship Cicero married Terentia, a lady of family and fortune, who shared in the trials of his banishment with great firmness, and whom he then appears to have tenderly loved, but whom for some domestic grievance, at which he delicately hints in a letter to Atticus, he afterwards divorced. By Terentia he had a son and a daughter. The son, with all the advantages of education and example, inherited neither the talents nor the virtues of his father; but the daughter, as she merited, possessed in an eminent degree his affections. She was first married to Piso, a young nobleman of great promise; but being left a widow in the bloom of youth, she again married Crassipes, and afterwards Dolabella, from whom, without any imputation on her chastity and honour, she was successively divorced. She died of child-birth in the thirty-second year of her age. Her father's grief was excessive. Retired from the world, and secluded even from his friends, he adopted the singular expedient of addressing to himself letters of consolation, and we owe to his seclusion at that period, many of those philosophical treatises, which have since delighted and instructed the world. Thinking her deserving of immortality, he had the weakness to seek her deification on earth, by erecting a temple in memory of her name and worth. Cicero believed the immortality of the human soul; but on the absurd principle derived originally from the Chaldeans, that, being a particle of the deity, and existing previously to the present, it would continue to exist in a future state. A faith thus borrowed from superstition, and unsupported by the force of truth, could have little effect upon his conduct, and he seems to have derived no comfort from the hope of being again restored to his beloved offspring. In a letter to Atticus respecting the death of a common friend, he urges the consolatory maxim, that "we are born on the condition of submitting to all the calamities entailed on our nature." But this sentiment, however beautiful, is calculated rather to silence than to soothe complaint; and yet this is the farthest limit to which the light of natural religion extends. The disciple of nature under affliction may cease to grieve, because to grieve is unavailing; because the cause of his sorrows is the inevitable lot of man. But the believer in revelation possesses sources of real consolation even in circumstances of the greatest distress. Deprived of his dearest friends and relatives, and even in the prospect of his own death, he looks through the evidences of christianity to a renewed and more exalted being. His fears therefore are changed into resignation, and his sorrows subside into serenity and joy.

The person of Cicero was tall and slender, with a long neck, but regular and manly features. His deportment was dignified and commanding, yet enlivened by cheerfulness and serenity. Though naturally weak, his constitution was made capable, by habit and discipline, of supporting all the fatigues of action and of study; while his moderation in respect to diet, with regular exercise, insured him perpetual health and vigour. His temper was open and communicative; his attachments, domestic and social, were warm and violent, but liable to change or abate with the change of objects or situation. While his connection with Atticus taught and exemplified the principle of genuine friendship, his frequent reconciliation, and even exertion in behalf of those who had been his bitterest enemies, prove that he possessed a forgiving and placable heart. His manner was free from the affectation of singularity; and in his dress he avoided the opposite extremes of rustic negligence and foppish delicacy. His villas, his gardens, and his studies were highly magnificent, adorned with the most valuable monuments of art, and the most expensive articles of furniture. The style of living, which he conceived suitable to his rank, and of entertaining his friends, was liberal to profusion. He seemed to think that money, with whatever toils acquired, should be chiefly spent by a man of rank, in the gratification of taste. The want of economy and attention to his domestic affairs, sometimes occasioned embarrassment to himself and losses to his friends; and he, whose talents enabled him to lay the whole community under tribute, was often under pecuniary obligations to inferior or obscure individuals. But his predominant failing was vanity. He knew the extent of his own powers; he felt the high estimation in which he was held as a scholar, an orator, and a statesman; he was sensible of the favours which his knowledge or his eloquence had conferred upon the public, and no commendation that might appear inadequate to the extent of his merits, could satisfy his appetite for praise. The parade with which he often speaks of his conduct in the republic, or in the government of Cilicia; the frankness, with which he extols the eloquence of his own compositions, or the effects of his speeches, his request to Lucceius to write the annals of his consulship, and to praise him, even at the expence of truth, are unfortunately still recorded to perpetuate his weakness. But these imperfections, though they might detract from the dignity, did not impair the moral excellence of his character. Few persons in christian countries, and none in his own age, were upon the whole so free from vice. He was an entire stranger to the sordid passions of lust and avarice; and however vain, irresolute, or inconsistent a part he sometimes acted, he does not appear ever to have committed a crime. His candour in the various relations of life exemplified the lessons of morality which his writings inculcate; and they are unquestionably the best and purest of which heathen antiquity can boast.

His character as an orator and philosopher is too well known to need a minute delineation. His powers of writing and speaking shone with unrivalled lustre; and his name soon became synonymous with that of eloquence. According to the unanimous opinion of critics, he possessed in an eminent degree the qualities of a fine speaker, a powerful voice, a commanding figure, graceful action, a brilliant imagination, a happy turn for wit and raillery, a correct taste, and a sound judgment: with a memory retentive and enriched with all the possible varieties of knowledge, which incessant study, active curiosity, conversation with the learned, and acquaintance with books could supply. With these endowments he soon rose above all competition. At the commencement of his judicial career, he eclipsed the famed Hortensius; and in the meridian of his glory, the forum and the senate served but as a throne to raise him above others, and to display to the view, not only of the empire, but of of surrounding nations and distant ages, the royalty and magnificence of his genius. It was his chief ambition, as he profited by the example, to rival the fame of Demosthenes; and if he did not possess the fire and energy of the Greek orator, he surpassed him in readiness of elocution, in the harmony of his periods, and in the richness and variety of his sentiments. With all the predilection of taste, even in modern days, his style however is not deemed perfect; and he appears to have been disapproved by his contemporaries, Brutus and Varro, as well as his admired critic Quintilian, for the technical uniformity of his arrangements, his frequently frigid attempts at wit, for the exuberance of his fancy, and the diffuseness of his sentiments.

As a philosopher, he may be said to have been a disciple and imitator of Plato, whom he admired to enthusiasm, and to whose dignified style and enlarged principles, he acknowledged himself more indebted than to the artificial rules of rhetoric. In his scientific disquisitions, he avoids the rigour of the stoics, and the uncertainty of the sceptics; and against the Epicureans, he maintains the existence of a supreme being; the doctrine of a providence; the immortality of the human soul; and the natural, immutable difference between good and evil. But these important principles he adopted, rather on the authority of the academy, as consonant with reason and virtue, than as the result of his own inquiry, and brought home to his conviction by irrefragable argument. We cannot therefore wonder, that, however they might amuse his understanding, they had little influence on his heart, or that he should have been more successful in demolishing the opinions of his adversaries, than in defining or establishing his own. Cicero was the first Roman, Lucretius excepted, who discussed, in Latin, the philosophy of Greece; and the several treatises which issued from his pen on that subject enriched the language, and enlarged the ideas of his countrymen. Of Grecian literature in all its branches, he had a profound and extensive knowledge. The perspicuity with which he states the tenets of the respective schools, the frequency with which he quotes or alludes to passages in their philosophers, orators, and poets, prove that their writings had not only passed through his hands, but were still retained in his memory. He could write and speak the Greek tongue with fluency; but some errors which he has committed, suggest a suspicion that his knowledge of it was more specious than solid, and that he was inferior in critical skill to his friend Atticus. See Tuscul. Disp. iv. 22. compar. with Dr. Clarke's note on Hom. Il. vi. 214. Guth. Translation of his Letters to Attic. b. xiii. 21, last edition. Many of his writings are lost; but those which remain, will preserve and endear his name, as long as literature is cultivated among men.

The works of Cicero, which are very numerous, have been commonly distributed into four classes, comprehending "Rhetorical Treatises," "Orations," "Philosophical Works," and "Epistles." Of the first class the most valuable are his three dialogues: "De Oratore," the art of oratory, addressed to his brother Quintus; his book "De Claris Oratoribus," on illustrious orators, entitled, "Brutus;" and his "Orator," the orator, addressed to Brutus. The number of "Orations" remaining under his name, amount to fifty-six; and whilst they comprehend the whole of his public life, they contain a treasure not only of eloquence, but of other matters pertaining to history and jurisprudence. The matter of his "Philosophical Works" was borrowed from the Grecian school; of these, the principal that treat of the philosophy of nature are "De Natura Deorum," a dialogue eloquently displaying the opinions of the Stoics and Epicureans, concerning the divine nature; "De Divinatione et Fato," exhibiting his superiority to the superstitions of his age and country; "Somnium Scipionis," founded on the Platonic doctrines, concerning the soul of the world, and the state of human souls after death. One of the most elaborate of Cicero's works that relate to moral philosophy is entitled "De Finibus," and discusses the opinions of the Grecian sects with regard to moral ends. His "Quæstiones Tusculanæ" treat of the contempt of pain and death, the remedies of grief and mental pertubation, and the sufficiency of virtue to a happy life. His treatise "De Officiis" is an excellent summary of practical ethics, chiefly upon the principles of the Stoics. His "Quæstiones Academicæ" contain his own opinions more directly than any other of his works. His dialogues entitled "Cato" and "Lælius" are very elegant pieces of moral writing. In his book "De Legibus" he explains the grounds of jurisprudence. His "Epistles," which are denominated "Familiar" with peculiar propriety, afford excellent specimens of the style adapted to such compositions, and abound with various matter, political and domestic. The suppression of Cicero's "Poetry" has done no injury to his reputation.

The editions of Cicero's works, whole or in part, have been very numerous; of the former, some of the best are Elzevir's, 10 vols. 12mo. L. Bat. 1642. Gronovii, 11 vols. 12mo. 2 vols. 4to. Amst. 1692. Verburgii, 16 vols. 8vo. 2 vols. fol. Amst. 1724. Oliveti, 9 vols. 4to. Paris, 1740. Ernesti, 6 vols. 8vo. Halæ. 1773—77. Lallemand, 14 vols. 12mo. Paris, 1768. Oxford, 10 vols. 4to. Of his separate works, all that have been edited by Grævius, Pearce, and Davis, merit recommendation. Most of his productions have been translated into various languages. Melmoth's versions of the "Epist. ad Familiares," and of the treatises on old age and friendship, are the best attempts of this kind in the English language. An improved edition of Guthrie's translation of Cicero's Epistles to Atticus, with many additional notes, by Mr. J. Jones, in 3 vols. appeared in 1806. Of the various lives of Cicero, that of Melmoth is the most complete, though it has too much the air of a continued panegyric or apology. Aikin's Gen. Biog.

Cicero, in *Geography*, a military township of America, in New York, on the S.W. side of Oneida lake, and between it, the Salt lake, and the Salt springs.

CICERONIASTRI, or Ciceroniani, in the *History of Literature*, an appellation given to those moderns who dispute the propriety of all expressions and words not found in Cicero. Such was the estimation in which the Roman orator was held as a writer, that his admirers will not allow that he was ever equalled; and, accordingly, they say of him that no sentiment occurs, in common with him and any other author, which is not best expressed by Cicero. Hence arose the enthusiasm excited by his works soon after the revival of literature, and the above-mentioned appellation.

CICERUM *lapis*, the *chich stone*, in *Natural History*, a name given by some authors to a sort of small round stones, of the nature of the pisolithe or pea-stones, but smaller than those usually are, and of a dusky grey colour. They very exactly resemble the fruit of the cicer or chich-pea, and are found in great abundance near the Old Jerusalem.

CICHALIX, in *Ancient Geography*, a mountain of Asia Minor, towards Bithynia.

CICHORACEÆ, in *Botany*, the first natural order in the tenth class of Jussieu, with the following character: *Florets* all strap-shaped and hermaphrodite, either entire or toothed

toothed at the tip. *Common calyx* of various forms. *Stigmas* two to each floret. *Seed* naked or downy. *Receptacle* naked or beset with hairs or chaff. *The whole plant* lactescent, herbaceous, often caulescent. *Leaves* alternate. *Flowers* generally yellow.

Jussieu has followed Vaillant in dividing this order into five sections, which, though not perfectly natural, he thinks useful, and therefore not to be discarded. 1. Receptacle naked; seed not downy; *lampsana*, *rhagadiolus*. 2. Receptacle naked; seed downy; down capillary; *prenanthes*, *chondrilla*, *lactuca*, *sonchus*, *hieracium*, *crepis*, *drepania*, *hedypnois*, *hyoseris*, *taraxacum*. 3. Receptacle naked; seeds downy, down feathery; *leontodon*, *picris*, *helmintia*, *scorzonera*, *tragopogon*, *urospermum*. 4. Receptacle chaffy or hairy; down feathery or capillary; *geropogon*, *hypochæris*, *seriola*, *andryala*. 5. Receptacle chaffy; down awned or none; *catananche*, *cichorium*, *scolymus*. Ventenat has adopted the above division, only adding arnoseris, which he has formed into a distinct genus for hyoseris minima of Linnæus, on account of its striated seeds, crowned with an erect, coriaceous, entire border.

CICHORIO *affinis*, Pluk. Amalth. tab. 380, fig. 2. See SIEGESBECKIA *orientalis*.

CICHORIUM, (κιχώρη and κιχώριον; Theophrast. lib. 7. cap. 7. and lib. 7. cap. 11.) It is said by Pliny to be an Egyptian name, adopted by the Greeks. It was sometimes written κιχόρειον, whence the

"Cichorea levesque Malvæ"

of Horace. The futile attempts of modern etymologists to derive it from the Greek are too contemptible to be noticed. Linn. Gen. 921. Schreb. 1251. Willd. 1427. Juss. 171. Vent. vol. ii. 492. Gært. 906. Tourn. Cl. 13. §. 2. Gen. 3. Chichorée; Lam. Encyc. Ill. Pl. 658. Class and order, *Syngenesia polygamia equalis*. Nat. ord. *Compositæ semiflosculosæ*, Linn. *Cinarocephalæ*, Juss.

Gen. Ch. *Cal.* calycled or composed of two ranks of scales; inner scales commonly about eight, narrow-lanceolate, forming a cylinder before the opening of the flower, reflexed as the seeds ripen; outer ones about five, short, loose. *Cor. compound*, flat, uniform; florets twenty in a ring, strap-shaped, deeply five-toothed. *Stam.* Filaments five; anthers united in a five-sided hollow cylinder. *Pist.* Germ oblong; style filiform, the length of the stamens; stigmas two, revolute. *Peric.* none. *Seeds* solitary, compressed, sharply angular, crowned with an obscurely five-toothed border, according to Linnæus. Gærtner asserts that it consists of many leaves, or chaff-like teeth, forming a kind of double series. *Recep.* somewhat chaffy.

Eff. Ch. Receptacle somewhat chaffy. Calyx calycled. Seed crowned with a chaffy border shorter than itself.

Sp. 1. Cichorium *Intybus*. Linn. Sp. Plant. Mart. Lam. Willd. Flor. Dan. tab. 907. Gært. tab. 157. Curt. Lond. Fasc. 4. tab. 56. Woodville, Supp. tab. 248. Eng. Bot. 539. (Cichorium sylvestre s. officinarum: Bauh. Pin. 125. Tourn. 479. Seris picris; Lob. Ic. 128. Intybus sylvestris, Fuchs. 979.) Wild succory. "Flowers in pairs, sessile. Leaves runcinate." Linn. *Root* perennial, spindle-shaped; running deep into the ground, often branched, white, fleshy, yielding a milky juice. *Stem* a foot and a half high and more, erect, stiff and firm, angular above, rough, leafy, except near the top, where it appears almost naked, many-flowered, branches divaricated. *Leaves* roughish; root ones runcinate; stem ones heart-shaped, embracing the stem, acuminate. *Flowers* axillary, in alternate pairs, large, handsome, blue, sometimes white; calyx-leaves with a rough keel, finally reflexed. *Receptacle* dotted, with a few scattered chaffy hairs. *Seeds* angular, crowned with a short border of chaff-like scales in a double series. Whole plant bitter. A native of England and other parts of Europe, on the borders of corn fields and by road sides, but most prevalent in a calcareous soil. When cultivated it is much more branched and rises to the height of five or six feet, with longer leaves, less deeply cut and almost smooth. It is then Cichorium sativum; Bauh. Pin. 125. Tourn. 479. Lob. Ic. 129. It certainly possesses considerable medical properties, though it has not obtained a place either in the London or Edinburgh pharmacopæas. Its virtues depend on its milky juice, which is of a penetrating bitterish taste, and of no remarkable smell or particular flavour; the roots are bitterer than the leaves or stalks, and these much more so than the flowers. The roots and leaves are stated by Lewis to be "very useful aperients, acting mildly and without irritation, tending rather to abate than increase heat, and which may therefore be given with safety in hectic and inflammatory cases. Taken freely, they keep the body open, or produce a gentle diarrhœa, and when thus continued for some time, have often proved salutary in beginning obstructions of the viscera, in jaundices, cachexies, hypochondriacal and other chronical disorders." "A decoction of it," adds Dr. Woodville, "with others of the same kind, in whey, and rendered purgative by a suitable addition of polychrest salt, has been found a useful remedy in cases of biliary calculi, and promises advantages in many complaints requiring what have been termed attenuants and resolvents; and we are warranted in saying, that its expressed juice taken in large quantities, has been found an efficacious remedy in phthisis and pulmonalis. Its seeds are reckoned among the four smaller cooling seeds." Med. Bot. The juice mixed with rhubarb, according to Du Tour, (Nouveau Dictionaire), is an excellent vermifuge syrup for children.

It was commonly eaten by the Romans, and, when blanched, is still used in France in soups or as a sallad, but little, if at all, in England, where C. endivia is preferred. If steeped some hours in water, the water being changed every two or three hours, it loses much of its bitterness. But this effect is more effectually produced by the operation of blanching, which leaves only so much bitterness as renders it not at all disagreeable. In Italy it has long been cultivated on a large scale, and esteemed, either green or dry, as an excellent fodder for horses, kine, and sheep. It was first introduced into France by Cretté de Pallael, and into England by the well-known Arthur Young, but the moist atmosphere of our island is less favourable to its being made into hay. The wild succory, says Du Tour, will grow in any kind of soil, but thrives best in a good one well manured, and is cultivated at a small expence. It sustains drought, excessive rains, and severe cold, and as it rises early in the year, affords an excellent spring supply. Its growth is so rapid, that it may be cut three or four times every year, or more frequently. Its produce in bulk and in weight is superior to that of trefoil and even of lucerne. There is no need of preparing cattle to use it as food; it is as wholesome as it is abundant, sweetens their blood, and preserves them from disease. In particular, it causes cows to give more milk without communicating any of its bitterness, and furnishes, eight months in the year, an excellent resource for the former, affording the first herbage for cutting in the spring, and the last in autumn. In Germany its dried powdered root is mixed with coffee, in the proportion of one third or a half, and is preferred to tea as more nutritious and much cheaper. 2. C. *pumilum*, Willd. Jacq. Obs. 4. p. 3. tab. 80. "Flowers axillary in pairs, sessile; leaves inversely egg-shaped, toothed." Willd. *Root* annual. *Stem* a foot or a foot and a half high, hispid, simple, or but little branched.

branched. *Upper leaves* lanceolate. 3. C. *endivia*, Linn. Sp. Plant. Mart. Lam. Willd. (C. latifolium, f. endivia vulgaris, Bauh. Pin. 125. Intybum fativum, Dod. Pempt. 634.) Broad-leaved fuccory or common endive. "Peduncles axillary, in pairs; one elongated, one-flowered; the other very fhort, with about four flowers; flowers in heads; leaves oblong, fomewhat toothed; branches zig-zag." Willd. *Root* annual, or at moft biennial, fibrous, milky. *Stem* two feet high, fimple, hollow-channelled. *Leaves* alternate. There is a variety with curled leaves, which is almoft exclufively cultivated in the fouth of England as an early fallad, but no kind of endive is much cultivated in the north. The French make a great confumption of it at their tables, eating it raw in fallads, boiled in ragouts, fried with roaft meat, and as a pickle, and efteeming it a wholefome efculent, which never difagrees with the ftomach. It poffeffes the fame medicinal properties as cichorium intybus, from which Du Tour fuppofes it originally derived; but is a native of the Eaft Indies, according to Willdenow, who affures us that he has in his herbarium a wild fpecimen gathered near Coringo. 4. C. *divaricatum*, Willd. Schoufboe Maroc. p. 197. "Peduncles axillary, in pairs; one elongated; one flowered; the other very fhort, with about two flowers; ftem dichotomous; radical leaves runcinate; ftem ones oblong, toothed." Willd. *Root* annual. *Branches* not zigzag. 5. C. *fpinofum*, Linn. Sp. Pl. Mart. Willd. Lam. Bauh. Pin. 126. Prod. tab. 62. (Chondrillæ genus elegans cæruleo flore, Cluf. Hift. 2. p. 145.) "Flowers axillary, folitary; ftem dichotomous; branches naked, fpinefcent; leaves lanceolate, runcinate-toothed." Willd. *Root* biennial. *Stem* from five to eight inches high, ftiff, fmooth, green, much branched, panicled; ends of the fmaller branches terminating in fharp, ftar-like fpines. *Root-leaves* long, narrow, very fmooth, blunt at the fummit. *Stem-leaves* few, fmall, entire. *Flowers*, like thofe of all the other fpecies, blue, chiefly fituated in the forks of the ftem and branches, but fometimes terminal; florets few. A native of the iflands of the Archipelago and of Sicily, in dry fandy places near the fea-coaft.

C. *pratenfe luteum hirfute afperum*, Bauh. Pin. 126. See Picris *hieracoides*.

C. *pratenfe luteum lævius*, Bauh. Pin. 126. See Crepis *tectorum*

C. *verrucatum*, *zazintha*, Cluf. Hift. 2. p. 144. See Lapsana *zazintha*, Linn.; Zazintha *verrucofa*, Willd.

Cichorium, in *Gardening*, comprehends a plant of the efculent kind, the broad-leaved endive or fuccory (C. *endivia*). It is an annual or biennial plant, the ftem of which rifes two feet in height, upright, round, thick, and branched; the root-leaves many, large, fub-uniform, finuate-toothed, fmooth on both fides; the uppermoft lanceolate, fmall, of a whitifh green colour, thick, and crifp, like cofs-lettuce, having pale, blue flowers, folitary, and peduncled. This is more proper for culinary ufes than for fallads, and lefs hardy than the curled fort. It is moftly cultivated only for ufe in the autumn. It is a native of Japan and China.

The variety chiefly cultivated is the green, curled-leaved, which forms a circular clufter clofe to the ground, twelve or fifteen inches in diameter; the centre-leaves being numerous, very clofely placed, and growing to a large, compact, finely branched, white heart. It is a fine, hardy variety, moftly cultivated for fallads and other culinary purpofes. In its cultivation, the great point is to have the true fort; as fome have long, irregular, thinly-placed leaves, very little curled, and the heart open and loofe. In faving feed, the fulleft leaved, moft curly, regular, bufhy plants, that bottom well, and have the heart perfectly full, clofe, and white, fhould of courfe be chofen: the white, curled, which is fmaller, having white, very fringy, curled leaves, in a circular clufter clofe to the ground, ten or twelve inches in diameter, very full and clofe in the heart, is likewife valuable.

Method of Culture. All thefe plants are raifed from feed, which fhould be fown at different times, from the beginning of June to the end of the following month, upon beds of fine, rich mould. And in order to have very early plants, it is a good practice to make a fowing about the middle of May. But when the fowings are made too early, the plants are apt to run to feed; and when they are deferred too long, they do not attain a fufficient growth before they are fet out in the autumn.

All thefe feparate fowings fhould be performed in as open an expofure as poffible, the ground being prepared by digging it over into proper beds, and reducing the earth well at the time. The feed fhould then be fown thinly over the furface, and lightly raked in. In the light forts of foil, it is the practice of fome to tread it in, but this is feldom neceffary.

Occafional flight waterings fhould be given when the weather is dry, and the plants be kept perfectly clear from weeds, and properly thinned out, fo as not to draw up too faft, and of courfe in a weak ftate. When they are of fufficient growth, as from four or five to fix inches in height, they fhould be planted out where they are to remain, which, for the more early plantings, fhould be in as open a fituation as poffible; but, for the latter crops, the more fouthern, fheltered afpects fhould be preferred, in order that they may ftand the feverity of the winter better. For this purpofe, the ground fhould be rich and mellow, being formed into beds about four feet in width, by digging over to a good fpade's depth: a line fhould then be extended the whole length, and the plants, after being taken up with their roots as perfect as poffible, and their tops and roots trimmed when neceffary, be fet out in regular rows, ten or twelve inches diftance each way, by means of a dibble, a good watering being given immediately afterwards when the feafon is dry. In this mode each bed will contain four rows of plants. But they may be planted without having the ground formed into beds: the raifed-bed method is however preferable, efpecially for the winter crops, and where the foil is inclined to moifture, as keeping the plants more free from ftagnant wetnefs, and preventing their rotting in the winter. In thefe cafes they are often planted at fmaller diftances, as fix or eight inches. Some likewife, for the late crops, are in the practice of forming a fort of banks floping towards the fouth, having the breadths of four or five feet, in which the plants are fet out in rows in the fame manner as above. In this way the plants ftand higher, more dry, and are capable of being protected by frames or mats with greater facility, when the feverity of the winter renders it neceffary. They are likewife more open to the influence of the fun when the weather is fine. Where they have been fet out clofe, in thefe cafes, fome may be drawn out in fuch a manner as to leave the reft ftanding at the proper diftances, which may be planted again in a warm border about February, or the beginning of the following month. Where plants of this fort are fet out in dry weather, it is a good method to make hollow drills, in order that the moifture may be more perfectly retained. It is neceffary that crops fhould be planted out in fome of thefe methods every fortnight or three weeks, from about the middle of June till the beginning of October, or later; by which means they will come forward in perfection, from the later fummer months till the fpring following, in order as they may be wanted for ufe. The only culture that is afterwards neceffary, is merely that of keep-

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ing the plants free from weeds, by proper hoeing: and when they have attained their full growth, tying them up, in order that they may be effectually blanched, and rendered ſweet, criſp, and tender for uſe.

Method of Blanching the Plants. This is a proceſs that depends almoſt wholly upon the hearts of the plants being kept perfectly ſecluded from the action of light, and which has been attempted in many different methods, as by tying up the leaves of the plants cloſe together with pieces of baſs; by earthing the plants well up; by placing plane-tiles or boards flat upon them; and by tranſplanting the full-ſized plants into the ſides of raiſed ridges, putting them in the earth nearly up to their tops. The two firſt modes are chiefly employed in the autumn and ſpring crops, and the laſt in the winter. But the two firſt are by much the moſt effectual methods, when performed in a perfect manner, as, while they render the plants quite white and criſp in a regular manner, they do not cramp or reſtrain their growth; the latter of theſe is chiefly to be employed in dry ſoils, and ſhould be done at two or three different times, in order that too many may not be ready at once.

In the third mode, the hearts are rendered ſufficiently white and tender, but the growth of the plants is too much reſtricted, and the buſineſs is not performed in ſo regular or effectual a manner. The plants are likewiſe more liable to rot and be injured by different ſorts of inſects. The laſt is uſeful when there is danger of the plants rotting by an exceſs of moiſture. In whichever way the ætiolation of theſe vegetables is performed, it ſhould conſtantly be done when the plants are quite dry, in the middle of a fine day, as, when executed while they are wet, much loſs and injury are ſuſtained by their rotting. They moſtly become well blanched in the courſe of a fortnight or ſooner, where the light has been excluded in a very perfect manner.

In very ſevere winters, it is of great utility to cover the plants with ſome light material, ſo as to prevent their rotting and being deſtroyed.

Theſe plants may be well preſerved in the winter ſeaſon alſo, by being placed in dry ſand in a ſhed, cellar, or other convenient place which is dry.

In the ſaving of the ſeed of theſe plants, great care ſhould be taken to collect it from the beſt and moſt perfect of the different varieties, and to have it perfectly ripened, as without care in this reſpect it never anſwers well as ſeed in raiſing the different crops.

CICHYRA, or Cichyrus, in *Ancient Geography*, a town of Epirus, according to Pauſanias; ſituated near Cocyta of the Acheron and the marſh Acheruſia.

CICIMENI, a name which, according to Pliny, was given to an ancient people who inhabited the banks of the Tanais.

CICINDELA, in *Entomology*, a beautiful genus of the *Coleoptera* tribe, found in general in dry ſandy places, and in none more abundantly or in greater variety than on the arid tracts of land upon the ſea-ſhore. They are extremely voracious, and prey on every other kind of inſects they can overcome, and on other animal ſubſtances. The larvæ of the cicindelæ are furniſhed with ſix feet; they are commonly whitiſh, ſoft, and long, and have the head ſcaly. Theſe larvæ live chiefly under ground, and, when waiting for prey lurk in a round perpendicular hole, with the head juſt emerging to the ſurface to ſeize upon other inſects that may happen to fall into the cell, or approach near it.

Species.

Longicollis. Thorax elongated, cylindrical, blue; thighs ferruginous. Olivier.

Deſcribed and figured as a Siameſe inſect from a ſpecimen in the Bankſian Cabinet.

Aptera. Thorax elongated, cylindrical; body black; thighs ferruginous. Fabr. *Cicindela aptera*, Lund. Act. Soc. Hiſt. Nat. Havn. i. t. 5. An Eaſt Indian ſpecies.

Angustatus. Thorax cylindrical, blue; wing-caſes teſtaceous, with the tip black. Paykull. Inhabits Germany.

5-Pustulatus. Thorax cylindrical, black; wing-caſes with two ſpots at the baſe, and band in the middle ferruginous. Fabr. Inhabits Paris. Muſ. Tigny.

Grossa. Black; wing-caſes pointed, with three white ſpots. Olivier.

Deſcribed from the Bankſian Cabinet. Inhabits the coaſt of Coromandel.

Cyanea. Blue, gloſſy; mouth teſtaceous. Fabr. Inhabits India.

Megacephala. Black, braſſy; wing-caſes ſtriated with dots; mouth, antennæ, and legs teſtaceous. Olivier. A native of Senegal.

Bicolor. Green, gloſſy; wing-caſes duſky blue, and without ſpots; margin of the abdomen teſtaceous. Fabr. An Indian ſpecies. Bankſian Cabinet.

Campestris. Green; wing-caſes with five white dots. Linn. Geoff. Donov. Brit. Inſ.

A general inhabitant of Europe. Found in ſandy places, and is a beautiful and common inſect.

Germanica. Green; wing-caſes with a dot and lunule near the tip white. Linn.

Inhabits Europe. Found in England, but not common. Donov. Brit. Inſ.

Sylvatica. Purpliſh, fuſcous; wing-caſes with an undulated band, and three dots of whitiſh. Marſh. Ent. Brit. *Cicindela ſylvatica.* Linn.

An European ſpecies; a native of England, but very rare; it has been found on Martleſham Heath near Woodbridge, in Suffolk. Vide Donov. Brit. Inſ.

Hybrida. Somewhat purpliſh; band and two lunules on the wing-caſes white; body ſhining gold. Linn. Found in Europe.

Arenaria. Head and thorax duſky coppery; wing-caſes with black, two lunules and a band in the middle white; body black. Fabr. A native of Barbary.

Littoralis. Duſky, braſſy; wing-caſes blackiſh, with ſix whitiſh dots, that at the baſe lunated, the middle one tranſverſe. Fabr. Inhabits the ſhores of Barbary.

Tristis. Black; wing-caſes with a yellow ſpot in the middle. Olivier. Native place unknown.

Interrupta. Wing-caſes brown, with a yellow dot at the baſe, three interrupted yellow bands, and a ſmall line at the tip. Fabr. Inhabits Africa.

Lunulata. Black; wing-caſes with two lunules, and two white ſpots, the inner one tranſverſe. Forſter. Native country unknown. Bankſian Cabinet.

Lurida. Duſky; wing-caſes with two dots, and three lunules of white, the middle one flexuous. Forſter. Country unknown.

Chinensis. Blue and gloſſy; wing-caſes greeniſh, with two black ſpots, the poſterior one with two white ſpots. Degeer, &c. A native of China.

Flexuosa. Duſky; wing-caſes with four dots and three lunules of white, the middle one flexuous. Fabr. Found on the Spaniſh coaſt. Dahl.

Capensis. Somewhat braſſy; wing-caſes white, with a tri-ramoſe line. Linn. Inhabits the Cape of Good Hope.

Turerculata. Thorax fuſcous, with two tubercles; wing-

wing-cases fuscous and green, varied; margin white, and three-toothed. Fabr. Inhabits New Zealand.

UNIPUNCTATA. Pale purple; tip and dot on the wing-cases white. Fabr. An American species.

BIPUNCTATA. Black; wing-cases with a white dot; legs yellow; thighs black. Olivier. Country unknown. Banksian Cabinet.

SEX-PUNCTATA. Brassy-green; wing-cases with the disk more dusky, and three white dots. Olivier.

QUADRILINEATA. Brassy-green; wing-cases dusky; margin and line in the middle white. Olivier.

CINCTA. Black; wing-cases with a lateral stripe, and three dots of white. Olivier. Inhabits Africa. Hunterian Cabinet.

BIRAMOSA. Dusky, brassy; wing-cases margined with a double branching white line. Herbst. *Cicindela tridentata*, Thunberg. Inhabits India.

SEX-GUTTATA. Green, shining; wing-cases with three marginal white dots. Olivier. Inhabits Virginia.

CATENA. Brassy-green; wing-cases whitish, with six green concatenate dots. Fabr. Thunb. &c. Inhabits India.

MARGINATA. Green; wing cases with a white margin, waved band, and two dots of white. Fabr. Inhabits Virginia.

8 GUTTATA. Dusky; wing-cases with four dots on the disk, and two marginal lunules of white. Olivier. Inhabits America.

TRIFASCIATA. Dusky; wing-cases with three white streaks, the second flexuous. Fabr. An American species. A small variety is said to inhabit Italy.

CAROLINA. Green, shining; tip of the wing-cases, mouth, antennæ, and legs yellow. Linn. A native of North America.

VIRGINICA. Shining; mouth, antennæ, and legs testaceous. Linn. Inhabits Carolina.

CAJENNENSIS. Above fuscous, beneath blue; tail and shanks of the posterior legs testaceous. Fabr. Inhabits Cayenne. Rohr.

EMARGINATA. Blue; mouth, antennæ, and legs rufous; wing-cases emarginate at the tip. Fabr. *Carabus dentatus*, Rossi.

ÆQUINOCTIALIS. Yellow; wing-cases with two broad black bands. Linn. Found in Surinam.

MAURA. Black; wing-cases with six white dots, the third and fourth parallel. Linn. Inhabits the East Indies.

MINUTA. Brassy; wing-cases with four marginal yellow lunules. Fabr. Inhabits India.

JAPONICA. Violet; wing-cases with the base, tip, and band coppery; and a yellow band and two dots. Thunberg. Inhabits Japan.

AUSTRIACA. Green; breast, and base of the abdomen beneath red bronzed; wing-cases with a very thin golden margin and a few white dots. Schrank. Inhabits Austria.

RIPARIA. Brassy-green; wing-cases with broad excavated spots. Linn.

Inhabits Europe, and is found, though generally sparingly, in England. Donov. Brit. Inf.

ULIGINOSA. Brassy-green; wing-cases striated with blue impressed dots. Panoz. &c. Inhabits Europe.

AQUATICA. Brassy, glossy; head striated. Linn. Inhabits Europe.

STRIATA. Brassy; wing-cases striated; legs yellowish. Paykull, &c.

Discovered on the sandy coast of Glamorganshire by Mr. Donovan. Vide "Descriptive Excursions, South Wales, &c."

SEMIPUNCTATA. Brassy and glossy; wing-cases dotted; back very glabrous. Gmel. *Cicindela striata*, Degeer. Found in Europe.

FLAVIPES. Dusky-brassy; wing-cases somewhat clouded; legs pale yellow. Linn. An European species.

BIGUTTATA. Brassy; wing-cases polished, and yellowish at the tip. Gmel. &c. Inhabits England, and other parts of Europe.

CICINES, in *Ancient Geography*, a people of Greece, in Attica. Hesychius places them in the Acamantide tribe.

CICISBEO, an Italian term, in its etymology signifying a *whisperer*; which has been bestowed in Italy both on lovers, and on those who to outward appearance act as such, attending on married ladies with as much attention and respect as if they were their lovers. When the custom of secluding the wife from all mankind but her husband took place in Italy, it became the fashion that she should never be seen with her husband, and yet always have a man at her elbow. The Italian husbands, finding that confinement was a plan generally reprobated, and that any appearance of jealousy subjected the husband to ridicule, agreed that their wives should go into company or attend public places, but always with a friend whom they could trust, and who, at the same time, should not be disagreeable to the wife. As this compromise could not fail of being acceptable to the women, the system soon became universal all over Italy, for the woman to appear at public places leaning upon the arm of a man; who, from their frequently whispering together, was called her Cicisbeo. It was stipulated, at the same time, that the lady, whilst abroad under his care, should converse with no other man but in his presence, and with his approbation; he was to be her guardian, her friend, and gentleman-usher. The present custom is, that this obsequious gentleman visits the lady every forenoon at her toilet, where the plan for passing the evening is settled; he disappears before dinner, for it is usual in Italy for the husband and wife to dine together tête-à-tête, except on great occasions, as when there is a public feast. After dinner the husband retires, and the Cicisbeo returns and conducts the lady to the public walks, the converfazioné, or the opera; he hands her about wherever she goes, presents her coffee, sorts her cards, and attends with the most pointed assiduity till the amusements of the evening are concluded; he accompanies her home, and delivers up his charge to the husband, who is then supposed to resume his functions. At the beginning of this institution, the husbands, says Dr. Moore (View of Society and Manners in Italy, vol. 2.) preferred the Platonic swains, who professed only the metaphysics of love, and whose lectures they imagined might refine the ideas of their wives, and bring them to the same way of thinking. In many instances, no doubt it would happen, that the Platonic admirer acted with "less seraphic ends;" but these instances seem only as proofs that the husbands were mistaken in their men; for however absurd it may appear in the eyes of some people, to imagine that the husbands believe it is only a Platonic connection which subsists between their wives and the Cicisbeos; it is still more absurd to believe, as some strangers who have passed through this country seem to have done, that this whole system of Cicisbeism was from the beginning, and is now, an universal system of adultery, connived at by every Italian husband. To get rid of this difficulty, it is supposed that the men, who, of all the inhabitants of Europe, were the most scrupulous with regard to the chastity of their wives, should acquiesce in, and in a manner become subservient to, their prostitution.

tion. In ſupport of this ſtrange doctrine, it is aſſerted, that the huſbands being the Cicisbeos of other women, cannot enjoy this privilege on any other terms; and are therefore contented to ſacrifice their wives for the ſake of their miſtreſſes, Dr. Moore has no doubt, that ſome individuals may be profligate enough to act in this manner; but that ſuch a ſyſtem is general, or any thing near it, in Italy, ſeems to him perfectly incredible, and contrary to the beſt information received by him, whilſt he remained in the country. It is alſo urged, that moſt of the married men of quality in Italy act in the character of Cicisbeo to ſome woman or other; and thoſe who are not Platonic lovers, ought to ſuſpect that the ſame liberties are taken with their wives which they take with thoſe of their neighbours. However men have a wonderful faculty of deceiving themſelves on ſuch occaſions. So great is the infatuation of their vanity, that the ſame degree of complaiſance, which they conſider as the effect of a very natural and excuſable weakneſs, when indulged by any woman for themſelves, they would regard as a horrible enormity if admitted by their wives for another man; ſo that whatever degree of licentiouſneſs may exiſt in conſequence of this ſyſtem, the majority of huſbands (as Dr. Moore is convinced) make exceptions in their own favour, and their ladies find means to ſatisfy each individual that he is not involved in a calamity, which, after all, is more general in other countries, as well as in Italy, than it ought to be. The Cicisbeo is, in many inſtances, a poor relation or humble friend, who, not being in circumſtances to ſupport an equipage, is happy to be admitted into all ſocieties and to be carried about to public diverſions, as an appendage to the lady. There are alſo Cicisbeos of a very different ſtamp, whoſe figure and manners might be ſuppoſed more agreeable to the ladies they ſerve, than to their lords. But, ſometimes, the huſband is poor, and the Cicisbeo rich. This ſyſtem is unknown to the middle and lower ranks; inſomuch that a perſon who attempts to viſit the wife or miſtreſs of any of the trades-people without their permiſſion is in no ſmall danger of a coltellata. This Italian cuſtom has been ſpoken of very reproachfully by ſome writers: Mr. Baretti (Account of the Manners, &c. of Italy, vol. i. c. 8.) has taken great pains to vindicate it. He aſcribes it to a ſpirit of gallantry, derived from the ages of chivalry, and much heightened and refined by the revival of the Platonic philoſophy in Italy, about the thirteenth century; and by the verſes of Petrarch in compliment to the beautiful Laura, and his numerous imitators.

In France, under the old ſyſtem, there was an important claſs of females, who might not improperly be denominated female Cicisbeos. When the rank of a woman of faſhion had enabled her to preſerve a degree of reputation and influence in ſpite of the gallantries of her youth and the decline of her charms, ſhe adopted this kind of equivocal character, and, relinquiſhing the adoration claimed by beauty, and the reſpect due to age, charitably devoted herſelf to the inſtruction and advancement of ſome young man of perſonal qualifications and uncertain fortune. By her exertions he was promoted in the army, or diſtinguiſhed at the levee, and a career, begun under ſuch auſpices, often terminated in a brilliant eſtabliſhment.

CICLA, in *Botany*. See Beta *cicla*.

CICLUT, in *Geography*, a fortreſs of Dalmatia, ſeated on an iſland formed by the river Narenta, taken from the Turks by the Venetians in 1694; 5 miles S.W. of Narenta, and 40 N. of Raguſa.

CICOLES, in *Ancient Geography*, a port of Thrace, which, according to Suidas, was that of Terone.

CICOLI, in *Geography*, a town of Naples, in the province of Abruzzo Ultra; 13 miles S.W. of Celano.

CICONES, in *Ancient Geography*, a people of Aſia placed by Pliny between the Indus and the Attæciani.—Alſo, a people of Thrace, who inhabited the country lying between the Hebrus and the Melas. The city of Enos, famous on account of the tomb of Polydorus, was their capital. Homer (Iliad. β) ſpeaks of three of their kings. In his Odyſſey, he ſpeaks of them as a numerous, well-diſciplined, and warlike people. From Herodotus we learn, that they had formerly inhabited part of the Samothracian towns, ſince the promontory of Serrhium had belonged to them; and that, in proceſs of time, they were driven more to the north and to the weſt by the Samothracians.

CICONIA, in *Ornithology*, the Ardea *Ciconia* of Linnæus and Gmelin, or *Ardea alba*, with black orbits and wing-quills, and ſanguineous bill, legs, and ſkin. This is the *white ſtork* of Pennant and Latham, and the *la cicogne blanche* of Buffon. It inhabits Europe, Aſia, and Africa, but is more rarely met with in Italy and England; ſettling in towers, chimnies, and ruins near our dwellings, fiſhing in our rivers, purſuing its prey in our gardens, and occaſionally taking up its abode in the midſt of cities. For a further account of it, ſee Stork.

Ciconia *nigra*, *ardea fuſca*, having its breaſt and belly white, the *cicogne noire* of Buffon, the black ſtork of Pennant, Ray, Willughby, and Latham. It is found in the Swiſs Alps, Poland, Pruſſia, Lithuania, Sileſia, and many other parts of Germany, and as far as the Caſpian ſea. This ſpecies is ſavage and ſolitary, ſhunning the habitations of men, and haunting the deſert fens. Theſe birds ſoar to a great height. Numerous flocks of them paſs in the ſpring over Sweden, and ſtretch farther towards the north; they return towards the ſouth in autumn. See Stork.

Ciconia *americana* of Briſſon, Ray, and Willughby, the *maguari* of Buffon, the *ardea maguari* of Gmelin, and *American ſtork* of Latham. It inhabits the hotter parts of America, particularly Braſil, and was firſt deſcribed by Marcgrave. Its orbits and legs are red, its bill cinereous, the quills and great coverts of the wings black, gloſſed with green; and the whole body, head, neck, and tail inveſted with white feathers, which below the neck are of a conſiderable length and pendulous.

Ciconiæ, one of the five ſections of the *ardea* genus, according to Gmelin, including the three preceding ſpecies. See Ardea.

CICONIUM Promontorium, in *Ancient Geography*, a promontory of Aſia Minor, upon the Boſphorus of Thrace.

CICONUM Flumen, a river of Thrace, paſſing through the country of the Cicones, and mentioned both by Pliny and Ovid.

Ciconum *Mons*, a mountain of Thrace, ſuppoſed to be the ſame with Iſmanus.

CICOYRUS, a town of Epirus, in Theſprotia, ſituated, according to Strabo, on the "Dulcis portus," who ſays that it was once called Ephyra.

CICSITANUS, an epiſcopal town of Africa, in the proconſular province.

CICUS, a river of Thrace, which diſcharged itſelf in the port of Byzantium.

CICUTA, in *Botany*, (in Latin authors, denotes the internode or ſpace between the joints of a reed, or of any plant uſed by ſhepherds for making their rural pipes; and as the hollow ſtems of ſeveral plants belonging to the natural family of umbelliferæ, known in England by the popular name of kecks or keckſies, were frequently employed for that purpoſe, the name was particularly applied to them, eſpecially to thoſe which are of a poiſonous nature,

ture, one of them having been employed by the Athenians as a mode of capital puniſhment.) Linn. Gen. 354. Mart. ſub. voce. Willd. 550. Cicutaria; Riv. Lam. Juſſ. Vent.) Claſs and Order, *pentandria digynia*. Nat. Ord. *Umbellatæ*, Linn. *Umbelliferæ*, Juſſ.

Gen. Ch. *Umbel univerſal* roundiſh; rays many, equal; involucre none, or conſiſting of one or two linear leaves. *Umbel partial* roundiſh; rays many, equal, ſetaceous; involucre, many-leaved; leaves briſtly, ſetaceous, ſhort. *Calyx* of the florets ſcarcely viſible. *Cor.* Florets all fertile conſiſting of five, egg-ſhaped, inflected, nearly equal petals. *Stam.* Filaments five, capillary, longer than the corolla. *Piſt.* Germ inferior; ſtyles two, filiform, longer than the corolla, permanent; ſtigmas headed. *Peric.* none; fruit ſomewhat egg-ſhaped, furrowed, diviſible into two. *Seeds* two, convex and ſtriated on one ſide, flat on the other.

Eſſ. Ch. Fruit ſomewhat egg-ſhaped, furrowed.

Sp. 1. C. *viroſa*. Linn. Sp. Pl. Mart. Willd. Flor. Dan. tab. 208. Eng. Bot. 479. Woodv. Sup. tab. 248. (Cicutaria aquatica; Lam. Sium; Bauh. Pin. 154, n. 3. Hal. Helv. n. 781. Mor. Hiſt. 3, tab. 5. fig. 4. Umb. tab. 5. S. paluſtre alterum, foliis ſerratis; Tourn. 308. Lob. Ic. 208.) Long-leaved water hemlock. "Umbels oppoſite the leaves; petioles margined, obtuſe." *Root* perennial, tuberous, hollow, cellular; fibres ſomewhat whorled. *Stem* three or four feet high, branched, furrowed, leafy; branches rather erect. *Leaves* twice ternate; larger ones pinnate; leaflets lanceolate, acute, ſerrated, ſmooth; ſtipulæ linear, adnate to the petioles, and a little ſhorter. *Umbels* erect, many-rayed; partial ones denſe. *Flowers* white, regular, ſmall; calyx five-parted; petals rolled inwards. *Fruit* compreſſed, rounded, almoſt didymous, ribbed. A native of ſtagnant pools and the margins of rivers in England and all the north of Europe, but not common in England. Towards the end of autumn, the root for the ſucceeding ſummer is formed out of the lower part of the ſtem; and being tranſverſely divided into many large unequal cells, ſo as to become ſpecifically lighter than water, it is buoyed up when the rivers or pools ſwell in winter. The old root then rots, floats all the winter, and in rivers is frequently carried to conſiderable diſtances. In the ſpring the old root is waſhed away, and the new one, on coming near the ſoil, ſends out many ſlender fibres, by which it is again fixed, grows, and flowers. It is reckoned one of the moſt virulent of our vegetable poiſons to the human race, and is equally fatal to cows and ſwine; but horſes, hogs, and goats eat it with impunity. The beſt remedy againſt its deleterious effects, when unfortunately taken into the ſtomach, is a ſpeedy emetic, ſucceeded by vegetable acids or oils. 2. C. *bulbifera*, Linn. Sp. Pl. Mart. Willd. (Cicutaria bulbifera; Lam. Enc. Ammi foliorum laciniis capillaribus caule angulato; Gron. Virg. 31. Umbellifera aquatica, foliis in monatiſſima et plane capillaria ſegmenta diviſis. Rai. Sup. 260.) "Stem bulbiferous," Linn. "Leaves divided into very numerous linear ſegments; branches bulbiferous." Lam. *Stem* a foot and a half high, ſmooth, branched; branches not bearing umbels, very ſlender, zig-zag, furniſhed with ſimple narrow leaves, and frequently with other ſmall axillary branches; from the axils of each branch ſprings an oval bulb, ſcarcely the ſize of a grain of wheat. *Flowers* white, ſmall, forming a ſmall umbel at the ſummit of the ſtem; univerſal umbel of one or two leaves. A native of Virginia and Canada. 3. C. *maculata*. Linn. Sp. Pl. Mart. Willd. (Cicutaria maculata. Lam. Enc. ægopodium foliolis lanceolatis, acuminatis, ſerratis; Gron. Virg. 32. Angelica caribæarum; Pluk. Alm. tab. 76. fig. 1. A. virginiana, foliis acutioribus, ſemine ſtriato; Moriſ. Hiſt. 3. p. 281. Myrrha; Mitch. Gen. 18.) "Serratures of the leaves mucronate, petioles membranous, two-lobed at the tip." Linn. "Leaves twice-pinnated; leaflets ſerrated; partial involucres ſhorter than their umbels." Lam. *Root* perennial, creeping. *Stem* a foot and a half or two feet high, upright, ſmooth, hollow, purple-brown, ſpotted near the bottom, a little branched towards the top. *Leaves* twice pinnated; leaflets lanceolate, green, finely ſerrated. *Flowers* white, ſmall, almoſt regular, generally without an univerſal involucre. A native of watery places in Virginia.

C. *domeſtica*, Moriſ. Umb. p. 18. c. 6. See Conium *maculatum*.—C. *major*, Bauh. Pin. See Conium *maculatum*.—C. *minor petroſelino ſimilis*, Bauh. Pin. 160. See Æthusa *cynapium*.—C. *arbor virginiana*, Pluk. Mant. 49. See Chærophyllum *arboreſcens*.

Cicuta, in the *Materia Medica*. *Conium Maculatum*, Linn. Hemlock.

The poiſonous qualities of this plant have been known for a great length of time; but it was ſcarcely adopted in medicine before the experiments of Dr. Stork, in 1760, ſince which time it has been introduced in moſt of the pharmacopœias of Europe. Although it has by no means anſwered the ſanguine expectations which were entertained of its virtues in ſeveral of the moſt formidable, and hitherto incurable diſeaſes, it is ſtill found to poſſeſs ſeveral valuable medicinal qualities.

The whole of the plant appears to poſſeſs the ſame power of affecting the human body, ſo that this power reſides in the common juice which pervades the plant. The part actually employed in medicine is all above the root, and as the plant is very ſucculent, it readily yields a conſiderable quantity of juice on ſtrong preſſure, which, when gradually inſpiſſated by evaporation, affords a brown *extract*, or *inſpiſſated juice*, which, with the dried leaves, are the only pharmaceutical preparations in uſe. This plant has a ſtrong and unpleaſant ſmell, but little, if any, peculiar taſte. When taken in a large doſe it produces vertigo, coma, convulſions, and ſometimes death. In ſmaller doſes it occaſions a trembling of the limbs, ſickneſs, head-ach, and ſenſe of fullneſs in the eyes; ſometimes temporary deafneſs, and now and then diarrhœa. Its effects, therefore, properly require it to be claſſed among the *narcotic* medicines, and it often ſhows only the more valuable properties of narcotics, in relieving pain and irritation of the body, and inducing ſleep.

The following are Dr. Withering's directions for preparing the extract, or inſpiſſated juice. "Let ſeveral people be employed to gather the plant, and as faſt as it is cut let others carry it in hand-baſkets to the preſs. Let the juice be immediately ſqueezed out, and as faſt as it runs out of the preſs it muſt be put over the fire and boiled, till three parts out of four of the whole liquor is waſted. Then it muſt be removed to a water-bath, and evaporated to the conſiſtence of honey. If it is now taken and ſpread thin upon a board or marble ſlab, and expoſed to the ſun and air, it will ſoon be of a proper conſiſtence to make pills."

In this ſimple method is the extract of cicuta prepared. This extract is of a dark greeniſh brown, almoſt black, of a ſtrong diſagreeable ſmell, and a ſlightly pungent taſte, but without bitterneſs. Like the other extracts of herbaceous plants (for the chemical properties of which ſee the article Extract) it contains but little reſin, but is conſiderably deliqueſcent, owing to the preſence of ſome acetite of potaſh, as may be at once perceived by adding a few drops of ſulphuric acid, which will diſengage a pungent vapour of acetous acid. Owing to this deliqueſcence the extract ſhould be kept in pots covered with bladders, for in the open air it ſoon moulds, and its virtues are loſt.

Some pharmaceutical authors direct that the expreſſed juice ſhould ſtand a ſhort time to clarify, and only the clearer part evaporated; but this is decidedly injurious, as there

there is every reafon to believe that the part, which would in this cafe be rejected as feculence, is at leaft as efficacious as the clear juice, fo that, as Dr. Withering has directed, the entire juice fhould be employed. More care is required to avoid empyreuma in the preparing of this extract, than in that of gentian, cinchona, and other plants, where the bitter principle is chiefly required, for the virtue of the hemlock is foon injured by heat. But as infpiffation in the water-bath is exceffively tedious, many chemifts ufe ovens very moderately heated, or ftoved chambers, which in the large way are preferable, as they afford a greater furface for evaporation. Inftead of compleating the evaporation to the proper pillular confiftence, fome direct that the foft extract fhould be made into a pillular mafs, by adding about a fifth of its weight of the leaves of the plant dried and powdered.

With all the care that can be taken in keeping this extract, its virtues are materially impaired in a few months, fo that thofe who are in the habit of employing it fhould always provide a frefh ftock every year. The feafon for gathering this, as of moft other herbaceous plants ufed in medicine, is when the plant is full grown, and about to flower. From the teftimony of Dr. Withering, the dried leaves are more uniform in their operation, and lefs liable to fpoil by keeping, than the extract. They fhould be kept in clofely-ftopped bottles, and in the dark. In exhibiting the hemlock, the extract is ufually made into pills of about two grains each, of which one may be taken for a dofe three times a day, and this may be rapidly increafed, till fome of the peculiar effects of the hemlock be perceived, after which the fame dofe, or nearly fo, may be perfifted in for as long a time as is thought proper. Of the powder, from fifteen to twenty grains may be taken twice or thrice a day. Of all the powerful narcotics the cicuta is perhaps the moft uncertain in its operation in a given dofe. This, no doubt, in part depends on the want of uniformity in the ftrength of the feveral preparations; but even with the fame individual preparation, fome perfons will be fenfibly affected by a few grains, and others will bear perhaps eight or ten times the quantity. In its moft favourable operation it fimply alleviates pain, without occafioning ficknefs, or head-ach, and often, without producing a greater tendency to fleep than what belongs to the mere effect of the fufpenfion of pain in haraffing and chronic difeafes; fo that it is then a moft valuable fubftitute to opium, the good effect of which it fecures, without occafioning the inconveniences infeparable from this valuable medicine. Unfortunately, however, it is (comparatively fpeaking) but rarely that the cicuta operates in this favourable manner, and very frequently it either produces no effect at all, except naufea, or fuch a degree of head-ach, vertigo, and debility, which render it unfafe to continue its ufe.

The cicuta was chiefly recommended by Dr. Stork, as a new and valuable remedy for cancer, and fchirrous tumours of all kinds, for chronic ulcerations depending on fcrofula, or any conftitutional difeafe. The obfervations of others, however, have led to a jufter eftimation of its powers, for (in this country at leaft) no dependence can be placed on it as a cure for cancer, though it is often ufeful as a palliative. It has been employed alfo with fome fuccefs in the hooping cough, and other fpafmodic diforders. As an external application, it is of great ufe in painful and extenfive fores of a cancerous nature, when applied as a warm fomentation or poultice, giving confiderable eafe, and changing the nature of the difcharge, from a thin fœtid fanies to healthy pus. In this, part of the good effect is doubtlefs to be afcribed to the narcotic quality of the plant, but part alfo to the mode of application, and to the efficacy which appears common to almoft all frefh vegetables; fince a fimilar advantage is derived from the carrot poultice, from the marfh-mallow fomentation, and from many other of the medicinal herbs in common ufe.

The cicuta of the ancients, is a fecret now fcarce poffible to be difcovered. Wepfer, in an exprefs treatife on the fubject, will have it the Œnanthe *cicutæ facie, fucco virofo;* which he defcribes by the name of *cicuta aquatica;* and of the difmal effects of which he gives a very ample relation. At leaft the violence of this plant makes it a much fitter inftrument of hafty death than the common cicuta or hemlock, which is much lefs malignant. Though fome have fuggefted, that the poifonous draught to which the Athenians doomed their criminals, was an infpiffated juice compounded of the juice of cicuta and fome other corrofive herbs. Vid. Mead's Effay on Poifons, ap. Bibl. Anal. Med. tom iii. p. 281.

Socrates drank the cicuta. Plato, in his Dialogue on the Immortality of the Soul, obferves, that "The executioner advifed Socrates not to talk, for fear of caufing the cicuta to operate too flowly." M. Petit, in his "Obfervationes Mifcellaneæ," remarks, that this advertifement was not given by the executioner out of humanity, but to fave the cicuta: for he was only allowed fo much poifon *per ann.* which if he exceeded, he was to furnifh the reft at his own expence. This conftruction is confirmed by a paffage in Plutarch: the executioner who adminiftered the cicuta to Phocion, not having enough, Phocion gave him money to buy more; obferving, by the way, that it was odd enough, that at Athens a man muft pay for every thing, even his own death.

CICUTARIA *major vulgaris*, in *Botany*, Cluf. Hift. 2. 200. See Conium *maculatum*.

Cicutaria *latifolia fœtida*, Bauh. Pin. 161. Morif. Umb. tab. 6. See Ligusticum *peloponenfe*.

Cicutaria *paluftris tenuifolia*, Bauh. Pin. 161. Lob. Ic. 735. See Phellandrium *aquaticum*.

Cicutaria, Riv. Pent. tab. 76. See Cicuta *virofa*.

Cicutaria *apiifolia*, Bauh. Hift. 3 p. 179. —— *fatua*, Lob. Ic. 280. See Æthusa *cynapium*.

Cicutaria *vulgaris*, Dod. Pemp. 701. Bauh. Hift. 3. 181. See Chærophyllum *fylveftre*.

Cicutaria *bulbofa*, Bauh. Pin. 162. Bauh. Hift. 3. 183. See Chærophyllum *bulbofum*.

Cicutaria *paluftris latifolia alba & rubra*, Bauh. Pin. 161. —— *latifolia hirfuta*, Bauh. Hift. 3. 182. See Chærophyllum *hirfutum*.

Cicutaria *arbor virginiana*, Rai. Sup. 257. See Chærophyllum *arborefcens*.

CID, in *Biography*, a Spanifh hero, whofe real name was Don Rodrigo Diaz de Bivar, was defcended from Diego Laynez, a perfon of confiderable family, and was brought up at the court of the kings of Caftile. On account of his great valour, he was, at an early age, created a knight. Before he received this honour, five Moorifh kings had united their forces and plundered Caftile. On the mountains of Oca, Rodrigo fell upon them as they were removing their fpoil, recovered the whole booty, and took the five kings prifoners, whom he treated with refpect, and difmiffed on a promife of tribute. The fpoil he diftributed among his followers. King Fernando, having received tidings of this victory, turned his arms againft the Moors of Portugal, and befieged Coimbra, which he took. Here Rodrigo was knighted. When meffengers arrived at Zamora with tribute to Rodrigo from the five kings, he offered a fifth of it to his fovereign as his due. Fernando would not accept it; and hearing the Moors addrefs Rodrigo by the title Cid or lord (Cid being the Arabic term for lord), he ordered him from that time to bear this honourable name. Upon the king's death, he divided his kingdoms among his children; allotting Caftile to Sancho, the eldeft; Leon to Alonfo, and other portions to Garcia, and to his two daughters. This

This partition occaſioned a conteſt among the brothers. When Sancho came to the crown, Rodrigo was his lieutenant general in his war againſt his brother Alonſo. He followed his ſovereign to the ſiege of Zamora, where Sancho was ſlain by treachery, and conducted back in good order the Caſtilian troops, with the dead body of the king. Alonſo was invited to the crown on condition of purging himſelf by oath of all ſuſpicion of concern in his brother's death. None of the nobility, who, as a body, had impoſed the condition, dared venture to exact the oath at the convention; Rodrigo, with a ſpirit of true loyalty to his departed maſter, admininiſtered it, and even obliged the king to repeat it. Before theſe adventures, he had married, with the concurrence of king Fernando, Ximena, daughter to count Gomez, whom he had killed in ſingle combat becauſe he had inſulted his father in his old age; an event, which, affording a fine diſplay of the contending paſſions in the perſon of the heroine, as at once the daughter and lover, has been the ſubject of a Spaniſh play, imitated by Corneille in the tragedy of "The Cid." Rodrigo, finding that Alonſo continued to reſent his conduct in exacting the above-mentioned oath, aſſembled his friends, and thoſe on whoſe fidelity he could rely, at the head of whom he entered Arragon, ravaging and plundering the country. He made himſelf maſter of the caſtle Alcocer, where, being joined by a number of freebooters, attracted by his fame, he made perpetual incurſions into the neighbouring Mooriſh territories. He afterwards ſold Alcocer to the Moors, and diſtributed its price among his followers. At length he penetrated ſouth of Saragoſſa, and fixed his reſidence in a ſtrong fortreſs called to the preſent times, the Rock of the Cid, where he maintained himſelf as an independent ſovereign. In the mean while Alonſo's hatred to the Cid had gradually abated; and when his aſſiſtance was needed, a reconciliation between them took place. Having accompanied Alonſo to the ſiege of Toledo, and accompliſhed that ſervice, he returned to Saragoſſa. Hearing of the murder of Yahia, king of Valencia, he deſired the aſſiſtance of Alonſo to enable him to revenge the deed; the requeſt was granted, and Rodrigo, in 1094, took Valencia, and held it till his death in 1099. Fiction has detailed ſeveral circumſtances that preceded and followed his death, which it is beſides our purpoſe to relate. As the Moors approached the city, he gave orders that the event of his death ſhould be concealed; and having aſſured his followers of victory, he expired. Having collected the whole treaſure of Valencia, and placed upon a war horſe the dead body of the Cid, they formed a proceſſion in order to leave the city. His wife, Ximena, with 600 knights as her guard, formed part of the train. The Moors were attacked and totally routed; and the Chriſtians, ſpoiling their camp as they paſſed through it, proceeded with the body towards Caſtile. Inſtead of burying the body, which was preſerved by the myrrh and balſam, with which it had been embalmed, in an apparently ſound ſtate, they placed it upright upon his ivory ſeat in the church, at the right hand of the altar. Ximena took up her daily abode in the church, and having ſurvived her huſband four years, was buried at his feet. After ten years, the body began to moulder; it was then interred in its garments, and with the ſword, by the ſide of Ximena. The hiſtory of the Cid, who flouriſhed from the year 1064, when he is firſt mentioned, till his death in 1099, under the reigns of Fernando the Great, and his ſons Sancho el Bravo, and Alfonſo VI. in whoſe time he eſtabliſhed himſelf as conqueror in the city of Valencia, is blended with fiction of the moſt beautiful kind. It is furniſhed both by his chronicle, and alſo by the "General Chronicle of Spain," compiled by order of Alfonſo the Wiſe, in the middle of the 13th century, about 150 years after Rodrigo's death. There is a poem upon his life which is probably a century older.

CIDAGER, or Cidaia, in *Geography*, a town of the iſland of Java.

CIDARES Kleinii, in *Natural Hiſtory*, hemiſpheric or ſpheroidal ſections of the Echinus.

CIDARIS, a ſpecies of Echinus; and a ſpecies of Turbo.

Cidaris, in *Ancient Geography*, a river of Thrace, which diſcharged itſelf into the harbour of Byzantium.

Cidaris, in *Scripture Hiſtory*, the mitre uſed by the Jewiſh high prieſts. Whenever there is mention of the high prieſt's mitre, the Hebrew word made uſe of to expreſs it is always *miznepheth*; and *myghaoth* is uſed to ſignify the bonnet belonging to common prieſts. The rabbins ſay the ſame thing is meant by both theſe terms, and that the bonnet uſed by prieſts in general was made of a piece of linen cloth ſixteen yards long, which covered their heads like an helmet or a turban; and they allow no other difference to be between the high prieſt's bonnet, and that of other prieſts, than this, that one is flatter, and more in the form of a turban, whereas the other worn by ordinary prieſts roſe ſomething more in a point. Exod. xxviii. 4.

It is to be obſerved, that the Hebrew prieſts never appeared in the temple without covering their heads. And ſtill at this day it is reckoned an incivility in the Eaſt, and a mark of contempt, for any man to pull off his hat or turban to another, or to ſhew his naked head before any one.

CIDER. See Cyder.

CIDES, in *Ancient Geography*, a town of Aſia Minor, in Ætolia.

CIDIAS, in *Biography*, an ancient Greek painter, contemporary with Eufranor, about the hundred and fourth olympiad. Amongſt other works, he painted a picture of the Argonauts, which was afterwards bought by Hortenſius for the ſum of forty-four thouſand ſeſterces (about fourteen thouſand four hundred florins), and placed it in a ſmall temple, built on purpoſe to receive it, in his villa at Tivoli. It was afterwards removed by M. Agrippa to the Portico of Neptune which he had fabricated in Rome. Dion. Caſſ. lib. 53. Della Valle, Vite dei Pittori Antichi.

CIDNUS, in *Geography*, a river of Cilicia, which ſprung from the Antitaurus, paſſed through Tarſus, and diſemboguedi tſelf into the Mediterranean, near the city of Anchiale. It was famous for the rapidity of its ſtream, and the coldneſs of its waters, which proved very dangerous to Alexander.

CIDYESSUS, a town of Aſia, ſituated in the northern part of Phrygia, between the towns of Midæum and Nacoleia. This town, like others of the proconſular province of Aſia, was governed by a ſenate, the preſidents of which were denominated archontes. The worſhip of Cybele was eſtabliſhed at Cidyeſſus. The inhabitants of this town rendered alſo a particular worſhip to Jupiter. The firſt miniſter of his temple preſided at the celebration of the games which had been eſtabliſhed in this place in honour of that deity. Cidyeſſus was an epiſcopal town in Pacatian Phrygia.

CIECIEREF, in *Geography*, a river which riſes in Poland, and runs into the Dnieper, 28 miles W. of Kiov.

CIEKANOW, a town of Poland, in the palatinate of Maſovia; 40 miles N. of Warſaw.

CIENFUEGIA, in *Botany*, Willd. 1277. Cavan. diſſ. 3. p. 174, tab. 72. fig. 2. Claſs and order, *monadelphia dodecandria*. Eſſ. Ch. Calyx double, outer one twelve-leaved; leaflets briſtle-ſhaped. Corolla five-petalled, ſtyle filiform, ſtigma club-ſhaped. Capſule three-celled, three-ſeeded.

Sp. C. *digitata*. *Root* perennial. *Leaves* alternate, petioled, ſmooth, three or five-cleft; ſegments lanceolate, rather obtuſe, either quite entire or toothed. *Peduncles* one-flowered, axillary. *Outer calyx* ſhort; inner one five-cleft. Nearly allied to Hibiſcus, but diſtinguiſhed from it by its club-ſhaped ſtigma, and three-celled capſule, with one ſeed in each cell.

CIEUX, in *Geography*, a town of France, in the department of Upper Vienne, and diſtrict of Belac, containing about 1200 inhabitants; 13 miles N.W. of Limoges.

CIFUENTES, a town of Spain in New Caſtile; 22 miles S. of Siguença.

CIGALE and CIGALON, in *Natural Hiſtory*, names given by the French to ſpecies of the *Cicada*.

CIGLIANO, in *Geography*, a town of Italy, in the Orvietan; 4 miles N. of Orvieto.

CIGNANI, Carlo, in *Biography*, an hiſtorical painter, of conſiderable eminence, born at Bologna in the year 1628. In infancy he received inſtruction from a maſter of little note, Gio. Batt[a] Cairo; but afterwards became the diſciple of Albano, the amenity of whoſe inventions he was ever deſirous to emulate: his ſtyle, however, both as to drawing and colouring, is principally founded on the model of Correggio, whoſe works he attentively ſtudied, and to which he not unfrequently added ſomething of the grace of Guido: and although he fell far ſhort of his great prototype, he is deſervedly conſidered one of the beſt painters Italy could boaſt, in the degenerate times in which he lived.

He painted many large works in the place of his nativity, as well as in other cities of Italy, and excelled equally in freſco and in oil. Amongſt his moſt admired performances, are four ſmall ovals, containing ſacred ſtories, and each ſupported by two beautiful boy-angels, at St. Michele in Boſco at Bologna; and an altar-piece repreſenting, as it is called, the conception of the virgin, in a monaſtery at Piacenza. The virgin, with a graceful dignity, bruiſes with her foot the head of the ſerpent, and the child, who is between her knees, ſuperadds the preſſure of his own little foot to that of his mother.

The Abbé Lanzi, in his *Storia Pittorica*, ſpeaks with rapture of this picture, which, for thought and execution, he conſiders one of the chef d'œuvres of Cignani. There is likewiſe a large work by this maſter in a room in the garden of the Ducal Palace at Parma, with ſubjects alluſive to the power of love. But his greateſt work is at Forli, where Cignani ſpent the latter part of his life: it is a cupola, which, in imitation of his admired Correggio, he painted in freſco, with the ſubject of the aſſumption of the Madona, amidſt a multitude of the angelic choir. This, in the opinion of ſome of the beſt judges, is the moſt intereſting work of painting of the period in which it was produced: it is ſaid to have employed the artiſt 20 years.

He painted, amongſt other cabinet pictures, many ſmall madonas and holy families in oil on copper, upon which his hiſtorian, Zannotti, beſtows the higheſt encomiums.

The ſtyle of Cignani is ſimple, broad, and of great relief, but ſeldom evinces loftineſs of conception, or more than ordinary force or delicacy of expreſſion. He died in the year 1719, at the advanced age of 91. Zannotti, Accademia Clementina. Lanzi, Storia Pittorica.

CIGNAROLI, Giovanni Bettino, a Veroneſe painter, one of the beſt of his time, was born in the year 1706, and was educated in the ſchool of Santo-Prunati. The works of Cignaroli were ſo admired, that he many times received the moſt preſſing invitations to ſettle in foreign courts, but the love of his country proved ſuperior to every other inducement, and he never could be prevailed on to quit Verona.

The works of Cignaroli are diſperſed in the galleries and churches of the different parts of Italy, as well as the palaces of foreign potentates: they are by no means, however, of equal merit. Amongſt others is a flight into Egypt, in the church of St. Antonia Abate at Parma, upon which Lanzi beſtows the higheſt encomiums.

The Virgin with the child is repreſented paſſing over a little narrow bridge, and old Joſeph is aſſiſting them on the dangerous occaſion, with a care of anxiety for their ſafety, which is admirably expreſſed: ſo entirely is he abſorbed in this one idea, that he pays no attention to part of his own mantle which is floating in the ſtream. The angels, who, in the cuſtomary manner, are introduced, poſſeſs much grace, and the madona has a dignified deportment, ſomewhat reſembling thoſe of Carlo Maratti.

There is frequently a pleaſing expreſſion and novelty of conception in the works of Cignaroli, and his compoſition is good; but his colouring is ſometimes more plauſible than true, and he was rather extravagant in the uſe of reds and greens in his fleſh: we may add, that his effects of chiaroſcuro are not unfrequently too far-fetched, and ſeem to want their foundation in nature.

He left many ſcholars, among whom was a brother named Giandomenico Cignaroli, whoſe pictures in Bergamo are ſaid to poſſeſs merit.—Gio. Bettino Cignaroli died in the year 1770, and the particulars of his life were publiſhed by P. Gregorio Bevilacqua. Lanzi, Storia Pittorica.

Cignaroli, (by ſome called Cingiaroli), Martino and Pietro, two brothers, Veroneſe painters, who, educated in the ſchool of Giulio Carpione, afterwards ſettled in Milan, where they were eſteemed for their landſcapes and bambocciate, and where Martino had a ſon called Scipione, who became a landſcape painter of ſome eminence. If, as it is ſaid, they were living in Milan in 1718, they muſt have been very old. Lanzi, Storia Pittorica.

Cignaroli, Scipione, the ſon of the above-mentioned Martino, was a landſcape painter of ſome note; he is ſaid to have been the ſcholar of Cavalier Tempeſta (P. Molyn called Cav. Tempeſta died 1701) but owed great part of his advancement to the ſtudies which he made at Rome upon the works of Gaſpar Pouſſin and Salvator Roſa. From Rome he returned to Milan, where he painted many pictures which did him credit, till, having acquired conſiderable reputation, he was invited to the court of the duke of Savoy, where he lived in high eſtimation for the remainder of his life. Orlandi. Pilkington.

CIGOLI. See Ludovico *Cardi*.

CIGURRI, in *Ancient Geography*, a people of Spain who, according to Pliny, inhabited the country at preſent called Aſturia.

CILBIANA Juga, a mountain of Aſia Minor, in Lydia, in which was the ſource of the river Caiſter. It is mentioned by Pliny and Strabo.

CILBIANI, the name of a people who inhabited a country in Aſia Minor, near the Caiſter. As this country conſiſted partly of mountains, called "Cilbiana Juga," and partly of a plain, denominated "Cilbianus Campus," we may diſtinguiſh between thoſe who inhabited the former, called "Cilbiani Superiores" and thoſe who occupied the latter, contra diſtinguiſhed by the name of "Cilbiani Inferiores."

CILBICENI, a people of Spain, placed by Feſtus Avienus, in Bœtica, on the ſea coaſt, and in the vicinity of the town Tarteſſus: they occupied the banks of the river "Cilbus."

CILENDROS, an epiſcopal town of Aſia, in Iſauria.

CILENI, a people of Spain who inhabited the territory called Tarragonenſis. Ptolemy calls them Cilini, and aſſigns to them the town of "Udata Therma."

CILERY, in *Architecture*, a term uſed to denote the drapery or leavage on the heads of columns.

CILIA, in *Anatomy*, the hairs which are implanted on the borders of the eye-lids, and which in common language are termed eye-laſhes. See Eye.

CILIARIS Musculus, a few fibres of the orbicularis palpebrarum muſcle, which immediately ſurround the opening of the eyelids, and are deſcribed by Albinus, as a diſtinct muſcle, under the abovementioned name.

CILIARY Arteries, are branches of the ophthalmic artery,

artery, diſtributed to the choroid coat of the eye, and the iris. See Arteries.

Ciliary *ducts*, thoſe minute canals on the inner ſurface of the eyelids into which the Meibomian glands pour their ſebaceous ſecretion. See Eye.

Ciliary *proceſſes*, the folds on the inner ſurface of the anterior portion of the choroid coat of the eye, which adhere to the front of the vitreous humour. See Eye.

CILIATED, in *Botany*, a term applied to ſuch leaves and other parts of a plant as have their edges beſet with parallel hairs reſembling thoſe of the human eye-laſh.

CILIBÆ or Cillibæ, in *Ancient Military Language*, round tables, on which the Greek and Roman ſoldiers placed their bucklers, when they returned from any expedition.

CILICES, coarſe cloths woven or wrought of horſe-hair, and goats-hair, ſtitched and filled or ſtuffed with cow-hair or flocks of wool between every two of them, which the ancients ſtretched and ſuſpended before their parapets, ditches, and over breaches to ſtop arrows, darts, and ſtones thrown from *manubaliſtæ*, *baliſtæ*, or *catapultæ*.

CILICIA. See Cilicium.

Cilicia, in *Ancient Geography*, a country of Aſia Minor, lying between the 36th and 40th degrees of north latitude, and bounded by Syria on the eaſt, or rather by mount Amanus, which ſeparates it from that kingdom, by a chain of mountains that divided it from Piſidia and Pamphylia on the weſt, by Iſauria, Cappadocia, and Armenia Minor on the north, and by the Mediterranean on the ſouth. This country is ſo ſurrounded by ſteep and craggy mountains, chiefly the Taurus and Amanus, that it may be defended by a few men againſt a whole army; there being but three narrow paſſes leading into it, commonly called "Pylæ Ciliciæ," or the gates of Cilicia, one on the ſide of Cappadocia, called the paſs of mount Taurus, and the other two called the paſs of mount Amanus, and the paſs of Syria, leading from Syria. The Perſian army marched through the ſtraits of mount Amanus, while that of Alexander was encamped at Iſſus, not far from the ſtraits of Syria, which lie more to the ſouth, and were guarded by a body of Macedonians under the command of Parmenio: the ſtraits of mount Taurus Alexander had paſſed in entering Cilicia, the Perſians who guarded that paſs having retired at the approach of the Macedonians. The whole country of Cilicia was divided by the ancients into Cilicia Aſpera, and Cilicia Campeſtris. The former called by the Greeks Trachæa, or ſtony, is bounded by Iſauria on the north, Pamphylia on the weſt, Cilicia Campeſtris on the eaſt, and the Mediterranean on the ſouth. The cities mentioned by the ancients in this part of Cilicia are Sydra, or Syedra, Nagidus, Anemurium, Arſinoe, Celenderis, or Celandris, Aphrodiſias, Holmus, or Holmia, Sarpedon, Zephyrium, and Sebaſte. Theſe were the moſt noted towns on the coaſt of Cilicia Aſpera; the inland cities were Seleucia, Domitiopolis, Philadelphia, Lamus, and Scandeloro. The chief cities of Cilicia, properly ſo called, or Cilicia Campeſtris, were Soli, or Solæ, afterwards known by the name of Pompeiopolis, Tarſus, Anchiale, Anazarbum, Epiphania, Mopſueſtia, Iſſus, and Alexandria. The rivers of principal note in Cilicia are the Pyramus, the Cidnus, the Calycadmus, the Lamus, the Sarus, the Pyramus, and ſeveral others of leſs note, which water this province, and diſcharge themſelves into that part of the Mediterranean, called by the ancients the "Sea of Cilicia," and extending near 250 miles from eaſt to weſt. Cilicia Campeſtris is repreſented by Ammianus Marcellinus as one of the moſt fruitful countries of Aſia; but the weſtern part equally barren, though famous even to this day for an excellent breed of horſes, of which 600 are annually ſent to Conſtantinople for the uſe of the Grand Signior. The air in the inland cities is reckoned very ſalubrious, but equally dangerous on the ſea-coaſt, eſpecially to ſtrangers.

Joſephus ſays (Antiq. l. i. c. 7.), that this country was firſt peopled by Tarſhiſh, the ſon of Javan, and his deſcendants, whence the whole country was called Tarſis. The ancient inhabitants, it is ſaid, were, in proceſs of time, expelled by a colony of Phœnicians, who, under the conduct of Cilix, the ſon of Agenor, and brother to Cadmus, firſt ſettled in the iſland of Cyprus, and from thence paſſed into the country, which, from their leader, they called Cilicia. Strabo ſays (lib. xvii.), that this Phœnician colony paſſed from Cyprus into Phrygia, where they lived in ſubjection to the kings of Troy, and, after the Trojan war, poſſeſſed themſelves of that country, which was afterwards called Cilicia. Several colonies from other countries in ſubſequent periods ſettled in this kingdom; ſome, particularly, from Syria and Greece, whence the Cilicians in ſome places uſed the Greek tongue, in others the Syriac, but the former greatly corrupted by the Perſian, the predominant language of the country being a dialect of that tongue. Bochart derives the name of Cilicia from the Phœnician word "Challekim," or "Challukim," ſignifying a ſtone; that part of Cilicia, which the Greeks call Cilicia Trachæa, being very ſtony, and to this day called by the Turks, "Tes Wileieth," that is, the ſtony province.

The Cilicians, according to the relations of the Greek and Latin writers, were a rough race of people, unfair in their dealings, cruel, great liars, and in the Roman times, entirely addicted to piracy. Hence proceeded the proverbs, "Cilix haud facile verum dicit. Cilicium exitium;" and the ſaying of Pherecrates, "Dii ſemper nobis imponunt, more Cilicium," *i. e.* "A Cilician ſcarcely ever ſpeaks the truth. Cilician cruelty. The Goths, like the Cilicians, always deceive us."

The Cilicians, before they ſettled in the country now called Cilicia, occupied that diſtrict of Myſia, called alſo Cilicia, S. of the mountains that bound Dardania, and having to the weſt the gulf of Adramyttium. This was divided into "Cilicia Thebaica," and "Cilicia Lyrneſſia," after the names of the two cities, Thebes and Lyrneſſus. The firſt, ſituated to the north, was ſeparated from the ſecond, placed to the ſouth, by the river Evenus. At this time they were governed by kings. But after they ſettled in the other Cilicia, we find no mention of their kings till the time of Cyrus, to whom they voluntarily ſubmitted. They continued ſubject to the Perſians till the overthrow of that empire; but were governed to the time of Artaxerxes Mnemon by kings of their own nation. Herodotus, indeed, (l. iii. c. 90.) refers Cilicia to the claſs of Perſian Satrapies; but other writers (ſee Xenophon Cyropæd. l. vii. Diodor. l. xvi. Curt. l. ii.), lead us to conclude, that the Cilicians were governed by kings of their own in the time of Xerxes and Artaxerxes Mnemon. After the extinction of the Perſian empire Cilicia became a Macedonian province. On the death of Alexander it fell to the ſhare of Seleucus, and continued under his deſcendants till it was reduced by Pompey. As a proconſular province it was firſt governed by Appius Claudius Pulcher, and after him by Cicero, who reduced ſome ſtrong holds on mount Amanus, and for his ſucceſs was ſaluted by the army with the title of Imperator, or general. The whole of Cilicia being thus brought under ſubjection, it was at firſt divided into Cilicia Campeſtris and Trachæa; the former became a Roman province, but the latter was governed by kings appointed by the Romans till the reign of Veſpaſian, when this part was alſo made a province of the empire, and the whole divided into Cilicia Prima, Cilicia Secunda, and Iſauria. The firſt comprehended the whole of Cilicia Campeſtris; the ſecond included the coaſt of Cilicia Trachæa; and the laſt the inland parts of the ſame diviſion; and in this ſtate

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it continued till the division of the empire. In Cilicia Prima there were eight episcopal sees, viz. Tarsus, Pompeiopolis, or Soli, Sebaste, Corycus, Adana, Aguria, or Augustopolis, Malchus, or Malus, and Zephyrium. The episcopal towns of Cilicia Secunda were the following nine, viz. Anazarba, Rosus, or Rossus, Mopsuestia, Ægæ, Epiphania, Alexandria, Irenopolis, Flavias, and Castabala.

Cilicia is now a province of Caramania, bounded on the N.W. by the long ridge of mountains which separates it from Isauria and Lycaonia; on the N. by Cappadocia and Lower Armenia; on the E. by Comagene; and on the S. by Syria and the Mediterranean. The eastern part, as we have already observed, is a fine flat fertile country; the other very hilly, rocky, and barren. The Cilicians were the inventors of a kind of manufactory of hair-cloth, chiefly of goat's-hair, called sack-cloth, and much used in the penitentiary humiliations of the Jews and primitive Christians. Adana is much resorted to from other towns of Cilicia, especially from the mountain side, for its wines, corn, and other fruit, hence dispersed into the most barren parts.

CILICIA is also a country and province of Cappadocia. Ptolemy says that it is the name of a prefecture, or military government.

CILICIA *Terra*, in the *Natural History of the Ancients*, a bituminous substance, though called an earth, which, by boiling, became tough like bird-lime, and was used instead of that substance to cover the stocks of the vines, for preserving them from the worms. It probably served both to drive those animals away by its nauseous smell, and entangle them if they chanced to get among it.

CILICIUM, a sort of habit made of coarse stuff, of a black or dark colour, formerly in use among the Hebrews, in times of mourning or distress. It was called *Cilicium*, because it came from Cilicia, or rather because the Cilicians invented this kind of habit, made of goat's hair, and used principally in camps and ships, by soldiers and mariners.

CILICIUM *Mare*, in *Ancient Geography*, a name given by the ancients to that part of the Mediterranean sea, which bathed the coasts of Cilicia. Pliny calls it "Cilicius Aulon."

CILICIUM *Insula*, the name of an island in the Euxine sea, in the Pontus-pelamoniacus, 15 stadia from the promontory of Jason, according to Arrian.

CILIMBENSII, a people placed by Ptolemy in the northern part of the island of Corsica.

CILINA, or CÆLINA, a town of Venetia, towards the north.

CILISARUM, or CILIZA, a town of Asia in Syria, between Cyrrhæ and Edessa. See Itinerary of Antonine.

CILIUM, an episcopal town of Africa, in the Byzacene.

CILIZA, a town of Asia in Syria, situated near the mountains on a stream W. of Deba.

CILLA, a town of Asia Minor in Ætolia, according to Herodotus. From Strabo, it appears that this town was at the foot of a mountain of the same name.—Also, a town of Africa Propria, according to Appian. It was episcopal.

CILLABA, a town of Africa, situated towards the deserts beyond the lesser Syrtis.

CILLÆ, or CELLÆ, a town of Thrace upon the route from Rome to Constantinople, between Philippopolis and Opizum; according to the Itinerary of Antonine.

CILLENE, a mountain of Arcadia, said to be the highest in the whole country.

CILLEUS FLUVIUS, a river of Asia Minor, which had its source in mount Ida, ran near a place named Cilla, before the town of Thebes in Cilicia.

CILLEY, in *Geography*, a town of Germany, in the duchy of Stiria, on the river Saan, and capital of a district, which extends as far as Pettaw. The inhabitants, who speak German and Sclavonian, are said by some to have been brought hither by the duke of Bavaria to oppose the Romans. Cilley is said to have once belonged to the Romans, and afterwards to have been destroyed; but when it was given by Lewis, the old king, and duke of Bavaria, to Hezillon, duke of Moravia, he re-built it. The district, or Comté, was once an independent principality; and governed by its own counts; 130 miles S.S.W. of Vienna. N. lat. 46° 21′. E. long. 15° 16′.

CILLUTA, in *Ancient Geography*, an island of the Indian Ocean, mentioned by Arrian, (l. vi. c. 19.) that seems to have been situated in the principal mouth of the river Indus; it was of considerable extent, and had several commodious ports.

CILMA, or OPPIDUM CHILMANENSE, now *Gelma*, a town of Africa, in Byzacium, situated 6 leagues to the E. of Sufetula; it appears to have been a large city, and has the area of a temple still remaining.

CILNIANA, CILMANA, CILUANA, or SILVIACA, a place of Spain, in Bœtica, between Gades and Calpé. M. D'Anville marks it in his chart upon the sea-coast, in the country of the Bastuli, S. of Munda.

CILOCA, in *Geography*, a town of South America, in Peru, on the coast of the Pacific Ocean; 40 miles W. of Arequipa.

CILURNUM, WALWICK-CHESTERS, the sixth station on the wall of Severus, in Britain, according to the Notitia Imperii. See STATION.

CIMA, in *Architecture*. See CYMA.

CIMABUE, GIOVANNI, in *Biography*, an Italian painter, who is generally honoured with the appellation of the father of modern painters; but although the arts of design have the greatest obligations to this extraordinary man, who first emerged from that hereditary barbarism of style, which for so many centuries had marked the wretched efforts of European painters; yet, it is equally certain, that, without any reference to the Greek artists who are supposed by Vasari to have been the masters of Cimabue, Italy for at least two or three centuries prior to the period of Cimabue's birth, had constantly possessed artists, and artists of her own, sufficiently instructed, to paint the miserable and ghost-like objects of superstition and devotion. See PAINTING, *History of*.

Cimabue, according to the authority of Vasari, was born of a noble family in Florence, in the year 1240, and, at a very early period, having evinced a strong desire and genius towards the art, was put under the tuition of some Greek painters, who were at that time employed to paint a chapel under the church of St. Maria Novella. These he quickly surpassed, and gave such striking proofs of his superior talents, that he soon became employed in the most considerable undertakings.

Of his numerous works at Florence little now remains, except his celebrated Madona, larger than the life, at St. Maria Novella; and another at the church of St. Trinita: they are both painted in distemper, and well preserved. The former of these works was considered, when finished, so extraordinary an effort of the pencil, that Vasari informs us it was carried in procession, accompanied by trumpets, from the house of the painter to the church; which circumstance, together with other rejoicings on the occasion, caused the street through which the picture passed to be called, as it is to this day, "Il Borgo Allegri." But an adequate idea of the genius of Cimabue can alone be formed by examining his decayed frescoes still remaining in the church of St. Francesco of Assini. Here, on one side of the church, he painted in sixteen compartments, with figures something larger than life, the histories of the Old Testament, from the creation of the world, to the story of Joseph and his Brethren; and on the opposite side the same number of stories from the New Testament, beginning with the Annunciation, and ending with the Resurrection; besides the four Doctors of the Church, and many other figures on the ceiling, and several stories from the Revelations in other parts of the church.

church. Although the greater part of these pictures has suffered greatly from the destructive hand of time, yet several of them are tolerably, and some of them perfectly preserved; and are, notwithstanding the rudeness of their execution, in so grand and so simple a style, as to strike with astonishment the traveller who has been taught to expect in the first efforts of the art nothing beyond the humble and imperfect attempt of servile imitation. Some of the conceptions and compositions in this work would not do discredit to the genius of Raffaele at an early period, and certainly possess an energy and boldness of expression far surpassing the tame though careful performances of his master, P. Perugino: and although Giotto and his followers, who immediately succeeded Cimabue, gave a greater softness and variety to their draperies, and more diversity in the characters and expressions of their heads, yet it is difficult to find instances in their works where the naked parts of the figure are so well drawn, as in some of the above-mentioned compositions. He died aged 60 in the year 1300. Vasari. Lanzi, Storia Pittorica, MS.

CIMAEON Mons, in *Ancient Geography*, a mountain of Asia Minor, placed by Ptolemy towards the Troade. It was probably the chain of mountains that separated the Troade from the country of the Lelegi.

CIMARA, a town of India, on the other side of the Ganges, according to Ptolemy.

CIMAROSA, Dominico, in *Biography*, maestro di cappella to the king of Naples, was a native of that capital, born at Capo di Monte; he studied music at the conservatorio of Loretto, and was a disciple of the admirable Duronte. He was carefully educated in other respects, and his docility and sweetness of temper, during his youth, gained him the affection of all who knew him. On quitting the conservatorio his talents were soon noticed, and his operas, chiefly comic, became the delight of all Italy. But though he composed for buffo singers, his style was always graceful, never grotesque or capricious. There is an ingenuity in his accompaniments which embellishes the melody of the voice part, without too much occupying the attention of the audience. His operas of "Il Pittore Parigino," and "L'Italiana in Londra," were carried to Rome, and thence to the principal cities of Italy, where their success was so great in 1782 and 1783, that he received an order from Paris to compose a cantata for the birth of the Dauphin, which was performed by a band of more than 100 voices and instruments. In 1784 he was engaged to compose for the theatres and cities which seldom had operas expressly composed for them; bringing on their stage such as were set for great capitals, such as Rome, Naples, Venice, and Milan. By these means the expences of poet and composer were saved. Cimarosa's success and fame were more rapid than those of any composer of the last century, except Piccini, and the fame of his comic opera of "L'Italiana in Londra," seems to have been as extensive as that of the "Buona Figliuola."

In 1787 he succeeded Sarti at Petersburg, and composed several operas for that court. The same year he furnished Milan with the comic opera of "Le Trame Deluse," and in 1788, with that of "Il Fanatico Burlato;" though he remained in Russia till 1790; when he went to Madrid, for which capital he composed two operas, one serious, intitled "La Virgine del Sole," and one comic, "Il Fanatico Burlato." In 1792, we believe he was at Vienna, where he produced two of his operas, both comic; one, "Le Trame Deluse," composed in 1787, and "Il Matrimonio Segreto." We find but few serious operas by Cimarosa. "Giunio Bruto" seems to have been the first, and "Ines di Castro," and "La Vendetta di Mino," for Spain, with "Penelope" for Naples, the last. His latter comic operas were, "Amor Rende Sagace," for Vienna; "I Fraci Amanti," and "Le Artuzie Femminile," both for Naples, in 1794. "L'Impegno Superato," with "L'Impresario in Angustia," both likewise for Naples, 1795; and "I Nunici Generosi," for Rome, 1796.

We are acquainted with his productions no further. Italy was in such a revolutionary confusion in subsequent years, that no art seems to have been cultivated there but that of war and its concomitants, rapine and slaughter.

Cimarosa, unfortunately for his fame and fortune, manifested a partiality for the French during their possession of Naples, which occasioned his disgrace at the court of his patron and natural sovereign, and he narrowly escaped the fate of convicted rebels and traitors. He was however allowed to die in his bed in 1801, in the 50th year of his age, extremely regretted by the lovers of music, as an original and exquisite composer, and an amiable man, of so obliging and sweet a temper, that being uncommonly corpulent, his immense size was ascribed to his good humour and placid disposition.

CIMARUS Promontorium, in *Ancient Geography*, a promontory which was situated, according to Strabo, on the northern coast of the isle of Crete.

CIMBINA, or Cibina, a town of Asia, in Media.

CIMBIS, a maritime place of Spain, which, according to Livy, was situated in the vicinity of Gades.

CIMBRI, the most northern people of Germany, mentioned by Pliny, Strabo, Mela, Tacitus, and Plutarch; but they are not agreed with respect to their origin; some tracing them to the Scythians, and others to the Cimmerians. They anciently occupied the peninsula which stretches out into the German sea and known under the name of the Cimbric Chersonesus. (See Chersonesus *Cimbrica.*) About the year 645 of Rome they left their own country, and joining the Teutones, Ambrones, and Tigurians, ravaged part of Germany, Helvetia, and the Lyonnese and Narbonnese Gauls, and penetrated into Italy. In their progress they defeated the Romans in several pitched battles, and threw Italy into the greatest consternation. In the first of these actions they vanquished the consul Papyrius Carbo; in another they defeated M. Junius Silanus, another consul, who was called to a severe account for his bad success; in the third, L. Cassius; and in a fourth, the brave M. Aurelius Scaurus, whom they took prisoner and put to death, by order of their king, Bolos, for speaking too warmly in praise of the Romans. However, after several other successes in Italy, during a war of eight years, they were totally defeated and destroyed by the valour and policy of Marius and Catulus, A. U. C. 653, as they were endeavouring to enter Italy through Noricum, now the Tyrol; 120,000 being killed and 60,000 taken prisoners. How highly the Romans estimated this victory may be deduced from the triumph and other singular honours which they decreed both to Marius and to Catulus, as well as from the monuments which these caused to be erected in memory of this transaction. Those Cimbri, who escaped the dreadful slaughter, probably returned into their own country; for they are said to have afterwards sent a submissive embassy to Augustus, and are likewise mentioned by authors of later date, as the most warlike of all the northern Germans, down to Claudian's time, who calls the North Sea by their name; but their name was sunk either in that of the Teutones, or of the Saxons, who, being their neighbours, joined with them in their excursions, and gradually became more powerful.

The Cimbri, supposed by Mr. T. Warton to be a Scandinavian tribe, and by others to be the northern Celts, the ancestors of the Welsh, called Cymri, were accompanied at their assemblies by venerable and hoary-headed prophetesses, apparelled in long linen vestments of splendid

did white. Their matrons and daughters acquired a reverence from their skill in studying simples, and their knowledge of healing wounds, arts reputed mysterious. The wives frequently attended their husbands in the most perilous expeditions, and fought with great intrepidity in the most bloody engagements. These northern nations dreaded captivity more on the account of their women than on their own; and the Romans availing themselves of this apprehension, often demanded their noblest virgins for hostages. Tacit. de Mor. Germ. cited by Warton. Hist. of English Poetry, vol. i. diss. i.

CIMBRIANÆ, a place of Mœsia, on the route from Sirmium to Carnuntum, between Tricciana and Crispiana, according to the Itinerary of Antonine. The Notitia Imperii places it under the department of the second Mœsia.

CIMBRISHAMN, or CIMBRISHAVEN, in *Geography*, a sea-port of Sweden, in West Gothland, and province of Schonen; 24 miles S. of Christianstadt.

CIMEGES, a town of France, in the department of the Dordogne, and district of Bergerac; 7 miles S.W. of Bergerac.

CIMELIANTHUS, in *Natural History*, a name given by authors to a species of the *oculus beli*. It is described to be of a white colour, resembling that of marble, with a yellow pupil in the middle. It was found on the shores of the Euphrates.

CIMELIARC, in *Church Architecture*, the room where the plate, vestments, &c. belonging to the church are kept. In English, a vestry.

CIMELOS, in *Ancient Geography*. See CIMOLUS.

CIMETERRE. See SCIMITAR.

CIMETRA, in *Ancient Geography*, a town of Italy in the country of the Samnites, taken by Fabius in the year of Rome 455. Livy.

CIMEX, in *Entomology*, a genus of hemipterous insects. Linnæus defines the genus cimex in the following manner. Rostrum or snout inflected; antennæ longer than the thorax; wings folded together cross-wise; the wing-cases coriaceous on the upper part; back flat; thorax margined; legs formed for running. These he divides into many sections. The first, *apteri*, are those without wings as in the common house-bug. The *scutellati*, those in which the escutcheon is extended so far as to cover the abdomen and wings. The *coleoptrati* have the wing-cases entirely coriaceous instead of having the extremity membranaceous as in the other cimices. The *membranacei* have, on the contrary, the wing-cases entirely membranaceous, and are much depressed. The *spinosi*, those which have the thorax armed each side with a spine. The *rotundati* are of an oval form, without spines on the thorax. The *seticornes* have the antennæ setaceous towards the tip. The *oblongi* are of an oblong form. The *spinipedes* have the thighs armed with spines; and the *lineares* have the body of a linear form.

Linnæus could not be aware of the amazing extent of the cimex genus as he had instituted it. The number of insects possessing the same characters which he proposed for the cimices that were known to him were comparatively few, amounting perhaps at the utmost to scarcely more than a tenth portion of those described since his time by various writers. With such scanty materials Linnæus found it sufficient for his purpose to dispose of insects very different in other respects, though according with his generic character, to some one of the sections he had formed, or to frame a new section for its admission. But considering the prodigious number of new species of this tribe that have been recently discovered, it will be found, we are persuaded, that the Linnæan genus is no longer adequate to the reception of the whole. Insects possessed of such very dissimilar characters, though truly Linnæan cimices, if brought together under a single genus, would present a most incongruous assemblage. Fabricius has been assiduous in the formation of new generical improvements in this tribe; he has availed himself of the discoveries of naturalists and collectors of the present time, and has been able by that means to introduce to our acquaintance many hundred species of this tribe that were before unknown. Fabricius constitutes of the Linnæan cimices seven distinct genera, acanthia, cimex, coreus, lygæus, miris, gerris, and reduvius. We are not the partizans of innovation on any established system, and above any other of that originally founded by Linnæus; but we really think it might be right to constitute even a still further number of genera than Fabricius has done to include the whole of those insects which stand as Cimices in the Linnæan system. But whatever may be our ideas in this respect, we shall, for the present, pursue only a middle line, retaining, somewhat after the manner of Gmelin, some of the Fabrician genera, as sub-divisions of the Linnæan cimices, and allowing others, which we think ought absolutely to stand as genera distinct from Cimex, to form an appendage to our article. It will be thus perceived, that in the Linnæan arrangements, the whole are Cimices, and in the Fabrician system so many distinct genera.

Genus *Cimex*. Linn.—Genus *Acanthia*. Fabr.

Species.

LECTULARIUS. Apterous; body ferruginous. Linn. *Acanthia lectularia*, Fabr. Common house bug. The history of this fœtid and nauseous insect is well known; it is the inhabitant of most houses; crawls from its lurking places in walls and furniture to suck the blood of those that are asleep during the night, in the day conceals itself; it is said to have an aversion to elder and tobacco. Scopoli pretends that it has been found with wings, some account of which seems to have been published in an old German pamphlet, but we cannot credit the assertion of the writer.

ATER. Glossy black; thorax with a white dorsal line. *Acanthia atra*, Fabr. Inhabits Germany.

ZOSTERÆ. Black; wing-cases coriaceous, and as long as the abdomen; tip hyaline and striated. Fabr. Inhabits Germany.

FLAVIPES. Black; wing-cases coriaceous, as long as the abdomen, and immaculate; legs pale. Fabr. Inhabits Saxony. C. *Saxonicus*, Gmel.

PALLICORNIS. Black and glossy; wing-cases coriaceous, abbreviated, and without spots; antennæ and legs pale. Fabr. Inhabits Saxony.

GRYLLOIDES. Apterous, black; thorax and wing cases margined with white. Fabr. C. *grylloides*, Linn. Inhabits Germany.

CORIACEUS. Apterous; shells coriaceous, black-grey. *Acanthia coriacea*, Fabr.

CLAVIPES. Apterous; black; legs pitchy; anterior thighs thickened and dentated. Fabr. Inhabits Tranquebar.

NIGRICORNIS. Black; anterior part of the thorax greenish; wing-cases coriaceous and greenish. Fabr. C. *nigripennis*, Gmel. Inhabits Germany.

CLAVICORNIS. Wing-cases with reticulated punctures; antennæ clavated. Panzer. Inhabits Germany.

CRASSICORNIS. Wing-cases dusky ash; extreme joint of the antennæ compressed and lanceolate. Fabr. Inhabits Germany.

VIRESCENS. Greenish; last joint of the antennæ ovate, thick, and black. Fabr. Inhabits the South American islands.

LAVATERÆ. Black; wing-cases and abdomen at the base rufous. Fabr. A native of Barbary.

SERRATULÆ. Black; wing-cases palish; tip of the wings fuscous. Fabr. Found in England.

FASCIATUS. Black; wing-cases palish, with two abbreviated black bands. Fabr. A native of Germany.

MACULATUS.

Maculatus. Brown; thorax with three white ſpots; abdomen beneath white, the edge dotted with black. *Acanthia maculata*, Fabr. Inhabits Tranquebar.

Pallipes. Black; wing-caſes pale with black baſe and marginal ſpot. Fabr. C. *marginalis*, Gmel.

Littoralis. Wing-caſes ſordid grey with white dots; body black. Fabr. Inhabits the north of Europe.

Rugosus. Wing-caſes pale; body oblong; anterior thighs very thick. Linn. A. *rugoſa*, Fabr. A native of North America.

Lunatus. Thorax lunate, with prominent margin: abdomen ſerrated. A. *lunata*, Fabr. An Indian ſpecies.

Corticalis. Membranaceous; abdomen imbricated at the ſides; body black. Fabr. Inhabits Europe. *Cimex corticalis*, Linn.

Depressus. Membranaceous; fuſcous; thorax with four elevated lines; wing-caſes white, with a raiſed fuſcous ring. *Acanthia depreſſa*, Fabr. Inhabits Germany.

Planus. Membranaceous, black; thorax with four raiſed black lines; wing-caſes, and wings white, ſpotted with black. *Acanthia plana*, Fabr. Inhabits Saxony.

Paradoxus. Membranaceous; thorax and abdomen lobated and ciliated with ſpines. Sparrman act. Holm. 1777. Inhabits the Cape of Good Hope, and reſembles a dead leaf.

Lævis. Black; abdomen ſmooth and brown; wings pale. Fabr. An Engliſh inſect.

Betulæ. Membranaceous; thorax denticulated; head ſpinous; anterior part of the wing-caſes dilated. Linn. A native of Europe.

Grisatus. Depreſſed, grey; abdomen beneath with a black ring. *Acanthia griſea*, Fabr. Found in Barbary.

Erosus. Membranaceous, abdomen yellow with black band; margin of the thorax ſinuate; anterior ſhanks thick. Linn. *Cimex Scorpio*, Degeer. A native of Surinam.

Monstrosus. Membranaceous, black; abdomen ſerrated, angular with white tip; head and thorax ſerrated; anterior ſhanks thickened. A. *monſtroſa*, Fabr. A native of Barbary.

Gibbus. Black; ſcutel and wing-caſes white, with a black dot at the tip. A. *gibba*, Fabr. Inhabits the Eaſt Indies.

Campestris. Black; wing-caſes white with fuſcous tip, and whitiſh ſpot; wings without ſpots. Fabr. Inhabits New Zealand.

Nemoralis. Black; wing-caſes with a white dot in the middle; wings fuſcous, at the baſe white. Fabr. Inhabits Zealand.

Pratensis. Black; wing-caſes yellowiſh, tip duſky; wings white with fuſcous ſpot at the tip. Fabr. Inhabits Germany.

Sylvestris. Black; wing-caſes white, with a black arch at the tip. Linn. Found in woods in Europe.

Alatus. Thorax with four raiſed fuſcous lines; wing-caſes pale, with a fuſcous ſpot at the tip. Fabr. Inhabits Sweden.

Costalis. Thorax with three raiſed lines; body brown; rib of the wing-caſes dotted with black and white. Fabr. An European inſect.

Sacchari. Thorax and ſcutel with three raiſed lines; body brown; wings hyaline and reticulated at the tip. Fabr. Inhabits South American iſlands.

Cardui. Thorax and ſcutel with three raiſed lines; tip of the antennæ black. Fabr. A native of Europe.

Humuli. Thorax with three raiſed lines; the margin very thick; body beneath black, legs rufous. Fabr. Inhabits Germany.

* *Scutel as long as the abdomen.*

Stockerus. Ovate; body green, with black ſpots; abdomen ferruginous. Linn.

Inhabits China. Donov. Inſ. China. Beneath ferruginous, at the ſides blue; colour above variable from gloſſy-green to blue.

Eques. Ovate; body green, with black ſpots; abdomen deep black; margin green, with black dots. Fabr.

Smaller than the preceding. Deſcribed from a ſpecimen in the cabinet of Lund, received from Tranquebar. We have ſeen the ſame from Africa.

Nobilis. Oblong, blue, gloſſed with golden, and ſpotted with black. Linn.

An Aſiatic inſect, much reſembling *Cimex ſtockerus*, but of a more oblong form, and far more rare.

Signatus. Oblong; thorax and ſcutel bluiſh, with ſix black ſpots. Fabr.

A native of Senegal, in the cabinet of Rouſſillon. Reſembles the preceding ſpecies.

Regalis. Thorax golden, with two bluiſh dots; ſcutel golden, with two bluiſh ſpots. Fabr. A native of New Holland. Donov. Inſ. N. H. Very rare.

Imperialis. Thorax and ſcutel rufous; abdomen blue; with a ſanguineous margin. Fabr.

Inhabits the ſame country as the preceding. Donov. Inſ. New Holland.

Banksii. Violaceous; on the thorax an anchor-ſhaped ſpot, with two curved lines, and three ſpots on the ſcutel ſanguineous. A new ſpecies. Donov. Inſ. New Holland.

Carinthis. Dull black, and without ſpots. Fabr. Inhabits Africa.

Dispar. Red, or fleſh colour; thorax and ſcutel with yellow ſpots, ſome containing a black pupil or dot. Fabr. Donov. Inſ. China. *Cimex ocellatus*, Thunberg.

Nigellæ. Dull black; anterior part of the thorax, edge of the abdomen, and legs white. Fabr. A native of Barbary. Found on the Nigella.

Annulus. Greeniſh, with black annular ſpots. Fabr. *Cimex argus* of Drury's Exotic Inſects. Inhabits Senegal.

6-Punctatus. Above teſtaceous; thorax with four; ſcutel with two black-blue dots. Fabr.

Deſcribed from the Hunterian Cabinet. Inhabits South America.

Arcuatus. Grey; thorax and ſcutel with two black curves. Fabr. A native of South America.

Druræi. Above red, with large irregular black ſpots. Drury Inſ. Inhabits America.

Fabricii. Somewhat purpliſh, with fulvous dots. Fabr. Inhabits Cayenne.

Argus. Black, with numerous ocellar fulvous ſpots. Stoll. Reſembles the former. Inhabits Surinam.

Schulzii. Braſſy black; ſcutel with a ſcarlet ſpot on each ſide at the baſe. Fabr. Found in Cayenne.

Paganus. Azure; ſcutel and abdomen rufous, with azure ſpots. Fabr. Donov. Inſ. New Holland. Bankſian Cabinet.

Illustris. Glaucous; thorax and ſcutel with two fuſcous dots. Fabr. Inhabits the Cape of Good Hope.

Furcifer. Brown; ſcutel with two black dots, and tridentated fulvous ſpot behind. Stoll. Cab. Holthyſen. Same country as the preceding.

Lineola. Above blue; head and thorax with a dorſal line of red, and two dots of the ſame colour on the ſcutel. Fabr. Inhabits the Cape of Good Hope.

Trilineatus. Black, with three yellowiſh lines. Fabr. Inhabits South America.

NIGROLINEATUS. Red; thorax with five black lines; ſcutel with three; abdomen yellow, dotted with black. Fabr. Inhabits South of Europe. Linn.

SEMIPUNCTATUS. Above rufous; thorax with ten black dots; ſcutel with four lines of black. Fabr. Inhabits America.

SILPHOIDES. Braſſy-black; margin of the abdomen beneath, and legs yellow. Fabr. A native of India.

ANCHORAGO. Azure; ſcutel at the baſe and tip yellowiſh; margin of the abdomen yellow, dotted with black. Solander. Inhabits America.

GRAMMICUS. Body yellowiſh, with a black longitudinal litural mark or daub. Linn. A native of Africa.

PÆDEMONTATRUS. Rufous, with numerous white ſpecks. Fabr. *Cimex allioni*, Gmel. An Italian ſpecies.

COSTATUS. Grey; rib of the wings at the baſe and the legs rufous. Fabr. Donov. Inſ. New Holland. A ſpecimen in the Bankſian Cabinet was found in Rotterdam Iſland.

HOTTENTOTTA. Ferruginous, and immaculate. Fabr. Inhabits the Eaſt. Prof. Forſkahl.

MAURUS. Cinereous; ſcutel with two white dots at the baſe. Linn. A native of the ſame part of the world as the preceding.

LYNCEUS. Duſky teſtaceous, dotted with black; ſcutel with two fulvous dots at the tip. Fabr.

ALBO-LINEATUS. Thorax ſomewhat ſpinous, grey, and ſtriated with white. Fabr. A native of Italy. Dr. Allioni.

RUSTICUS. Fuſcous; head and anterior part of the thorax ferruginous; beneath varied with white, and fuſcous.

IRRORATUS. Greeniſh, ſpeckled with fuſcous. Fabr. A native of America.

LANATUS. Braſſy-black, with grey hairs. Pallas. Inhabits Siberia.

GLOBUS. Globoſe, gloſſy-black; margin of the abdomen ferruginous. Fabr. Inhabits the ſouth of Europe.

SCARABÆOIDES. Body entirely braſſy. Linn. Found on flowers of the ranunculus.

PALLIPES. Braſſy-black; margin of the ſcutel, and abdomen, with the legs pale. Inhabits Africa. *Cimex acaroides*, Thunberg.

FLAVIPES. Braſſy-black; whole margin, and the legs yellow. Fabr.

Deſcribed from a ſpecimen in the Bankſian Cabinet. Inhabits New Holland.

DESFONTAINII. Thorax ſpinous; above grey, beneath whitiſh. Fabr. Inhabits Barbary.

FULIGINOSUS. Scutel ſooty, with five black litural marks or blotches, the poſterior one white. Linn. Inhabits Europe.

VAHLII. Gloſſy black; head with two yellowiſh blotches; margin of the thorax, ſcutel, and legs yellow. Fabr. Inhabits the Eaſt.

TUBERCULATUS. Duſky; ſcutel ſcabrous, before the tip tuberculated. Fabr. A native of Italy.

LITURA. Black; two ſmall yellow lines at the baſe, and dot at the tip white. Fabr. Inhabits Arabia according to Forkſkahl.

INUNCTUS. Black; ſcutel at the baſe, with the legs grey. Fabr. An Engliſh ſpecies.

ARABS. Thorax ſpinous; body ovate, livid; tail bidentated. Linn. Found in American iſlands.

STOLIDUS. Thorax ſomewhat angulated; body above green, beneath yellow; tail armed with two teeth. Linn. An Indian ſpecies.

* *Thorax ſpinous each ſide.*

CERVUS. Green; wing-caſes fuſcous, with white margin; ſpines of the thorax obtuſe, and ſomewhat bifid. Stoll. A native of Cayenne.

TAURUS. Grey; ſpines of the thorax advanced, compreſſed, and truncated. Fabr. Inhabits the Coromandel coaſt.

DAMA. Grey; ſpines of the thorax obtuſe and emarginate. Fabr. This is of a large ſize and inhabits the Eaſt Indies.

VACCA. Olive; thorax obtuſely ſub-ſpinous; antennæ rufous at the baſe; ſternum ſhort and compreſſed; tail armed with four teeth. Fabr. A large ſpecies. This inhabits Guadaloupe.

GAZELLA. Thorax obtuſely ſub-ſpinous; above greeniſh; head and anterior part of the thorax yellowiſh; abdomen ſerrated. Fabr. Inhabits Martinique. Iſert.

TARANDUS. Thorax ſpinous, above blue-black; anterior margin of the thorax, three dorſal lines, and tip of the ſcutel white. Fabr. A ſpecies of large ſize, deſcribed from an inſect in the Britiſh Muſeum. Native country unknown.

BIDENS. Spines of the thorax ſharp; body grey; antennæ rufous. Linn. Found in gardens in Europe.

SANGUINIPES. Spines of the thorax obtuſe; body fuſcous; ſcutel at the tip whitiſh; ſpots on the margin of the abdomen and legs black. Fabr. Inhabits Italy.

RUFIPES. Spines of the thorax obtuſe; body grey; legs rufous. Linn. Inhabits Europe. Found in Gardens.—*Obſ.* In ſome ſpecimens the tip of the ſcutel is rufous.

LURIDUS. Spines of the thorax obtuſe, greeniſh; wing-caſes grey with a fuſcous ſpot; ſhield emarginate. Fabr. Deſcribed by Fabricius as an Engliſh inſect on the authority of the Bankſian cabinet. Taken in woods near London, but rare. Donov. Brit. Inſ.

CUSTOS. Thorax obtuſely ſpined, grey; antennæ yellow, with two black annulations. Fabr. A native of Germany.

NIGRICORNIS. Thorax obtuſely ſpined, ſub-ferruginous; ſpines and antennæ black. Fabr. A native of Saxony.

NIGRISPINUS. Thorax obtuſely ſpined; above grey; head and ſpines black; antennæ with a black ring. Fabr. Inhabits China.

ICTERICUS. Oblong; above reddiſh; beneath yellow. Linn. Amœn. Acad. Inhabits America.

PUNCTATUS. Thorax ſomewhat ſpinous; fuſcous, abdomen variegated at the margin; ſhanks with a white ring. Fabr. A native of Europe, ſometimes found in England.

VARIUS. Thorax obtuſely ſpined; above rufous, beneath yellowiſh; ſcutel black, with the baſe and tip white. Fabr. Inhabits Spain. Vahl.

LUNULA. Thorax obtuſely ſpinous; above rufous; on the anterior part of the thorax five little yellow lines; two lunules at the baſe of the ſcutel, and the tip white. Fabr. Inhabits Barbary.

ALBIPES. Thorax ſomewhat ſpinous; above blackiſh; margin of the thorax and ſcutel tip white. A Fabrician ſpecies deſcribed from the cabinet of Dr. Allioni. A native of Italy.

DENTATUS. Thorax ſlightly ſerrated; body varied with cinereous and black. Fabr. An Eaſt Indian ſpecies.

FLORIDANUS. Black, varied with red; ſcutel with three red ſpots, Linn. A native of America.

ARMATUS. Spines of the thorax acute; ſcutel black, two dots and tip teſtaceous; antennæ and legs red. Fabr. Inhabits New Holland. Bankſian cabinet.

HÆMORRHOUS. Black; abdomen rufous; wing-caſes, with five black linear dots. A Linnæan ſpecies. Inhabits America.

2-PUSTU-

2-Pustulatus. Black; wing-cases livid; head with two scarlet dots. Linn. A native of Surinam.

Punicus. Black; lunule on the scutel, and tip red. Linn. An African insect.

Ypsilon. Livid; scutel with a yellow y-like mark. Linn. Found in Surinam.

Clypeatus. Green, with yellowish band; head shielded. Fabr. A native of China. Gronovius.

Elector. Above grey, beneath yellowish, with black dot; antennæ black; band before the tip yellow. Fabr. Country unknown.

Albicollis. Thorax dentated; above green; head, fore part of the thorax, and base of the scutel yellow. Fabr. *Cimex flavicollis*, Drury. A native of Jamaica.

Hæmorrhoidalis. Thorax obtusely spinous; somewhat greenish; antennæ black; sternum projecting, Linn. An European species. Found in England, Donov. Brit. Inf. &c.

Spinideus. Spines of the thorax acute; fuscous; scutel at the tip and margin of the upper wings white. Fabr. Found in Tranquebar.

Sagittata. Thorax acutely spined and serrated; grey; under-wings with a black fillet; antennæ and legs yellow. Fabr. Inhabits South American islands.

Oculatus. Grey; scutel with two yellow dots; anterior tarsi of the legs compressed and membranaceous. Fabr. A native of China.

Annulatus. Grey; shanks annulated with white. Fabr. A native of Virginia.

4-Pustulatus. Thorax obtusely spined, and crenated, with two rufous dots; scutel with two rufous dots at the base. Fabr. An American species.

Maculatus. Greenish; thorax obtusely spined, with four brown spots; tip of the scutel and wing-cases brown. Fabr. Same country as the former.

Pugnax. Thorax acutely spined, oblong and greenish; antennæ rufous. Fabr. Inhabits America.

Emeritus. Thorax acutely spined, greenish; abdomen with two lines of white. Fabr. A New Holland species in the Banksian cabinet.

Gladiator. Thorax acutely spined, and with the scutel yellow dotted with black; wing-cases rough with white dots. Degeer, &c. An American insect.

Ferrugator. Thorax acutely spined; above grey; head and spines black; abdomen ferruginous, Paykull, &c. Inhabits Sweden.

Crenator. Thorax crenated; above grey, beneath yellowish. Fabr. A native of the American islands. Smidt.

Furcatus. Thorax acutely spined and serrated; fuscous; shield of the head acuminated and bifid. Fabr. Described from an insect in the Banksian Cabinet, found on the coast of Patagonia.

Pugillator. Thorax acutely spinous; fuscous; margin yellow, beneath fulvous dotted with black. Fabr. Inhabits Africa.

Perditor. Thorax acutely spinous, with two dots and band in the middle brown; margin of the abdomen varied with fulvous and green. Fabr. Inhabits American islands.

Victor. Thorax acutely spined; fuscous; tip of the scutel rufous; legs pale, dotted with black. Fabr. Inhabits American islands.

Delirator. Thorax acutely spined; black; antennæ ferruginous; legs pale, dotted with black. Fabr. Inhabits American islands.

Ciliatus. Thorax ciliated, obtusely spinous, and black; margin and band behind yellow; posterior thighs serrated. Fabr. An American species.

Melacanthus. Thorax acutely spinous; dusky ferruginous; spines black; abdomen black with yellowish stripes. Fabr. Inhabits Africa.

Aggressor. Thorax acutely spinous; tail four toothed; body yellowish; spines same colour. A new Holland species, described from the Banksian cabinet. Fabr.

Vittatus. Thorax somewhat spinous; greenish; wing-cases with a yellow stripe near the margin. Fab. Inhabits the Cape of Good Hope.

Hamatus. Thorax acutely spined; green; abdomen serrated, the denticles black. Fabr. An East Indian species.

Velox. Thorax acutely spined, with two dots; wing-cases with a yellow dot at the base, and streak at the tip yellow. Fabr. Inhabits America.

Humeralis. Green; wing-cases yellow at the base. Thunberg. Country unknown.

Comma. Cinereous; scutel with a yellow line. Thunb. Inhabits Africa.

Transversus. Green; head and anterior part of the thorax yellow. Thunb. Same country as the former.

Fullo. Black, specked with white; head and thorax with a white line. Thunb. Inhabits Japan.

Tibialis. Chesnut-brown, with white and brown lines; scutel with two white spots. Thunb. Country unknown.

* *Ovate; thorax unarmed.*

Aurantius. Orange; head, anterior margin of the thorax, marginal spots on the abdomen, and legs black. Fabr. Donov. Inf. China. Inhabits China and other parts of India.

Punctatum. Above blackish; thorax behind orange; wing-cases white with a black dot. Fabr. *Cimex nigripes*, Sulz. Inhabits Java.

Nigripes. Above sanguineous; scutel with two spots and wing-cases with one spot of black. Fabr. *Cimex incarnatus*, Drury. An East Indian insect.

Iserti. Testaceous; head, thorax behind, scutel anteriorily, band on the wing-cases, with the wings and legs, blue. Fabr. According to Dr. Isert, inhabits the woods of Guinea.

Papillosus. Olive; antennæ black; sternum gibbous, and compressed. Fabr. *Cimex Chinensis*, Thunberg. Described perhaps erroneously as a native of Sierra Leone, Africa. We have received the species from China. Donov. Inf. China and India.

Rubens. Red; head, anterior part of the thorax and scutel greenish; margin of the abdomen spotted with yellow. Fabr. An East Indian species.

Danus. Sanguineous; head, scutel at the base, and wings, black. Fabr. *Cimex danus*, Stoll. *Cimex afer*, Drury. Inhabits American islands.

Obscurus. Fuscous; thorax, wing-cases, and scutel dusky olive; last joint of the antennæ yellow. Fabr. Inhabits the East Indies.

Torquatus. Green; head, and anterior part of the thorax, yellowish. Fabr. A native of Italy.

Ritulans. Green and brassy; a sanguineous band on the anterior part of the thorax; fore part of the scutel and wing-cases yellowish. Fabr. An African species.

Guttatus. Brassy green, with whitish dots; anterior shanks dilated and membranaceous. Fabr. A native of Siam. Banksian cabinet.

Viridulus. Above yellow, dotted with green; beneath green. Linn. A native of India.

Prasinus. Green, and without spots; last joints of the antennæ rufous with the tip fuscous. Linn. Found in woods in Europe; in England rarely. Donov. Brit. Inf.

Dissimilis. Above green, beneath ferruginous. Fabr. A native of Germany.

Juniperinus. Green; margin entirely and tip of the scutel yellow. Fabr. Found on the juniper in Europe.

Smaragdulus. Green, scutel with three yellow spots at the base. Inhabits Madeira.

Azureus. Dusky-green; mouth and legs yellowish. Fabr. A native of Guinea.

Beryllus. Pale; margin of the thorax orange; wing-cases with a ferruginous spot, and marginal little lines of black. Fabr. An East Indian insect.

Calidus. Above fuscous, beneath testaceous; antennæ black. Fabr. Inhabits Sierra Leone. Dr. Pflug.

Lynx. Greenish; margin of the abdomen with black ocellar spots. Fabr. A native of Hungary.

Cœlebs. Greyish-brown; three dots on the scutel with the tip yellowish. Inhabits New Holland. Described by Fabricius from a specimen in the Banksian cabinet.

Iratus. Green-brown, thorax with a yellow band. Fabr. Inhabits Cayenne.

Dumosus. Dusky; dorsal line, two dots on the scutel, and ring on the shanks rufous. Linn. Inhabits the North of Europe.

Tripunctatus. Yellowish; three lines on the head, and three dots on the scutel black. Fabr. An American species.

Atomarius. Grey and fuscous varied; wings white, dotted with fuscous. Fabr. Inhabits America.

Nubilis. Grey and black varied; wings white, striated with black. Fabr. A native of the Cape of Good Hope. Banksian cabinet.

Tristriatus. Yellowish; wing-cases with an ocellar black spot at the tip; abdomen with three white lines. Fabr. An Italian insect. Dr. Allioni.

6-Punctatus. Pale yellow and black varied; thorax pale yellow, with six black dots. Linn. An Indian species.

Signatus. Grey; scutel with a black stripe. Fabr. A native of Sierra Leone.

Gravis. Fuscous; scutel with two yellow dots; wing-cases with a black dot. Fabr. A native of New Zealand.

Meditabundus. Above green; wing-cases fuscous, beneath yellowish. Fabr. A South American species. Dr. Isert.

Cinctus. Green; margin of the thorax and abdomen sanguineous. Fabr. *Cimex Forskahlii*, Gmel. Inhabits the East.

Rubrofasciatus. Greenish; thorax with a sanguineous band. Fabr. Inhabits Tranquebar, and is described from a specimen in the cabinet of Hybner. Gmelin alters the Fabrician specific name to Hybneri.

Agathinus. Punctured yellowish; scutel with a black band; abdomen above black; tail rosy. Fabr. A German species.

Lituratus. Green speckled with brown; thorax with a band; wing-cases with a blotch of sanguineous. Fabr. Inhabits Italy.

Cruentus. Green; thorax, margin of the abdomen, with the antennæ and legs ferruginous. Fabr. A native of Surinam.

Geniculatus. Dusky; thorax and margin of the abdomen yellowish; tail and joints of the legs ferruginous. Fabr. Inhabits Cayenne.

Mixtus. Punctured, grey, spotted with black; margin of the abdomen black, with yellow dots. Fabr. Same country as the former.

Picus. Grey; antennæ and shanks of the legs black, with white rings. Fabr. An Indian species.

Griseus. Grey; sides of the abdomen varied with black and white; sternum projecting. Linn. Found in gardens in Europe.

Interstinctus. Grey; margin of the abdomen with black spots. Linn. Inhabits Europe.

Funebris. Ovate, black, antennæ, legs, and wings same colour. Fabr. Inhabits Sierra Leone.

Baccarum. Somewhat fulvous; margin of the abdomen spotted with fuscous. Linn. An European insect.

Mucoreus. Black, speckled with white; head black; margin and line in the middle white. Fabr. Inhabits China.

Ornatus. Black and red varied; head and wings black. Linn. Inhabits Europe.

Festivus. Black and red varied; thorax with six black dots; wings fuscous, margin whitish. Linn. *Cimex dominulus*, Scop. Found in the south of Europe.

Cruciatus. Black and pale varied; scutel black with a white cross. Fabr. Inhabits the East Indies.

Bioculatus. Above black; thorax rufous with two black dots; margin of the scutel rufous. Fabr. An American insect.

Gramineus. Roundish, green, and without spots. Fabr. A native of Tranquebar.

2-Punctatus. Dusky rufous; two dots on the scutel, and tip white; margin of the abdomen dotted with black. Fabr. A native of Italy. Called by Gmel. C. *Italicus*.

Bicolor. Black; wing-cases white and black varied; wings white. Linn. Found in gardens in Europe. An English species. Donov. Brit. Inf.

Oleraceus. Blue-brassy; small line on the thorax, tip of the scutel, and dot on the wing-case white or red. Linn. Geoffr. &c. Found in gardens in Europe.

2-Guttatus. Black, with the whole margin white; wing-cases with white dots. Linn. Inhabits Europe; lives chiefly in gardens.

Histrio. Variegated; head and abdomen black with white lines. Fabr. Inhabits Tranquebar. Hybner.

Cæruleus. Blue and without spots. Linn. An European species.

Albo-Marginellus. Blue; margin of the thorax, wing cases, and tip of the scutel white. Fabr. Inhabits Germany. *Cimex albo-marginatus*, Geoffr.

Nigrita. Black; wings white; legs rufous; shanks serrated. Fabr. Inhabits Germany.

Flavicornis. Black; wings white; antennæ yellow; thorax and shanks ciliated. Fabr. Inhabits Europe.

Morio. Deep black; feet rufous. Linn. &c. Found on plants in Europe.

Tristis. Deep black; shield orbicular; thorax retuse. Fabr. *Cimex spinipes*, Schranck.

Spinipes. Black; legs pitchy; shanks very spinous. Fabr. An African species.

Æthiops. Black; thorax with an impressed line in the middle; shanks very spinous and black. Fabr. Inhabits Cayenne. Rohr.

Lugens. Fuscous; thorax, small line on the scutel and margin of the abdomen white. Fabr. A native of America.

Melanocephalus. Grey; head and base of the scutel brassy black. Fabr. A native of England.

Perlatus. Grey; head black; scutel with a white dot each side. Fabr. Inhabits Germany. Smidt.

Decrepitus. Black; head and legs fuscous. Fabr. Found on grass in Denmark.

Acuminatus. Front attenuated, whitish with fuscous streaks; tip of the antennæ rufous. Lin.

Elegans. Dark green; thorax yellow with four blackish spots; margin of the scutel and transverse band yellow.

low. Donov. Inf. New Holland. A recently difcovered fpecies.

Genus *Coreus*, Fabr. *Cimex*, Linn.

Marginatus. Thorax obtufe fpinous; margin of the abdomen acute; antennæ in the middle rufous. Fabr. *Cimex marginatus*, Linn.

Scapa. Thorax obtufely fpined; margin of the abdomen acute, and fpotted with white; two fpines on the anterior part of the head. Fabr. Inhabits Germany.

Spiniger. Thorax obtufely fpinous, and dentated; head with four fpines. Fabr. Inhabits Italy.

Venator. Thorax obtufely fpinous, dufky grey; beneath yellowifh; antennæ and legs ferruginous. Fabr. An Italian fpecies. Dr. Allioni.

Bellator. Thorax fpinous, above fufcous; beneath yellowifh; antennæ black with white rings. Fabr. A native of Cayenne.

Armiger. Thorax acutely fpinous, grey; fcutel with two dots; antennæ and legs pale. Fabr. An African fpecies in the Bankfian cabinet.

Lanciger. Thorax acutely fpined, yellowifh; thorax behind, and wing-cafes fufcous; wing-cafes with a white band. Fabr. Inhabits Guinea. Dr. Ifert.

Hastator. Thorax acutely fpined, dufky grey; margin of the abdomen whitifh with black dots. Fabr. Inhabits fame country as the laft.

Scorbuticus. Thorax obtufely fpinous, fufcous; pofterior legs dotted with black. Fabr. Found in the iflands of America.

2-Guttatus. Thorax acutely fpined, grey, with two callous white dots on the fcutel. Fabr. Inhabits the Eaft Indies.

Delirator. Thorax acutely fpined, yellowifh, dotted with black; pofterior part of the thorax and the wing-cafes fufcous.

Defensor. Thorax acutely fpined; tail four-toothed; body green; fpines black. Fabr. A native of New Holland. Bankfian cabinet.

Pugnator. Thorax acutely fpined, oblong; above fufcous, beneath yellowifh; antennæ rufous with the tip black. Fabr. Inhabits Tranquebar. Hybner.

Fasciculatus. Thorax fomewhat fpinous cinereous; wings fufcous; legs with fafciculated hairy tubercles. Fabr. Inhabits the Cape of Good Hope.

Insidiator. Thorax acutely fpinous; above rufous, beneath yellowifh. Fabr. Inhabits Barbary.

Calumniator. Thorax acutely fpinous, cinereous-brown; beneath yellowifh with ftreaks of black dots. Fabr. A native of India. Prof. Abildgaard.

Hirticornis. Thorax acutely fpinous, ferrated, and rufous; antennæ hairy; pofterior thighs ferrated. Fabr. Inhabits Barbary.

Sulcicornis. Thorax obtufely fpinous; above rufous, beneath yellowifh; antennæ triangular, abdomen fomewhat fquare. Fabr. A native of Barbary. Muf. Desfontaines.

Rhombeus. Thorax acutely fpined; abdomen dilated, rhombic, and armed behind with fix teeth. Linn. *Coreus rhombea*, Fabr. An African infect.

Quadratus. Thorax obtufely fpinous; above fufcous, beneath yellowifh; abdomen fquare. Fabr. A native of Germany.

Hastatus. Thorax acutely fpinous, and dentated; wing-cafes dufky with a pofterior white ftreak. Fabr. Inhabits Tranquebar. Hybner.

Gravidator. Thorax ferrated, dufky cinereous; margin of the wing-cafes dotted with black; wings white; antennæ fufcous. Fabr. Inhabits South American iflands.

Genus *Lygæus*, Fabr. *Cimex*, Linn.

* *Thorax fpinous.*

Valgus. Thorax fpinous and ferrated; pofterior thighs incurvated, and with the fhanks armed with a fingle tooth. Linn. Inhabits the Cape of Good Hope.

Serratus. Head, thorax and abdomen ciliated with fpines; body black. Fabr. Inhabits America.

Merianæ. Thorax fomewhat fpinous; wing-cafes fufcous, reticulated with white; abdomen fpinous at the bafe. Fabr. A native of Surinam.

Grossipes. Thorax ferrated, lineated with red; pofterior thighs thick, and with the abdomen at the bafe fcabrous; fhanks with a fingle tooth. Fabr. Inhabits Tranquebar.

Tragus. Spines of the thorax compreffed, lunulated, and ferrated; pofterior fhanks membranaceous and ferrated. Fabr. A native of China. Dr. Pflug.

Tenebrosus. Thorax fomewhat fpinous; pofterior thighs incurvated, and clubbed; bafe of the abdomen with three fpines. Fabr. &c. An Eaft Indian fpecies.

Fulvicornis. Thorax fpinous, and ferrated; brown; thighs bidentated; pofterior one with many teeth. Fabr. An Eaft Indian fpecies.

Incubator. Thorax obtufely fpined, and ferrated; fnowy before the margin; body grey. Fabr. Inhabits Carolina.

Heros. Thorax obtufely fpined, and ferrated; fufcous; pofterior thighs clavated and dentated; fhanks membranaceous and ferrated. Fabr. Inhabits the Eaft Indies.

Femoratus. Thorax flightly fpined; pofterior thighs incurved, and dentated; pofterior fhanks compreffed. Fabr. Inhabits India. Bankfian cabinet.

Curvipes. Thorax acutely fpined; thighs bidentated at the tip; pofterior ones incurved. Fabr. Inhabits Africa.

Clavipes. Thorax ferrated, dufky; thighs with many fpines; pofterior ones thick. Fabr. A native of China.

Dentator. Thorax ferrated, dufky; pofterior thighs dentated; fhanks pale. Fabr. A native of Italy. Dr. Allioni.

Pictor. Thorax fpinous, and ferrated; ochraceous; wing-cafes fpeckled with black. Fabr. A native of the Eaft Indies.

Compressicornis. Thorax fpinous and ferrated, with ocellar black fpots; body black; laft joint of the antennæ compreffed and white at the bafe. Fabr. A native of St. Jago.

Membranaceus. Thorax fpinous and without fpots, blackifh; wing-cafes with a whitifh band; pofterior fhanks membranaceous and dentated. Fabr. Inhabits South America.

Auctus. Thorax fomewhat fpinous and black; two fpots fulvous; wing-cafes with a yellow band; pofterior fhanks membranaceous and yellow. Fabr. A native of America.

Sanctus. Thorax acutely fpined, oblong, rufous; wing-cafes black, with a ferruginous crofs. Fabr. A Brafilian infect.

Lætus. Thorax fpinous, green; head, band on the wing-cafes, abdomen, and thighs, yellow; wing-cafes black. Fabr. Inhabits Cayenne.

Kermesinus. Thorax fomewhat fpinous, oblong, rufous, with a whitifh band, dotted with black; pofterior thighs with many teeth. Linn. A native of Surinam.

Australis. Thorax fomewhat fpinous, oblong, black; a red band on the thorax before; pofterior fhanks membranaceous. Fabr. Defcribed from a fpecimen taken in Otaheite. Bankfian cabinet.

Balteatus.

Balteatus. Thorax somewhat spinous; ferruginous; wing-cases with a transverse yellow line; posterior thighs with many teeth. *Cimex balteatus*, Drury. Inhabits South America.

Sinuatus. Thorax acutely spined, livid; posterior shanks compressed, sinuated and black. Fabr. A native of Cayenne.

Serripes. Thorax acutely spined, rufous; posterior thighs dentated. Fabr. A native of New Holland.

Dentipes. Thorax spinous, elongated; posterior thighs long and serrated; body fuscous beneath; sides white. Fabr. Inhabits Africa.

Linearis. Thorax acutely spined, elongated, fuscous; posterior thighs lengthened, and dentated. Fabr. A native of China. Drury.

Crenulatus. Thorax dentated and rufous, with a black spot; posterior thighs dentated; body black. Fabr. Inhabits American islands.

4 Spinosus. Elongated, red; thorax armed with four spines. Linn. A native of America.

* *Thorax unarmed.*

Phasianus. Fuscous; posterior thighs arched, clavated, and armed with a single tooth; abdomen at the base beneath gibbous. Fabr. An African insect.

Bellicosus. Fuscous; posterior thighs arched and dentated; abdomen four-spined. Fabr. An African species. Banksian cabinet.

Meleagris. Fuscous; extreme joint of the antennæ, and anterior shanks yellow; all the thighs serrated. Fabr. A native of China.

Gallus. Wing-cases fuscous with yellow streaks; disk of the abdomen rufous; posterior thighs serrated. Fabr. Inhabits Surinam.

Faber. Black; abdomen fuscous, with yellow margin; anterior thighs bidentated at the tip. Fabr. A native of Paulicondor.

Indus. Abdomen red, and bidentated; wing-cases fuscous with pale streaks. Linn. A native of Cayenne.

Civilis. Red and black varied; thorax with two red lunules; wings fuscous, spotted with white. Fabr. Inhabits Tranquebar.

Saxatilis. Black; thorax with the lateral margins and line down the middle red; wing cases with three red spots; wings immaculate. Fabr. Inhabits the south of Europe.

Hyosagami. Black and red varied; wings fuscous and without spots. Linn. An European species.

Varicolor. Black and red varied; wing-cases black; with two yellowish spots. Fabr. Found in Trinity island.

Scabrosus. Black; margin of the thorax and two bands on the upper wings reddish. Fabr. A native of America.

Leucurus. Black; wing-cases red; wings black, the base and tip white. Fabr. Inhabits Amsterdam island.

Koenigii. Testaceous; wing-cases with a black dot; wings deep black. Fabr. Inhabits Tranquebar.

Slanbuschii. Sanguineous; thorax with an abbreviated band; scutel, dot on the wing-cases, and the wings black. Fabr. Inhabits China. Donov. Inf. China.

Ægyptius. Red and black varied; wing-cases red, with a black dot. Linn. A native of Egypt.

4-Guttatus. Wing-cases rufous, with black band; wings with two white dots. Fabr.

Punctato Guttatus. Black; wing-cases rufous, with a middle black dot; wing black with two white dots. Fabr.

Suturalis. Rufous; antennæ and wings black; the suture entirely white. Fabr.

Rolandri. Black; wings with a rhombic yellow spot. Linn. Found on the pine in Europe.

Sordidus. Black; thorax behind, wing-cases and legs grey. Fabr. Inhabits Tranquebar.

Genus *Miris*, Fabr. *Cimex*, Linn.

Dolabratus. Wing-cases ferruginous, whitish at the sides; antennæ black. Linn. A native of Europe.

Lævigatus. Whitish; sides white. Degeer. A native of Europe.

Lateralis. Black; sides whitish. Fabr. An European species.

Holsatus. Whitish; two lines on the thorax brown, and wing-cases brown within. Fabr. Inhabits Europe.

Pabulinus. Green, without spots; wings hyaline. Linn. Inhabits Europe.

Virens. Green; ends of the feet, and tips of the antennæ rufous. Fabr. An European species.

Pallens. Pale; head and body black. Paykull. A native of Sweden.

Calens. Head, thorax, and wing-cases black; scutel fulvous. Linn. A native of India.

Gronovii. Thorax and wing-cases black, with a yellow line forming a band. Linn. Inhabits India.

Ferus. Grey and without spots. Linn. Found in European woods.

Vagans. Grey; head and line on the thorax black; legs testaceous. Fabr. A native of Sweden.

Cingulatus. Fuscous; head, and three lines on the thorax, with the margin of the wing-cases white. Fabr. A native of India.

Marginellus. Black; three lines on the thorax white; wing-cases edged with white, and at the tip a scarlet spot. Fabr. An Italian insect.

Striatus. Black; wing-cases yellow striated with brown; tip and legs rufous. Linn. Inhabits Europe.

Abietis. Fulvous spotted; legs rufous; thighs thick and dentated. Degeer. Inhabits Europe.

Ulmi. Above rust colour; wing-cases streaked with sanguineous; wings varied behind with brown and white. Fabr. Linn. &c. Found on the elm in Europe.

Genus *Gerris*, Fabr. *Cimex*, Linn.

Lacustris. Black; anterior legs very short. Linn. Very common in ditches during summer. Donov. Brit. Inf.

Paludum. Black; beneath silvery; margin of the abdomen somewhat ferruginous. Fabr. Twice the size of the last. A native of Europe.

Fossarum. Above fuscous; margin, thorax, scutel, and dorsal line yellow. Fabr. A native of the East Indies.

Stagnorum. Nearly round; blackish; thorax with two globular dots in the middle. Linn. Inhabits England.

Rivulorum. Black, dotted with white; abdomen fulvous. Fabr. Inhabits the mountainous rivulets of Alsace.

Pallipes. Black; legs pale; breast two-spined. Fabr. An Italian insect. Cabinet of Dr. Allioni.

Culiciformis. Thorax armed with many spines; grey; wing-cases with many blotches. Fabr. An American species.

Mantis. Fuscous; streak on the wing-cases and joints of the legs white. Fabr. Country unknown.

Tipuliformis. Sanguineous; wings and legs black; antennæ very long. Fabr. A native of Guinea.

Præcatorius. Brown; head and thorax two-spined; margin

margin of the thorax elevated behind and obtufe ; antennæ very long. Fabr. A native of Guinea. Dr. Ifert.

Pedestris. Body fufcous and yellow varied; pofterior thighs elongated and toothed. Fabr. Inhabits the Eaft Indies.

Filiformis. Antennæ ferruginous; body linear, pale, and greenifh. Fabr. A native of America.

Oratorius. Greenifh; antennæ before the tip white. Fabr. A native of India.

Angustatus. Above grey, beneath yellowifh; antennæ and legs fomewhat teftaceous. Fabr. A native of China. Dr. Pfiug.

Filum. Fufcous; wings abbreviated; legs very long. Fabr. An Eaft Indian fpecies in the cabinet of the late Dr. Fothergill.

Longipes. Black; margin of the thorax and band on the wing-cafes fanguineous. Fabr. An American fpecies.

Cursitans. Above fufcous, beneath cinereous; legs very long; tail bidentated. Fabr. A New Holland infect. Bankfian cabinet.

Tipularius. Whitifh; all the legs long; thighs clavated; antennæ biclavated. Fabr.

Vagabundus. Wing-cafes with the wings fufcous and white varied; legs very long, ringed with cinereous. Fabr. An European infect.

Clavipes. Cinereous; thighs clavated, antennæ biclavated. Fabr. Inhabits Sweden.

Apterus. Apterous, fufcous; abdomen fulvous; fpot at the bafe black with white dots. Fabr. An Italian infect.

Currens. Apterous, fufcous; margin of the abdomen raifed, fulvous with black dots. Fabr. A native of Italy.

Genus *Reduvius*, Fabr. *Cimex*, Linn.

Gigas, Black; margin of the thorax and obfolete flexuous band on the wing-cafes rufous. Fabr. Inhabits the Eaft Indies.

Personatus. Antennæ capillary at the tip; body beneath fubvillous and fufcous. Linn.

Villosus. Villous, black; fcutel at the tip recurved and pointed. Fabr. A native of Barbary.

Barbicornis. Black; thorax and bafe of the abdomen olive. Fabr. Inhabits Sierra Leone.

Maculatus. Rufous; thorax with four; wing-cafes with three black fpots. Fabr. An African fpecies.

Stridulus. Glabrous, black; wing-cafes rufous; thin margin cinereous, and dotted with black. Fabr. Inhabits Europe.

Nitidulus. Black; thorax olive; anterior thighs rufous. Fabr. Inhabits Africa.

Pilipes. Black, thorax and wing-cafes at the tip villous with grey hairs. Fabr. A native of Cayenne.

Longipes. Red; wing-cafes black; bafe and band red. Linn. A native of American iflands.

Phalangium. Rufous; antennæ and legs elongated and black. Fabr. A native of the American iflands.

Nigripennis. Rufous; wing-cafes and abdomen beneath black; fcutel bidentated. Fab. Inhabits the Eaft Indies.

Marginatus. Above rufous, wing-cafes black; abdomen deep black with rufous margin. Fabr. Inhabits the Eaft Indies. Bankfian cabinet.

Rufipes. Deep black; wing-cafes grey veined with black; margin of the abdomen and pofterior legs rufous. Fabr. A native of Cayenne.

2-Pustulatus. Above black; a rufous dot at the tip of the wing-cafes. Fabr. Inhabits Surinam. Bankfian cabinet.

Annulatus. Tip of the antennæ capillary; body black, beneath fpotted with fanguineous. Linn. Geoffr.

Sanguineus. Black; margin of the abdomen fanguineous fpotted with black. Fabr. A native of Barbary.

Bicolor. Deep black; thorax behind, wing-cafes, and margin of the abdomen pale. Fabr. An African fpecies. Bankfian cabinet.

Litura. Dull, fufcous; tip of the antennæ and blotch in the middle of the wing-cafes white. Fabr. A native of Cayenne.

Attelaboides. Teftaceous and black varied; anterior part of the thorax teftaceous, with two black teeth. Fabr. A New Holland infect.

Diadema. Black; head and thorax fpinous. Fabr. A native of North America.

4-Spinosus. Thorax four-fpined, black; wing-cafes teftaceous; head and legs yellow. Fabr. Inhabits Cayenne.

Fasciatus. Head and thorax black; wing-cafes yellowifh; band and wings at the tip black. Fabr. A native of Cayenne.

Maurus. Ferruginous, margin of the abdomen fpotted with black; anterior part of the thorax fomewhat fpinous. Fabr.

Fornicatus. Thorax raifed, vaulted, pale with three brown fpots. Fabr. A native of Cayenne.

Acantharis. Thorax fpinous; abdomen ciliated with fpines. Fabr. Inhabits Jamaica.

Guttula. Gloffy black; wing-cafes and legs fanguineous; wings with a white dot. Fabr. A native of Germany. Dr. Heiffe.

Elongatus. Elongated, rufous; antennæ and legs black. Fabr. Inhabits Africa.

Minutus. Black, fcutel at the tip, and wing-cafes at the bafe white. Fabr. Inhabits Paris.

CIMICIFUGA, in *Botany*, (fo called from its driving away bugs). Linn. gen. 1282. Schreb. 933. Gært. 810. Juff. 234. Clafs and order, *polyandria tetragynia*. Nat. Ord. *Multifiliquæ*, Linn. *Ranunculaceæ*, Juff.

Gen. Ch. *Cal.* four or five-leaved; leaflets roundifh, concave, caducous. *Cor.* Nectaries refembling petals, pitcher-fhaped, membranous. *Stam.* Filaments twenty, projecting a little out of the flower; anthers didymous. *Pift.* Germs four to feven; ftyles recurved: ftigmas adhering longitudinally to the ftyle. *Peric.* Capfules from four to feven, oblong, opening with a lateral future, Linn. (opening at the ventral future, Gært.) *Seeds* many, covered with fpreading fcales.

Eff. Ch. Calyx four or five-leaved. Nectaries four, pitcher-fhaped. Capfules from four to feven.

Sp. C. *fœtida*, Mart. Lam. Willd. Gmel. Sib. 4. tab 70. Lam. Ill. Pl. 487. Gært. tab. 140. (Actæa cimicifuga, Linn. Sp. Pl. Thalictroides fœtidiffimum, Chriftophorianæ facie, Amm. ruth. 102.) *Root* perennial, thick, knotty, fhort, with many thickifh fibres creeping tranfverfely. *Stem* fix feet high, cylindrical, flightly ftriated, a little hairy, hollow, with alternate branches. *Leaves* pinnated; leaflets egg-fhaped, ferrated; terminating one commonly three-lobed. *Flowers* in long alternate terminal racemes, on fhort peduncles. *Capfules* netted, beaked with the fhort curved ftyle, one-celled, opening at the interior or ventral future. *Seeds* feveral, oblong, covered with linear-oblong flexile pale fcales, attached to the future. The whole plant, efpecially in its wild ftate, has an almoft infupportable fmell. According to Linnæus it bears a great refemblance to Actæa racemofa. A native of Siberia, from the river Jenifea, flowering

flowering in the middle of July, and ripening its feed in Auguft. It varies much in the number of parts in the calyx, corolla, and piftils; nor is either the fex or proportion conftant.

CIMIER, the French term in *Heraldry* for a creft. See Crest.

Cimier, in *Military Language*. The ancient knights, or chevaliers, in France and other countries, put each of them a *cimier* on his helmet by way of ornamenting it. But it was fo incommodious, by its weight, that fubfequent chevaliers laid it afide; and contented themfelves with placing fmall allegorical figures in its ftead. See Crest.

CIMINIA, in *Ancient Geography*, a country of Italy, in Etruria.

CIMINIUS *lacus*, a lake of Italy, in Etruria, mentioned by Livy.

Ciminius *Mons*, a mountain of Etruria, fituated N. and N.E. of the lake of the fame name.

CIMKOWICZKE, in *Geography*, a town of Lithuania, in the palatinate of Novogodrek, 18 miles W. of Sluck.

CIMMERII, in *Ancient Geography*, the name of a people, who, according to Pofidonius, were the fame with the Cimbri. The firft appellation, by which they were diftinguifhed, is unknown; but it appears that they did not acquire the fecond before they inhabited the town of "Cimmerium," built in Afia upon the bank of the ftrait that feparates it from the Tauride. The time of the eftablifhment of the Cimmerians muft have been very ancient; for it appears they had gained celebrity in the 9th century before the Chriftian æra, becaufe Homer mentions them in his "Odyffey" as a people who inhabited the northern and north-weftern parts of Greece, in a climate approaching the pole. Strabo fuggefts (l. iii.) that from the time of Homer, the Cimmerians and Amazons entered into Afia Minor, and penetrated into Æolia and Ionia; and Eufebius, in his Chronicle, marks, in the year 1076 before Chrift, an incurfion of the Cimmerians and Amazons into Afia Minor. Orofius alfo mentions another about the year 782, thirty years before the foundation of Rome. The Cimmerians, according to Pofidonius, advanced gradually from the fea-coaft to the interior of Germany, and at length occupied the whole country, which extended from the ocean to the Euxine fea. The principal eftablifhment of the Cimmerians was towards the banks of the Tyras, according to Herodotus (l. iv. c. 12.) who fays, that they there affembled to hold a general council of the nation, on the fubject of the Scythian invafion. Having advanced towards the eaft, they had traverfed the Boryfthenes and the Hypanis, and had paffed the Cherfonefus or peninfula, which has always preferved their name. From this country they proceeded to the Bofphorus, or the ftrait which feparates it from Afia, and by which the waters of the Tanais, after having formed the Palus-Mæotide, difcharge themfelves into the Euxine fea.

The country bordering on the Palus Mæotis, and the Bofphorus, which was inhabited by the Cimmerii, is reprefented by the ancients as an inhofpitable place, covered with forefts and fogs, which the fun could not penetrate (See Bosphorus); and their frightful defcription of it gave Cicero and Ovid occafion to fay, that an eternal night reigned in this gloomy climate, and that fleep had taken up its abode here. Hence "Cimmerian darknefs" became, according to Lactantius, proverbial, fignifying an impenetrable darknefs, and likewife a gloomy and ftupid mind.

Herodotus adds, that they took poffeffion of the two banks of this ftrait, and there conftructed forts, the veftiges of which remained in his time. Strabo, fpeaking (l. xi.) of Cimmerium, fays, that it was built on the Afiatic bank of this ftrait. Herodotus fays, moreover, that the Cimmerians, after having croffed the ftrait, proceeded along the fea-coaft, and advanced into Afia Minor, which they ravaged, whilft the Scythians were pillaging Media and Paleftine. He adds, that the Cimmerians penetrated into the peninfula of Sinope, which they found to be a defert. We have an account, fince the year 1076, of two expeditions of the Cimmerians into Afia Minor. In one of thefe, it is faid, on the authority of Ariftotle, they feized poffeffion of the town of Antandros, fituated at the foot of Mount Ida, at the bottom of the gulf of Adramyttium. He adds, that thefe people gave the name of "Cimmeris" to this town, and that they continued mafters of it for a century. In thefe two invafions, the Cimmerians pillaged the town of Sardes. Strabo fays (l. i.) that Midas, king of Phrygia Major, having been conquered by the Cimmerians, killed himfelf, in order to avoid falling into their hands. Eufebius places the death of Midas at the year 697, or about the 4th year of Gyges. Strabo farther informs us (l. xiv.) that the Cimmerians remained mafters of the plains of Caifter or of Lydia, for a confiderable time after the deftruction of Magnefia, and the pillage of Sardes. However, he fometimes diftinguifhes the people who deftroyed Magnefia and pillaged Sardes, fometimes by the name of Cimmerians, and fometimes by that of Treres, or Trerones, and calls their chief Lygdamis; and this, according to Callimachus, was the name of the king of the Cimmerians, who came from Scythia, or the coaft of the Euxine fea, to ravage the plains of Caifter. Hefychius alfo informs us, that this Lygdamis pillaged the town and burnt the temple of Ephefus. Strabo (l. xiv.) fays, that this Lygdamis, after having ravaged Lydia and Ionia, loft his life in Cilicia; that is unqueftionably the Cilicia of the Troade, where the Cimmerians had their place of arms (Id. l. i.). This author always gives the furname of Cimmerians to the Treres or Trerones of Afia, in order to diftinguifh them from thofe of Thrace. Herodotus fays, that after the council held on the banks of the Tyras, already mentioned, the Cimmerians, conceiving themfelves unable to refift the Scythians, migrated towards the eaft; and that the Scythians, having taken poffeffion of their country, difpatched an army to purfue them, but that this army having loft its way in the mountains, wandered, in croffing the Caucafus, and followed the courfe of a valley, which led them to the coaft of the Cafpian fea. The Cimmerians, at length, proceeded along the coaft of the Euxine, and returned to the Colchide in Afia Minor.

The Cimmerian nation confifted, at the time of the Scythian invafion, of three divifions; viz. thofe of Afia Minor, the colony of the Cherfonefus, and the principal body of the nation, which inhabited the regions fituated between the Danube and the Boryfthenes, the moft confiderable eftablifhments of which were formed on the bank of the river Tyras. The Cimmerians of Afia Minor, accuftomed to plunder, were attacked by Alyattes, a valiant and active prince, who deftroyed moft of them that remained, and thofe who efcaped the fword of the conquerors were made flaves, and difperfed through the countries of Lydia and Myfia. The Cimmerians of the Cherfonefus and the Bofphorus poffeffed cities on both fides of this ftrait; but they found it difficult to defend themfelves againft the Scythians. They probably, therefore, abandoned the plains of the ifthmus and Bofphorus, and retired into the mountains to the fouth and eaft of the peninfula; mountains that were fertile, and yet difficult of accefs to the cavalry of the Scythians. As to the principal body of the Cimmerians, who inhabited the country between the Danube and the Boryfthenes, the Scythians continued mafters of their country

500 years before Christ. The Greeks had many colonies on the sea-coast, and these colonies extended their commerce into the interior parts of the country. It is from the inhabitants of these colonies, and from a Scythian prince, that Herodotus derived his information concerning these territories. It is probable that the Cimmerians ascended the Carpathian mountains, and descended on the western side of it. After their flight, when this event took place, the different people which composed the Cimmerian league, separated from one another, and settled in different places; and as the league no longer subsisted, each people resumed its ancient name, and began to form a distinct state.

The learned M. Pezron, in his "Antiquities of Nations," &c. maintains, that the Cimmerians were of the same family with the *Sacæ;* and that whilst these were proceeding from Bactriana, which they had previously occupied, by the south, the Cimmerians, who likewise came from the same country, took their route by the north of Asia; and he represents them as making their way by force of arms, till they settled upon the Palus Mæotis. In proof of the opinion which he advances, he appeals to Plutarch, Posidonius, Diodorus, and Strabo. Herodotus, however, to whom we have already referred, assigns to their march a quite contrary direction, from the Palus Mæotis towards Caucasus and the east (l. iv. c. 12.) The writers above cited, says Mr. Bryant (Anal. Anc. Mythol. vol. iii.), have not a syllable to the purpose for which M. Pezron alleges their authority. That there were such people as the Cimmerians upon the Mæotis, is, indeed, as certain as that there were Phrygians in Troas, and Spartans at Lacedæmon. But that they came from Bactria, and fought their way through different countries; that they were the brethren of the Scythians, styled Sacæ, and took the upper route, when the others were making their inroad below, are circumstances which, says Mr. Bryant, have not the least shadow of evidence. They are not mentioned by the authors to whom M. Pezron appeals, nor by any writers whatever. Indeed Strabo expressly says (l. xi.), that the Cimmerians were driven out of their country by the Scythians.

CIMMERII, a people of Italy, who inhabited the environs of Baiæ and Cumæ near the lake *Avernus*, which see. Those that have given an account of this colony, among whom are Lycophron, Pliny, Eustathius, Servius, &c. inform us, that the sun never shines in this small canton; but Strabo, who was better acquainted with these countries, describes them as abounding with all the necessaries of life, and rather pleasant than disagreeable.

CIMMERIUM, a town of Asiatic Scythia, or the Cimmerian Bosphorus. It was the last city to the right, when a person passes this straight from the south or the north.

CIMMERIUM, *Eski-krim*, a town in the interior of the Tauric Chersonesus, according to Ptolemy and Strabo. M. le Peyssonel, in his Observations historical and geographical, says, that this town, now reduced to a wretched burgh, was formerly large and flourishing; as appears from several existing monuments. It was situated to the north of Mount Cimmerius, and to the W.N.W. of Theodosia.—Also, a town of Italy, in Campania, situated, according to Pliny, near the Lucrine and Avernian lakes.

CIMMERIUM *Promontorium*, a promontory of Asia, on the southern coast of the Palus Mæotis, marked by Ptolemy between the town of Apatura and the mouth of the river Vardan.

CIMMERIUS BOSPHORUS. See BOSPHORUS.

CIMMERIUS *Mons, Aghirmiche-Daghi*, a mountain in the Tauric Chersonesus, according to Strabo, who says, that it derived its name from the Cimmerii, a people who anciently occupied the whole Bosphorus. See CIMMERII, *supra*.

CIMOLIA, a place of Greece in the Peloponnesus. Diodorus Siculus reports that the Athenians gained in this place a victory over the inhabitants of Megara.

CIMOLIA, in *Mineralogy*. This term occurs in some of the ancient pharmacopœias as designating pipe-clay and fuller's earth, of which the former was denominated cimolia alba, and the latter cimolia purpurascens. See PIPE CLAY and FULLER'S EARTH.

CIMOLIA *Terra*. See CIMOLITE.

CIMOLIS, or CIMOLUS, in *Ancient Geography*, one of the Cyclades, or islands of the Archipelago. It was also called *Echinussa*, or Viper Island, on account of the great number of those reptiles with which it abounded, at a time, when little frequented by men, it was covered only by rocks, forests, and brambles. It was anciently known by the substance which was found in it, and to which it gave the name of "Cimolia Terra." It was situated a little to the N.E. of Melos, and to the S.S.W. of Siphnos. The Greeks at this day call it "Kimoli;" but it is more generally known by the name of "Argentiera," which see. The virtues of the earth which it produces are recited by Pliny (N. H. l. xxxv. c. 17.), Dioscorides (l. v. c. 133.), and Galen (Epitome de Curatione Morborum). See CIMOLITE.

CIMOLIS, an episcopal town of Asia Minor in Paphlagonia.

CIMOLITE of Klaproth, *Cimolia* of Pliny, in *Mineralogy*, is a mineral of a light, greyish, white colour, inclining to pearl-grey; but by exposure to the air it acquires a reddish tint. It occurs in mass, forming large strata; its fracture is earthy, uneven, and its texture more or less slaty. It is opake, of a greasy texture, and may be scraped with a knife like steatite. It adheres firmly to the tongue, stains the fingers in some degree, and though soft, is very tough, and difficultly pulverizable. Sp. gr. 2.

When exposed by itself to the action of the blow-pipe, it becomes at first of a dark grey colour, but afterwards recovers its whiteness with little or no alteration: with microcosmic salt it runs into a colourless globule; with borax it forms a light-brown glass. Its component parts are

63	Silex
23	Alumine
1.25	Oxyd of iron
12	Water
99.25	

It abounds in the island of Cimolis (whence its name), now called Argentiera, and was highly valued by the Greeks and Romans for its detergent properties: at present its use is almost entirely confined to the inhabitants of that island. When triturated with a little water it forms a soft, pap-like mass, and being applied in this state to silk or woollen cloth, and allowed to dry on, it absorbs all the grease which they may contain, like Fuller's earth, but more effectually, and is again discharged by a slight washing, leaving the cloth restored to its original lustre.

CIMON, in *Biography*, an Athenian, son of Miltiades, by Hegisipyle, the daughter of a Thracian king. He served under his father in his youth, and was more addicted to active pursuits, than to those studies and accomplishments, for which the Athenians peculiarly valued themselves. As he advanced in life he showed that he was not deficient in abilities; he possessed a natural eloquence, which, united to an openness and generosity of temper, rendered him well qualified to make his way in a popular government. When his father died he was imprisoned, because unable to pay the fine imposed upon him. He was released from confinement chiefly

chiefly by means of his fister Elpinice, who regarded him with the tendereft affection. Cimon paffed fome of his younger days in licentious pleafures; but at the time of the Perfian invafion, his martial fpirit, and refolute temper fhone forth with great luftre. At the advice of Themiftocles, he quitted the city, embarked on board the fleet, and greatly diftinguifhed himfelf in the naval combat of Salamis. Ariftides having formed a favourable opinion of his integrity and talents, initiated him in public bufinefs, with a view of bringing him forward to counterbalance the influence of Themiftocles. After the expulfion of the Perfians, Cimon was made admiral of the Athenian fleet, which was commanded by Paufanias. In this fituation, his difpofition being a perfect contraft to that of Paufanias, he gained univerfal refpect and efteem, fo that after the commander was recalled, the confederates readily accompanied him in an expedition to Thrace. In this, among many other brilliant and important achievements, he reduced the ifland of Scyros, inhabited by pirates, and returned to Athens with the bones of Thefeus, to be interred in the native city of the hero, which he had quitted four hundred years before. Having re-inforced his fleet, he proceeded to the coaft of Caria, thence to Cyprus, where he was informed that the Perfian fleet lay at anchor. He purfued it to the mouth of the Eurymedon, and there completely defeated it, deftroying many veffels and capturing two hundred. Then landing his men on the fame day, he gained a fignal victory over the land forces of the enemy. This action, which is fo celebrated in ancient hiftory, took place B. C. 470. Cimon afterwards got poffeffion of eighty Phœnician fhips in the port of Cyprus, and he brought back to Athens an immenfe booty, which enabled the Athenians to build the fouth wall of their citadel, and to lay the foundations of the long walls which were to connect the city with the port. Cimon might have enriched himfelf by this expedition in the moft honourable manner, but he chofe rather to expend his wealth upon his native city. He had a plain but plentiful repaft provided daily at his houfe for a numerous company, to which the pooreft citizens were made welcome. He not only fed the hungry, but clothed the naked, and was ready at all times to fupply the needy with fums of money to affift them in their various exigencies. Many of his public acts of benevolence carried with them the air of oftentation; it has, however, been afferted, that Cimon never aimed at courtefy, the populace being in reality attached to the ariftocratical party, which he alfo favoured in his political conduct. As a ftatefman, he confirmed the naval fuperiority of his country, not only by his fplendid victories, but by the wifdom of his policy. For, many of the Greek ftates, which were bound by treaty to furnifh fhips to the allied fleet, chufing rather to compound this fervice for money, he advifed the acceptance of their compofition, but at the fame time he would not hear of fuch an indulgence to the Athenians. The confequence of which was, that the other ftates loft all their practice in, and fpirit for, naval affairs, while the Athenians were kept in full exercife and difcipline. The Perfians renewed their hoftilities, which gave Cimon a new opportunity for achieving more victories: he then reduced the Thracians, who had revolted from the Athenians, joined the Perfians, and feized the gold mines in Thrace. About this period, the Lacedæmonians fent to requeft aid from Athens in fupport of their authority over the Helotes. Ephialtes oppofed the grant of it, with a view of keeping the Spartans in as depreffed a ftate as poffible, but Cimon vindicated their caufe, and prevailed. He was fent to their relief with a confiderable force, and obtained much honour in the fervice. Some time afterwards another body of Athenian troops, marching in to the affiftance of the Lacedæmonians, was difmiffed by them with circumftances of fufpicion, which offended the citizens of Athens, and indifpofed them againft the friends of Sparta. Pericles began to poffefs influence in Athens, as the head of the popular party, in conjunction with Ephialtes. They, envying the glory acquired by Cimon, conceived his ruin to be a neceffary ftep to the eftablifhment of their power. He was profecuted at their inftigation for having received bribes from Alexander, king of Macedon, to ftop the progrefs of the Grecian arms againft that country. Cimon, indignant at the ingratitude which he experienced for the fervices that he had performed, could fcarcely deign to vindicate his honour, which his enemies themfelves believed to be unfullied. He was, however, banifhed; but in a fhort time afterwards the Athenians became involved in a war with the Lacedæmonians, in which the armies of both nations met at Tanagra in Bœotia; a fevere action enfued, but neither of the contending parties could claim the victory. The battle was on the point of being renewed the next day, when Cimon appeared, and requefted to fight as a volunteer in his country's fervice. His petition was rejected, and himfelf commanded to leave the army. Before he retired, he addreffed himfelf to his friends, who had been confidered as acceffaries with him in the confpiracy againft the ftate, and intreated them to act in fuch a manner as to convince the Athenians, that they had not among them either braver or more honourable men than Cimon and his friends. They requefted him to leave his armour, fince their generals would not allow him to fight at their head. They formed clofe round it, to the number of about a hundred, and, rufhing amidft the thickeft of the foe, fought with undaunted courage till they were every man killed. Victory decided againft the Athenians, and the fubfequent events of the war caufed them to regret the abfence of Cimon, of whofe real patriotifm no one now entertained a doubt. Pericles, at whofe inftigation chiefly he had been fent away, himfelf drew up and fupported a decree for his recal. On his return, he fpeedily made peace between the Athenians and Spartans.

Such was become the conftitution of the Athenian commonwealth, and fo great the effects which the continuance of war had produced on the minds of the people, that, in order to preferve quiet at home, Cimon faw the neceffity of turning the fpirit of enterprife towards foreign conqueft, and againft the common enemy of Greece. He determined to attack Cyprus, that his countrymen might defift from making war upon the Lacedæmonians, or oppreffing their allies. For this purpofe, he took the command of a powerful fleet, part of which he detached to Egypt to diftract the attention of the Perfian government. With the remainder he attacked Citium and Malum, of which he made himfelf mafter. He afterwards defeated the Phœnician fleet, obtained a victory over the Perfian army encamped in Cilicia, and, re-embarking the troops, returned to Cyprus, and laid fiege to the principal city. In the camp before that place, Cimon died in the arms of victory. It is not known whether his death was occafioned by ficknefs, or by a wound which he had received. His remains were carried to Athens and buried there, and a magnificent monument was erected to his memory, which exifted there in the time of Plutarch. The death of this great man was not lefs honourable than his life had been glorious. When he found that he was about to expire, he gave fuitable directions to the principal commanders, ordered them to conceal his difeafe, and to embark immediately for Athens. Great as was the military character of Cimon, his wifdom, integrity, and moderation, and conciliatory conduct, were virtues for which the lofs

lofs of him was moft feverely felt and deplored. Others might command fleets and armies, and obtain victories, but they could not, or did not, like him, free Greece from civil feuds and domeftic wars. It has alfo been remarked in praife of this great man, that he, in the midft of wealth, as well as Ariftides in poverty, preferved the reputation of patriotifm unimpeached. Corn. Nepot. Plutarch. Univer. Hift.

CINA, or KINAH, in *Ancient Geography*, a town of Judæa, in the tribe of Juda. It was the town of the Cinæani, who defcended from Jethro, the father-in-law of Mofes. —Alfo, a town of Afia Minor, in Galatia, called Ciœna and Cenes.

CINABARENSIS, an epifcopal fee of Afia Minor, placed by the Greeks in Phrygia Salutaris.

CINABORIUM, a town of the Greater Phrygia.

CINÆDA, in *Natural Hiftory*, the name of a ftone found in the head of a fifh, of a whitifh colour, and oblong figure. The ancients fuppofed it prefaged tempefts when its furface looked dufky and obfcure; and, on the contrary, fair weather, when it looked bright and clear.

CINÆDOCOLPITÆ, a name given by Ptolemy to a people of Arabia Felix; he adds that their country was watered by the river Baetius, and affigns to them two towns and two villages fituated on the coaft of the Red Sea.

CINÆDOLOGIA, among the *Ancients*, a kind of fatyrical poetry, the chief fubject of which were the *Cinædi*.

CINÆDOPOLIS, in *Antient Geography*, an ifland of Afia Minor, in the Doride. Pliny fays that it was fituated at fome diftance from the continent, in the Ceramic gulph.

CINÆDUS, in *Antiquity*, is ufed to fignify a dancer or pantomime.

At firft they performed only on the ftage, but afterwards were admitted to the entertainments of princes.

CINÆDUS, or CYNÆDUS, in *Ichthyology*, the name of a fifh common in the Archipelago, about the fhores and rocks, fuppofed by many to be the fame fpecies with the alpheftes, and of the labrus kind, only with its back fin prickly all its length. It is of a yellowifh hue all over, blended and variegated with an admixture of purple: its fcales are rounded and indented; and its teeth very ftrong and firm, and difpofed in two rows in each jaw, and are long and fharp.

CINÆTRUM, in *Ancient Geography*, a mountain of Greece, in the Peloponnefus, towards the ifle of Cythera.

CINALOA, in *Geography*, a province of N. America, in the country of Mexico, or New Spain; bounded on the weft by the gulph of California, on the fouth by the province of Culiacan, on the eaft by Leon, and particularly by the high craggy mountains called Tepecfuan, or Topia, 30 or 40 leagues from the fea, and on the north by New Bifcay; from S.E. to N.E. it is about 100 leagues, and at its greateft breadth not above 40. It was firft difcovered in the year 1552 by Nunez de Guzman. The country is well watered, the air is pure and falubrious, the land is fertile, and produces all forts of fruit, grain, and cotton; and the rivers abound with fifh. The natives are robuft and warlike, and make ufe of bows with poifoned arrows, clubs of red wood, and bucklers; they are alfo induftrious, and manufacture cotton cloth for their own wearing. The political ftate of thefe people refembles that of the inhabitants of N. America. They have neither laws nor kings, nor have they any fpecies of authority or political government for punifhing any crime, or reftraining them in any part of their conduct. They acknowledge, indeed, certain caziques, who are heads of their families or villages; but their authority appears chiefly in war, and the expeditions againft their enemies. This authority the caziques obtain, not by hereditary right, but by their valour in war, or by the power and number of their families and relations. Sometimes they owe their pre-eminence to the eloquence with which they difplay their own exploits. Some tribes in this province feem to be among the rudeft people of America united in the focial ftate. They neither cultivate nor fow; they have no houfes in which they refide. Thofe in the inland country fubfift by hunting; thofe on the fea-coaft chiefly by fifhing. Both depend upon the fpontaneous productions of the earth, fruits, plants, and roots of various kinds. In the rainy feafon, when the country is fubject to fudden floods by the torrents from the mountains, deftitute of the fhelter of houfes, they gather bundles of reeds, or ftrong grafs, and binding them together at one end, they open them at the other, and fitting them to their heads, they are covered as with a large cap, which, like a penthoufe, throws off the rain, and will keep them dry for feveral hours. During the warm feafon, they form a fhed with the branches of trees, which protects them from the fultry rays of the fun. When expofed to the cold, which is extreme in December and January, (the weather, during the reft of the year, being very warm,) they make large fires, around which they fleep in the open air. In the mine Yecorato of this province there was found a grain of gold of 22 carats, which weighed 16 marks, 4 ounces, 4 ochavas; this was fent to Spain as a prefent fit for the king, and is now depofited in the royal cabinet at Madrid. The chief mining ftation is Sivirijoa.

CINALOA, a town of Mexico in the above-mentioned province, feated on a river of the fame name, which difcharges itfelf into the gulph of California. N. lat. 26°. W. long. 106° 10′.

CINARA, in *Botany*. See CYNARA.

CINAROCEPHALÆ, the fecond natural order in the tenth clafs of Juffieu, with the following general character and divifions. Flowers all flofculous; florets fometimes all hermaphrodite; fometimes neutral in the ray; rarely feminine intermixed with hermaphrodites. *Calyx* common, many-leaved, imbricated; fcales with or without fpines. *Receptacle* common, befet with hairs, or more frequently with chaff-like fcales; neutral florets often irregular; hermaphrodite ones five-cleft, regular, pentandrous; ftigma of the latter fimple or bifid, often without any marked diftinction from the ftyle. *Seed* downy; down capillary or plumofe. *Stem* herbaceous, rarely frutefcent. *Leaves* alternate, with or without fpines. *Flowers* various in colour, terminal, or rarely axillary.

I. True cinarocephalæ. Scales of the calyx fpinous. *Atractylis, cnicus, carthamus, carlina, arctium, cinara, onopordum, carduus, lappa, crocodilium, calcitrapa, feridia.* II. True cinarocephalæ. Scales of the calyx without fpines. *Jacea, cyanus, zoegea, rhaponticum, centaurea, pacourina, ferratula, pteronia, ftæhelina.* III. Anomalous cinarocephalæ. Calyxes one or few-flowered, aggregate. *Jungia, naffauria, gundelia, echinops, corymbium, fphæranthus.* Juffieu obferves that the genera of the laft divifion do not properly belong either to this natural order, or to the fucceeding one corymbiferæ, but are a link connecting both.

Ventenat has adopted the above divifions, adding in the firft, berardia and cirfium; difcarding pacourina, pteronia, and ftæhelina from the fecond; and retaining only gundelia, echinops, and fphæranthus in the third.

CINARUS, in *Ancient Geography*, an ifland fituated in the vicinity of that of Leros. It is mentioned by Athenæus, Plutarch, and Pliny, the latter of whom calls it "Cinara."

CINCARITANUS, an epifcopal fee of Africa in Bizacium. Some have thought that this fee was in the town of Cercina, in an ifland of the fame name.

CINCENSES, a people of Spain, placed by Pliny in

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the Tarragonenfis; they are probably the Cinnenfes, fo called from the name of the town Cinna.

CINCHONA, in *Botany*, (fo called from the Countefs del Cinchon, lady of a Spanifh viceroy, whofe cure is faid firft to have brought the Peruvian bark into reputation). Linn. Gen. 228. Schreb. 301. Juffieu 201. Vent. 2. p. 573. Gært. 204. Willd. 346. Quinquina; Lam. Encyc. Clafs and order, *pentandria monogynia*. Nat. Ord. *Contortæ*, Linn. *Rubiaceæ*, Juff.

Gen. Ch. *Cal.* Superior, one-leafed, five-toothed, permanent. *Cor.* monopetalous, tubular, funnel-fhaped, deeply five-cleft; tube long, obfcurely angular; fegments lanceolate, or linear. *Stam.* Filaments five, in the middle of the tube; anthers elongated, either fhorter than the tube, or projecting beyond it. *Pift.* Germ inferior, top-fhaped, obfcurely angular; ftyle the length of the ftamens; ftigma thick, either bifid or entire. *Peric.* Capfule crowned with the calyx, two-valved, two-celled; valves opening at their inner fide, turned in at their edges, and feparating, when ripe, fo as to have the appearance of two capfules. *Seeds* numerous in each cell, oblong, compreffed, bordered, attached to a central oblong receptacle.

Eff. Ch. Calyx top-fhaped, five-toothed. Corolla tubular, five-cleft. Stamens five, inferted into the middle of the tube. Capfule oblong, two-valved, two-celled, many-feeded.

* *Flowers tomentous*; *ftamens included.*

Sp. 1. C. *officinalis*, Linn. Sp. Pl. 1. Mant. 1. Lam. 16. Willd. 1. Lam. Ill. Pl. 164. fig. 1. Gært. tab. 33. fig. 4. Woodv. Med. Bot. tab. 200. (Arbor peruviana febrifuga; Rai. hift.) Common Jefuits' bark, or officinal Cinchona. "Leaves ovate-lanceolate, fmooth; capfules oblong." Vahl. A tall tree rather thicker than a man's thigh. *Branches* oppofite, covered with a reddifh brown bark, frequently rugged with obliquely tranfverfe chinks, and marked with the fcars of fallen leaves; upper ones a little compreffed. *Leaves* from two to three inches long, and one broad, remote on the flowering branches, but approximating on the others, oppofite, petioled, acute, fmooth on both fides, green above, paler underneath, marked with lateral fimple parallel nerves, a little curved at the fummit; petioles channelled above, convex underneath: ftipules fmall, acute, caducous. *Flowers* in a terminal, trichotomous panicle; peduncles flightly pubefcent, furnifhed with fmall acute oppofite bractes, at the bafe and about the middle; calyx-teeth fhort, acute; corolla flightly tomentous without, woolly within; fegments acute, fhorter than the tube; anthers the length of the tube; germ tomentous; ftigma thick, flightly bifid. *Capfules* half an inch long, oblong, fmooth, marked with obfcure raifed lines. A native of Peru, growing abundantly on a long chain of mountains, extending between two and five degrees of latitude to the north and fouth of Loxa. The proper time for cutting the bark is from September to November, the only feafon when, in that country, there is fome intermiffion from rain. Care muft be taken not to cut the bark wet; and if it fhould happen to be fo, it is carried directly to the low country to be dried.

This tree has been fuppofed to be the Quina-quina of the Peruvians, and has accordingly been given by many authors as one of its fynonyms. But the contrary has been proved by a fpecimen of the true Quina-quina fent by Monf. Condamine to Cromwell Mortimer, efq. fecretary of the Royal Society, about the year 1749, of which an engraved figure was then publifhed. Anthony Juffieu, who examined a dried fpecimen preferved in the herbarium of Jof. Juffieu, has pronounced it in his natural orders of plants, to be not a Cinchona, and to have no natural affinity with that genus; but to be a decandrous leguminous plant, which he has referred to Myrofpermum of Jacquin, a genus which has been united by Willdenow with the Myroxylon of Schreber. As the fpecimen fent by Condamine, is without fructification, this point cannot be abfolutely determined; but, from the defcription, the opinion of Juffieu feems highly probable, though it does not appear to be taken up by any other author as a diftinct fpecies. It has a triangular furrowed, pithy ftem, with alternate branches; and a thick, leafy, curioufly veined wing running along every angle, like a three-edged fword-blade, terminating here and there in a rounded form. A fragrant refin diftils from the trunk by means of an incifion. The feeds, called by the Spaniards Pepitas de Quinaquina, are of a brown colour, and woody fubftance, having the form of beans or flat almonds, and are enclofed in a kind of doubled leaf, (Qu. valves of the legume?) between which and the feed is found a little of the fame refin that diftils from the tree. Their chief ufe is to make fumigations, which are reputed cordial and wholefome, but their reputation is now on the decline. This tree grows abundantly in feveral provinces of Peru, as in the neighbourhood of Chucuifaca or La Plata, Tanja, &c. The natives make rolls or maffes of the refin, which are ufed for feveral other purpofes in phyfic, fometimes under the form of a plafter, fometimes under that of a compound oil made from the refin, and are fuppofed to promote perfpiration, ftrengthen the nerves, and reftore the motion of the joints of gouty people. In addition to thefe real or imaginary medical virtues, its bark is efteemed an excellent febrifuge, and before the difcovery of the tree of Loxa, was in great repute for curing tertian agues, &c. The Jefuits of La Paz or Chicuiapa gathered its bark which is intenfely bitter, and ufed to fend it to Rome, where it was diftributed under the true name of Quina-quina, and employed for the cure of intermittent fevers. The bark of Loxa, or Cinchona officinalis, having been brought into Europe, and particularly to Rome, by the fame means, the new febrifuge became confounded with the old one, and that of Loxa having been moft ufed, took the name of the firft, which is now almoft entirely forgotten, though the name Cafcarilla, or fmall bark, given to that of Loxa, feems to have been invented to diftinguifh it from fome other, undoubtedly the ancient Quina-quina. See Linnean Tranfactions, vol. iii. p. 59. with a figure copied from the original one.

Two forts of the Loxa bark are in ufe, the pale and the red, poffeffed of fimilar properties, but in a different degree, the latter being found by experience to be the moft powerful. It has been doubted whether they are the produce of different fpecies or of the fame plant from different parts of its furface, or, which is the fame thing, in different ftages of the growth of the bark itfelf. But the queftion feems to be nearly, if not altogether decided, by a drawing of the plant which produces the red kind, fent from Peru to Linnæus, and which appears to be a diftinct fpecies, though its fpecific difference has not been botanically determined. This drawing has been found in the Herbarium of Linnæus by Dr. James Edward Smith, and the ufe of it liberally granted to Dr. Woodville, who has publifhed in his Medical Botany a figure taken from it. See Medical Botany, vol. iii. p. 555. 2. C. *pubefcens.* Mart. 2. Willd. 2. Poiret Encyc. 17. Vahl. Act. Soc. Hift. Nat. Haf. 1. p. 19. tab. 2. "Leaves egg-fhaped, elongated at the bafe, pubefcent underneath; capfule cylindrical." *Root* perennial. *Bark* whitifh, whence it has been called white bark. *Branches* pubefcent on their upper part. *Leaves* from eight to ten inches long, and from five to fix inches broad, petioled, egg-fhaped, obtufe, narrowed at the bafe, and decurrent a little way along the petiole, pubefcent and tomentous underneath, hairy on the principal nerves, almoft fmooth above; nerves ftrongly marked, fimple, parallel, dividing into fmall fimple lateral veins; petioles about two inches

inches long. *Flowers* numerous, in large terminal panicles; bractes small at the base of the divisions of the peduncles; calyx small, with five sharp teeth; corolla scarcely an inch long, furnished with whitish hairs along its edge, and on its inside five-cleft; segments egg-shaped, shorter than the tube. *Capsules* an inch long, smooth, cylindrical, lessening a little at both ends. A native of Peru. Poiret suspects that the Cinchona hirsuta, purpurea & ovata, of Ruiz and Pavon in the Flora Peruviana, are nothing more than varieties of this species. They are thus severally characterized by those authors. C. *hirsuta*. "Leaves oval, thick, reflexed at the edges; the terminal ones somewhat heart-shaped: corolla with a purplish down; border hairy." C. *purpurea*. "Leaves oblong-oval and egg-shaped, purplish; panicle brachiate, large; flowers somewhat in corymbs; corollæ light purple; border hairy, white. C. *ovata*. "Leaves egg-shaped, downy underneath; panicle brachiate; flowers somewhat in corymbs; corollæ purple; border hairy." 3. C. *macrocarpa*, Mart. 3. Poiret 18. Willd. 3. Vahl. Act. Soc. His. Nat. Hafn. 1. tab. 3. Lambert. Gen. Cinch. tab. 3. (C. officinalis; Linn. Syst. Ed. 12. as far as relates to the description. C. officinalis; Linn. Jun. Sup. 144) "Leaves oblong, pubescent underneath, ribbed." *Root* perennial. *Branches* villous-tomentous. *Leaves* petioled, oblong, more than three inches long; somewhat coriaceous, smooth and shining above, pubescent underneath, with villous tomentous ribs; younger ones elliptical, hairy above, especially along the nerves; petioles an inch long; stipules two, lanceolate, caducous, connate at their base, smooth on the inside, often longer than the petioles. *Flowers* in a terminal, trichotomous, pubescent, panicle; peduncles of the ramifications an inch and a half long, compressed, with three nearly sessile flowers; bractes an inch long, linear-lanceolate; with others much smaller, awl-shaped ones at the base of each flower; calyx bell-shaped, pubescent, silky within; with five, sometimes six small sharp teeth; corolla an inch and half long, coriaceous, villous, almost tomentous; segments of the border lanceolate, obtuse, the length of the tube; filaments very short; anthers linear, longer than the tube; germ five-sided, obtuse; stigma bifid. *Capsule* two inches long, cylindrical, smooth, narrowed at the base; the two valves, as the fruit ripens, widely separating both at their base and summit. A native of Santa Fé. Vahl received it from Ortega.

** *Corollæ smooth; stamens projecting.*

4. C. *caribæa*, Linn. Sp. Pl. 2. Mart. 4. Poir. 1. Willd. 4. Jacq. Amer. tab. 179. fig. 95. Observ. Bot. 2. p. 47. Amer. pict. tab. 63. Gært. tab. 33. fig. 4. (C. Jamaicensis; Wright Act. Angl. Vol. 67. p. 504. tab. 10.) "Peduncles axillary, one-flowered." A tree from ten to twenty feet high. *Branches* dark brown, smooth, striated; often marked with brilliant oval, white or yellowish spots. *Leaves* two inches long or more, and about one broad, oval, lanceolate, narrowed at both ends, entire at their edges, thin, smooth on both sides; petioles short; stipules very small, broader than long, ciliated, acuminate. *Flowers* numerous; dusky yellow; peduncles not longer than the petioles, smooth; calyx smooth, short, somewhat cylindrical, with five short, acute teeth; tube of the corolla cylindrical; segments of the border long, linear, rather obtuse, smooth, longer than the tube; stamens a little projecting; anthers pale yellow, very long, narrow. *Capsule* opening from the top, black, with an even surface, very smooth, shining. *Seeds* oval, compressed, surrounded with a salient border. A native of Jamaica and Guadaloupe. It is called in Jamaica, Sea-side Beech. The bark in general is smooth and grey on the outside, though in some specimens rough and scabrous. Its flavour is sweet, with a mixture of the taste of horse radish, and the aromatics of the East, but when swallowed has the bitterness and astringency of the Peruvian bark. 5. C. *longiflora*, Poir. 2. Lamb. Gen. cinchon. p. 12. "Peduncles axillary, one-flowered; leaves linear-lanceolate, smooth; corolla very long." Nearly allied to the preceding, but distinguished from it by the remarkable length of the flowers, and by its longer narrower leaves. A tree. *Leaves* opposite, near together, with oblique lateral nerves, on moderately long petioles; stipules small, acute; segments of the border of the corolla linear, three or four times shorter than the tube. 6. C *corymbifera*, Mart. 5. Poir. 3. Willd. 5. Linn. Jun. Sup. 144. Forst. Act. Nov. Up. 3. p. 176. Flor. Aust. Prod. 88. "Leaves oblong-lanceolate; corymbs axillary." *Trunk* six feet or more in height, upright, round, smoothish, the thickness of the human arm. *Branches* round, spreading, opposite; upper ones herbaceous, compressed at the joints. *Leaves* three inches long, opposite, with an even surface, smooth, acuminate, quite entire, deep green, mid-rib purple underneath; petioles scarcely an inch long, round, spreading; stipules membranous, acute. *Flowers* white, red on the outside, dusky purple before they open; corymbs large, dichotomous; peduncles solitary, compressed at the tip, the length of the leaves; partial peduncles three, an inch long, angular, trifid; pedicels one-flowered; two, three, four, or more together, half an inch long, round, slender, erect; bractes very small, membranous, solitary, acute, at the base of each pedicel; corolla tubular; segments of the border shorter than the tube, narrow, obtuse, curved inwards; anthers erect, a little projecting; stigma thick, simple. A native of the islands of Tongatabu and Eaoowe in the South Seas, where it is cultivated for the odour and elegance of its flowers. Its bark is extremely bitter, and somewhat astringent, much resembling the common Jesuits' bark. 7. C. *lineata*, Mart. 6. Poir. 4. Willd. 6. Vahl. Act. Soc. Hist. Hafn. 1. tab. 4. Lambert. Gen. Cinch. tab. 6. "Panicle terminal; leaves egg-shaped, acuminate, smooth; capsules five-sided." A tree. *Branches* cylindrical, especially at the base, greyish, purple, and compressed near the top. *Leaves* two inches or more long, and one broad, on short petioles, not at all shining, bluntish, thin, smooth; nerves simple, lateral; stipules egg-shaped, acute. *Flowers* in large trichotomous panicles; peduncles compressed, three-flowered; bractes bristle-shaped; calyx-teeth long, awl-shaped; corolla two inches long or more; tube cylindrical; segments of the border linear, obtuse; germ five-sided, obtuse; stigma globular. *Capsules*, short, small, brown, smooth, oval, crowned with the teeth of the calyx. Nearly allied to C. floribunda and C. angustifolia; but differs from the latter in having much broader leaves, and from both in having its leaves rounded at the base with nerves visible on both sides. A native of the West Indies. 8. C. *floribunda*, Mart. 7. Poir. 5. Willd. 7. Vahl. Act. Soc. Hist. Nat. Hafn. 1. p. 123. Lam. Ill. Pl. 164. fig 2. Lamb. Gen. Cinch. tab. 7. (Cinchona floribus paniculatis, glabris, &c. Swartz Prod. 41; flor. Ind. Occid. 1. p. 375. Nov. Act. Acad. Nat. Curios. 9. p. 1. fig. 1. C. montana; Badier Journ. de Phys. feb. 1. 789. p. 129. fig. 1. Aust. Bot. Mag. p. 96. tab. 3. C. Sanctæ Luciæ; Philos. Trans. vol. 74. p. 452. tab. 19. Trachelium arborescens & fluviatile; Desport. Hist. Morb. S. Doming. 2. p. 231. Quinquina piton; Journ. de Phys. 1781. p. 169—179.) "Panicle terminal; capsules top-shaped, with an even surface; leaves elliptical, acuminate." A tree, thirty or forty feet high. *Trunk* straight, about a foot in diameter. *Branches* cylindrical at the bottom, obscurely tetragonal and purplish near the top. *Leaves* from eight to ten inches long, three or four broad, petioled, opposite, lanceolate-elliptic, acuminate, quite smooth,

ſmooth, even and ſhining on the upper ſurface, paler underneath, veined; nerves lateral, projecting, parallel, a little branched and confluent at their extremity; petioles an inch and half long; ſtipules oppoſite, ſheathing, oblong, obtuſe, caducous. *Flowers* at firſt white, afterwards purpliſh, numerous; panicle large; ramifications oppoſite, compreſſed, quite ſmooth; calyx-teeth very ſhort, awl ſhaped; tube of the corolla cylindrical, an inch long; ſegments of the border long, ſmooth, linear; ſtigma oval, entire. *Capſules* oblong, black, narrowed at the baſe. The bark of this ſpecies is more bitter and more aſtringent than that of C. officinalis. A native of St. Lucia, Martinico, Guadaloupe, and Hiſpaniola, where it bears the name of Pitton, becauſe it is found on the tops of mountains, which bear that name in the Weſt Indies, the mountains themſelves being called Morne. 9. C. *brachycarpa*, Mart. 8. Poir. 6. Willd. 8. Vahl. Soc. Hiſt. Nat. Hafn. 1. p. 24. Lamb. Gen. Cinch. tab. 8. Swartz. Prod. 42. Ind. Occid. vol. i. p. 378. "Panicle terminal; capſules inverſely egg-ſhaped, ribbed, leaves elliptical, obtuſe." *Leaves* large, ſmooth on both ſides; nerves alternate, lateral, a little branched at the ſummit; petioles ſhort; ſtipules ſhort, egg-ſhaped, acute. *Panicle* trichotomous, furniſhed with ſmall bractes at the diviſion of the peduncles; calyx-teeth ſhort, a little obtuſe; tube of the corolla rather long, cylindrical, ſlender; ſegments of the border linear, reflexed; ſtigma ſimple, globular. *Capſule* with ten ſtrong projecting ribs, connivent at their baſe. A native of Jamaica. The deſcription formed by Poiret from Lambert's figure. 10. C. *anguſtifolia*, Mart. 9. Poir. 7. Willd. 9. Swartz. Act. Stockh. Ann. 1787. p. 117. tab. 3? Prod. 42. Flor. Ind. Occid. 1. p. 380. Lam. Illuſt. Pl. 164. fig. 3. Lamb. Gen. Cinch. tab. 9. "Flowers panicled, ſmooth; capſules oblong, five-ſided; leaves linear-lanceolate, pubeſcent." A ſmall tree, from ten to fifteen feet high. *Trunk* upright, ſmooth, with a wrinkled aſh-coloured bark, which becomes brown and ſtriated near the root. *Branches*, ſlender, filiform, ſmooth. *Leaves* two or three inches long, ſcarcely half an inch broad, oppoſite, petioled, ſoft to the touch; ſtipules ſmall, egg-ſhaped, acute. *Flowers* white, odorous; panicle terminal, frequently with trifid ramifications; bractes ſmall, ſhort; calyxes ſhort, tubular, pubeſcent, with five upright awl-ſhaped teeth; tube of the corolla an inch long, ſmooth, ſlender; ſegments of the border the length of the tube, linear, narrow, obtuſe, reflexed. *Capſules* ſhort. *Seeds* very ſmall, ſmooth, rounded. A native of Hiſpaniola on the borders of rivers in a rocky ſoil. 11. C. *coriacea*, Poir. 8. (Cinchona nitida; Flor. Peruv.?) "Leaves ovate-oblong, ſhining on both ſides, coriaceous; panicles ſhort, ſmooth; anthers projecting, filiform." *Branches* with an even ſurface ſtriated; bark cinereous. *Leaves* oppoſite, petioled, narrowed at their baſe, obtuſe at their ſummit; nerves lateral, alternate, a little branched at the ſummit, projecting on the under ſurface of the leaf. *Flowers* in terminal panicles, with nearly dichotomous ramifications, on ſtiff ſmooth peduncles; calyx oblong, with upright acute teeth; corolla two inches long; tube ſtraight, cylindrical; diviſions of the border narrow, obtuſe, the length of the tube, ſmooth, reflexed; anthers upright, filiform. *Capſules* an inch long, blackiſh, cylindrical. A native of St. Domingo. The C. nitida of Ruiz and Pavon, Flor. Peruv. vol. ii. tab. 191. has inverſely egg-ſhaped, ſhining leaves; a brachiate panicle; light purple corollæ with a ſomewhat hairy border. Poiret judges it to be near a-kin to this ſpecies; but its panicle is larger, the tube of the corolla only half the length, and its capſule elongated; diminiſhing a little at its ſummit. 12. C. *grandifolia*, Poir. 9. Ruiz and Pavon Flor. Peruv. vol. ii. tab. 196. "*Leaves* oblong and oval, ſmooth; panicle brachiate; flowers ſomewhat in corymbs: corollas white, with a ſlightly villous border." A large tree with a denſely tufted head. *Bark* cinereous brown, reddiſh within, of an even ſurface, bitter and acidulous, without being unpleaſant. *Younger Branches* quadrangular, reddiſh. *Leaves* from one to two feet long, quite entire; ſhining on the upper ſurface, paler underneath, traverſed by purple veins; the principal ones furniſhed at their baſe with whitiſh ſilky hairs. *Stipules* oval, acuminate, caducous. *Flowers* white; corymb-like panicle about a foot long, and much branched, leafy; bractes ſmall, oval, acute; calyx purple, five-toothed; corolla an inch long; border a little villous within; ſtamens incloſed within the tube; anthers oblong, bifid at their baſe. *Capſule* large, ſcarcely ſtriated. *Seeds* oval, membranous at their borders. A native of Peru in the foreſts of the Andes in the neighbourhood of torrents. 13. C. *parvifolia*, Poir. 10. "Leaves egg-ſhaped, obtuſe, ſmooth; flowers panicled, twice-trichotomous, villous; corolla very ſmall. C. micrantha; Flor. Peruv. v. ii. tab. 194.? "Leaves oval, obtuſe; panicle large; flowers numerous, ſmall, white, with a woolly border." *Branches* ſmooth, upright, cylindrical. *Leaves* three inches long or more, one and a half broad, thin, entire membranous, petioled, with lateral nerves, narrowed at their baſe. *Stipules* oppoſite, ſheathing, awl-ſhaped, enlarged at the baſe. *Flowers* in a moderate panicle; peduncles axillary, oppoſite towards the extremities of the branches, upright, forked at the ſummit, each fork trichotomous, villous, compreſſed, with about three pedicelled flowers; bractes ſmall, at the baſe of the diviſions; calyx ſhort, tubular, villous; teeth ſcarcely viſible; corolla three or four lines long, pubeſcent on the outſide; ſegments of the border obtuſe. Stamens not projecting. *Capſule* unknown. A native of Jamaica. The Peruvian plant of Ruiz and Pavon has larger panicles; a corolla white on the inſide, reddiſh without, pubeſcent; and an oblong, acute, brown, capſule, with ten obſolete ſtriæ. 14. C. *lanceolata*, Poir. 11. Flor. Peruv. vol. ii. p. 51. "Leaves lanceolate-oblong; panicle brachiate, large; flowers ſomewhat in corymbs; corollas purple, inclining to roſe-colour; border hairy." A tall tree. *Bark* brown, a little ſpotted, yellowiſh within, very bitter, a little acid, but not unpleaſant. *Leaves* oppoſite, petioled, quite entire, ſmooth on both ſides, with purpliſh veins: petioles half an inch long; ſtipules flat, egg-ſhaped, obtuſe, connate at the baſe. *Panicle* terminal, wide-ſpreading; bractes ſmall, awl-ſhaped, caducous; calyx ſhort, purple; border of the corolla open, villous; ſtamens villous at the baſe. *Capſule* an inch long, oblong, narrow, ſlightly ſtriated, reddiſh brown, opening from the baſe to the ſummit. *Seeds* egg-ſhaped, with a membranous border, often much torn. A native of Peru on the mountains of Muyna. 15. C. *grandiflora*, Poir. 12. Flor. Peruv. vol. ii. tab. 198. "Leaves oval and inverſely egg-ſhaped, very ſlightly veined, coriaceous, white underneath; corymbs terminal; corollæ, large, ſmooth, white." A tree about twenty feet high. *Bark* cinereous brown, yellowiſh within, rather leſs bitter than the other ſpecies. *Branches* ſpreading; younger ones ſlightly tetragonal. *Leaves* ſpreading, rather near together, quite entire, ſhining green above, ſtipules obtuſe, ſlightly ſtriated. *Flowers* about thirty in a corymb, of a pleaſant ſmell, peduncled; bractes awl-ſhaped; calyx funnel-ſhaped, tubular, teeth upright, ſharp; corolla ſmooth; ſegments of the border reflexed; ſtigma two-lobed, oblong. *Capſule* narrowed at the baſe, marked with two furrows, opening from the ſummit to the baſe. *Seeds* numerous, very ſmall, with a linear membrane, on a large receptacle. A native of Peru in the foreſts of the Andes. 16. C. *roſea*, Poir. 13. Flor. Per. vol. ii. tab. 199. "Leaves oblong, obtuſely acuminate; panicle brachiate;

brachiate; flowers in corymbs; corollæ rofe-coloured; border tomentous at the edge." A tree, fifteen feet high. *Bark* brown, even, with cinereous fpots, very aftringent, flightly bitter. *Leaves* oppofite, petioled, very large, quite entire, fmooth, fhining, veined underneath; ftipules egg-fhaped, obtufe, purple, pubefcent on the outfide, connate at the bafe. *Flowers* in a terminal corymb; peduncles fpreading, pubefcent, compreffed; bractes egg-fhaped, acute; calyx fhort, purple; tube of the corolla fhort, flightly curved, cylindrical, fmooth at its edge, dilated into a tomentous border; fegments of the border fhort; ftamens villous at the bafe, fhorter than the border. *Capfule* a little recurved. A native of Peru in the forefts of the Andes. 17. C. *dichotoma*, Poir. 14. Fl. Peruv. vol. i. tab. 197. "Leaves oblong-lanceolate; peduncles terminal, dichotomous, few-flowered; capfules narrow, linear, long." A low tree. *Bark* brown, a little rugged, marked with whitifh fpots. *Branches* cylindrical, a little compreffed between the joints. *Leaves* flat; principal nerves oppofite; fmaller ones almoft reticulated; ftipules egg-fhaped, oblong, obtufe. *Flowers* in a loofe panicle; ramifications oppofite, with an expanded bifurcation. *Flowers* unilateral, nearly feffile. *Capfules* about two inches long, flightly ftriated; valves boat-fhaped. *Seeds* numerous, brownifh, with a narrow membranous wing. A native of Peru. 18. C. *caroliniana*, Poir. 15. (Pinkneya pubens; Michaux Flor. boreal. Amer. vol. i. tab. 13.) "Pubefcent; leaves egg-fhaped; flowers in a fafciculated panicle, axillary." Poiret. A middle-fized tree. *Branches* oppofite, villous, cylindrical, a little compreffed near the end. *Leaves* fix inches long, or more, three broad, petioled, narrowed at the bafe, pubefcent underneath, efpecially along the principal nerves, green and fmooth above; petiole fhort, pubefcent; ftipules two, lanceolate, acute, caducous. *Flowers* almoft feffile; calyx oblong, top-fhaped, divided at its orifice into five oblong, acute, nearly equal, caducous fegments, one of which often lengthens into the appearance of a leaf, or oval bracte, about an inch long, of a yellowifh white colour, as in muffærda frondofa; corolla tubular, cylindrical, pubefcent, an inch long or more; fegments of the border oblong, obtufe, reflexed, two-thirds fhorter than the tube; filaments attached to the corolla a little above the bafe, briftle-fhaped, upright; anthers projecting, almoft verfatile, obtufe, fhorter than in the other fpecies; germ enclofed in the tube of the calyx: ftyle the length of the ftamens; ftigma thick, almoft dichotomous. *Capfule* large, rounded, a little compreffed, marked with two oppofite furrows, obtufe, flattened and naked at its fummit, coriaceous, two-celled; partition reaching only to the middle. *Seeds* numerous, almoft round, with a fhort membranous ring. A native of Carolina and Georgia. Michaux on account of fome peculiarities found for it a new genus: but on account of its near affinity to Cinchona, Poiret has been induced to place it here.

Obf. Poiret obferves that Cinchona fpinofa of Lambert is evidently a fpecies of Catefbœa, near a-kin to catefbœa fpinofa of Linnæus.

Cinchona, in the *Materia Medica; Peruvian Bark.* This moft valuable medicine was firft introduced into Europe by the Jefuits as a cure for intermittent and other fevers, the ufe of which had long been known to the inhabitants of Peru and other parts of the American continent. It long remained a lucrative article of commerce to the order, whence it obtained the name of *Jefuits' Bark* or *Jefuits' Powder;* and it gradually (though not without confiderable oppofition at firft from the regular phyficians) rofe in reputation, and its ufe has extended over all the civilized world, fo that it has for many years been juftly efteemed as the moft fafe and powerful febrifuge which we poffefs.

There are three principal forts of Peruvian Bark in common ufe, and known in the European markets; befides which, there are many other varieties which are generally confounded with one or other of the above three forts, and which differ from them only by fome flight circumftances, fo as hardly to require a diftinct notice in a general defcription like the prefent. The three common forts now in ufe, are the *pale*, the *red*, and the *yellow* bark, and of thefe the two laft are comparatively of very recent date, and the red is now become very fcarce and is hardly ever imported, fo that in fact the pale and the yellow are the only barks now feen.

The chemical analyfis and fenfible properties of each, are on the whole extremely fimilar, but there is found an infinite variety in the proportion of conftituent parts.

The pale bark is brought over from the Spanifh main, in large bundles clofely packed up in goat and other fkins, and in pieces of different fizes, fome rolled up into fhort thick quills, and others flat. The outfide is brownifh and fcabrous, and generally covered with mofs; the infide is of a dull red or rufty iron colour. The beft fort breaks clofe and fmooth, and often minute fhining grains of a blackifh refin may be difcovered by clofe examination. It is very friable when chewed, and readily breaks down into a powder of a light cinnamon colour. The inferior forts are more tough and fibrous.

The yellow bark is in much larger pieces than the pale, and flatter and thicker. The outer part is fmoother, and the colour of the inner part is of a light red. It weighs lighter than the pale, and when reduced to powder, its colour is paler.

The red bark is alfo in larger and thicker pieces than the pale, and more convoluted than the yellow, though not actually forming quills or cylinders. It alfo breaks fhort, and the inner part is very red.

All the fpecies of cinchona have fo many properties in common, that the fame defcription is here meant to apply to all, except the contrary be particularly fpecified. The cinchona has a flight and fomewhat mufty fmell, though this may, perhaps, arife from the fkin in which it is packed. It requires to be chewed for a little while before the tafte comes out fully, which then is bitter and aftringent, with a flight aroma, but not fufficient to prevent its being difagreeable to moft palates.

The chemical analyfis of the cinchona has been attempted by fome able chemifts; and the effect of water, alcohol, and other reagents, as far as is neceffary for pharmaceutical purpofes, has been examined, with confiderable care. Enough has been learnt by them to decide on the beft mode of exhibition of this valuable remedy, but to the fcientific chemift much doubt ftill remains as to the true nature of many of the conftituent parts of this, as probably of all other refinous barks.

We fhall firft mention the fimpler experiments that relate more efpecially to pharmacy, and then defcribe fome more elaborate chemical proceffes.

The firft menftruum to be mentioned, is water. This fluid, whether hot or cold, acts fpeedily and powerfully on the cinchona. If this bark, thoroughly bruifed and reduced to coarfe powder, be boiled for a few minutes in water, it makes a clear decoction, which, when hot, is clear and reddifh, but on cooling it becomes very turbid and of a pale yellowifh or wheyifh hue, and a dark brown fediment is depofited. This decoction is intenfely bitter, gives a deep black with folutions of iron, and a very fmall quantity of precipitate with a folution of ifinglafs or glue. The latter circumftance fhews that it contains a little tannin; the blackening

with

with iron indicates gallic acid, and the bitternefs is occafioned by the prefence of an extractive matter, the peculiar quality of which will be prefently mentioned more at large. On keeping for fome days the fupernatant liquor of the decoction becomes almoft colourlefs and tranfparent, and the precipitate more copious. In time, though not very fpeedily, it grows mouldy and four, and acquires rather an offenfive fmell. A few drops of the ftrong acids added to the frefh decoction caufe a copious precipitate in a few minutes, and the clear liquor is left nearly without colour, but its tafte is ftill intenfely bitter.

If the fame portion of bark be boiled fucceffively with different portions of water, employing only a few minutes in each boiling, the contents of the feveral decoctions fhew, in fome meafure, the different degrees of folubility of the conftituent parts. The quantity of bitter extract given by thefe decoctions is by much the greateft in the firft, and goes on uniformly diminifhing till the whole is exhaufted. The gallic acid is more difficult of extraction, fo that the decoction will blacken the folutions of iron after it has ceafed to poffefs any other fenfible property. It has been mentioned, that the decoctions of bark grow turbid on cooling, and depofit a fediment in which much of the medicinal virtue is fuppofed to refide. This applies peculiarly to the firft decoction, which is loaded with foluble matter. If the turbid liquor be again heated, a part of the fediment is re-diffolved, but not the whole, and the proportion of infoluble matter is much increafed by the length of time employed in the boiling, and the furface expofed to the air. Hence it is inferred, and this is fupported by other chemical reafons which will be afterwards mentioned, that part of the foluble matter of the bark becomes permanently infoluble by abforbing oxygen from the air; and when thus rendered infoluble, it is alfo inferred, that it has loft moft of its medicinal properties, fo that the practical direction feems to be indicated in preparing this decoction, to boil the water on the bark only a fhort time, and in a covered veffel.

Cold water alfo diffolves very readily a confiderable portion of the foluble matter of the bark, and faturates itfelf with it in a digeftion of a few hours. This infufion is of a light brown red, and quite tranfparent. Its tafte is very bitter and lefs naufeous than the decoction. But by keeping it grows turbid, and are dinfoluble powder is precipitated. This infufion has been adopted in medicine in the proportion of about one part of powdered bark to eight of cold water, infufed for about fix hours, with occafional ftirring. It appears, however, from Dr. Lewis's experiments, that a fingle hour produces as ftrong a folution.

Alcohol digefted on bark acquires a deep brown colour, and a ftrong bitter and aftringent tafte. This folution, when evaporated to drynefs, leaves a black, fhining, brittle refin.

Dilute fpirit of wine alfo acquires a deep colour and ftrong impregnation with the active principle of the cinchona, by digeftion for a few days in a moderate heat. On increafing the heat, the colour deepens, and the fpirit becomes turbid, and a fediment is depofited which will not again entirely re-diffolve. The tincture of bark is made with dilute alcohol. The bark, after the utmoft effect of the alcohol, ftill yields fome foluble matter to water, and the decoction thus made is both bitter and aftringent. A part of this matter, which alcohol will not diffolve, and which water will, is the mucilage which the cinchona is found to contain in a notable quantity, and which, as in other cafes where mucilage is prefent, though infipid itfelf, ftrongly unites to a portion of the bitter extract and gallic acid, and appears to defend it from the action of the alcohol.

When a ftrong decoction of cinchona is evaporated at a boiling-water heat, it gradually becomes more and more turbid, deepens in colour almoft to a brownifh black; and at laft a dark pitchy-looking *extract* is left behind, which may be infpiffated to perfect drynefs if required, but in pharmacy is generally left of the confiftence of thick pafte. This extract has a ftrong, fomewhat faccharine, and agreeable fmell; to the tafte it is intenfely bitter and aftringent; it readily diffufes in water, but a part only is diffolved. The extract, of courfe, contains all the foluble parts of the bark blended together, partly in chemical union and partly in fimple mixture; and is, in fact, an extremely compound mafs. Its analyfis will be mentioned at the conclufion of this article. The directions given for preparing this extract in the pharmacopœias are extremely fimple and very fimilar. The cinchona is boiled with ten or twelve times its weight of water for an hour or two, and when the firft decoction is poured off, the bark may be again boiled with a frefh portion of water. The united decoctions are then evaporated at a boiling heat till they begin to be thick, and the drying to a due confiftence is then to be performed over a water-bath or in a ftoved room. The water-bath, however, is, in fact, feldom ufed, being very tedious; but the whole is performed by moft of the druggifts in this town in a fingle pan over a naked fire, which is kept very flack towards the end, and the extract conftantly ftirred to avoid burning.

The extract of bark is made in London only from the pale bark. The yellow bark does, indeed, furnifh a confiderable portion of extract, but the parts are apt to feparate fpontaneoufly, and it has not that uniform pitchy confiftence which the common extract has. The quantity yielded by different barks varies extremely, nor does there appear any other criterion to judge of the goodnefs of any fample of cinchona for this purpofe, except that nice and minute obfervation of colour, fracture, and the like, which is acquired by long and extenfive practice. It is reckoned a very good bark that yields a fourth of its weight of extract.

The cinchona is exhibited in medicine in a variety of forms. The fimple powder is by far the moft efficacious, and, in fact, is the only form that can be depended on for the cure of intermittents, and many other difeafes that require the vigorous ufe of this medicine. In London, the bark is powdered in large quantities in mills, where it is reduced to a moft impalpable duft. Some difficulty is found in bringing it entirely to this ftate, on account of the different degrees of brittlenefs of the feveral parts of the bark, fo that much of it would be loft in fine duft before the whole was powdered unlefs fome addition be made in the mill. To prevent this, fome add a fmall quantity of oil of almonds. This operation alfo gives the opportunity of practifing many frauds and adulterations; one of the commoneft of which is to mix in with the frefh bark that which has already ferved for the purpofes of decoction and tincture, and therefore has loft moft of its virtue, though not the whole.

The dofe of the powder, when good and genuine, is from twenty to fixty grains. The great inconvenience attending the powder is, the extreme difguft which it is apt to give to fick perfons, partly from the tafte, which is naufeous, and partly from the mere bulk and quantity of impalpable powder which muft be got down. This difguft too does not always go off, but as often increafes by ufe. Befides this inconvenience, the cinchona in any form is liable to produce coftivenefs, and as the powder of bark itfelf is little foluble in the ftomach, the whole alimentary canal is apt to be loaded and oppreffed with the accumulated dofes of the powder, fo that after a long courfe of this medicine, it is often difcharged from the bowels unaltered, and may be clearly

clearly detected in the ſtools. An occaſional purgative, therefore, is particularly neceſſary in a long courſe of this medicine.

The diſagreeable taſte and feel of bark in the mouth may be conſiderably checked and corrected by various ways. A cup of coffee with cream and ſugar will bear the addition of a doſe of the powder, with very little alteration in the taſte, if taken immediately on mixture. Red wine is often uſed as a vehicle, or water with a ſmall quantity of brandy or warm tincture. Liquorice is generally thought to cover the taſte moſt effectually; or elſe the powder may be made into a ſtiff electuary with a little ſyrup, and a lump of this, equal to the required doſe, may be wrapped up in wafer paper and ſwallowed.

In the liquid form the decoction is the moſt commonly uſed, and by far the beſt. The London College direct that one ounce of coarſely powdered bark be boiled with a pint and three ounces of water for ten minutes only, in a covered veſſel. The decoction, which is clear when hot, ſhould be ſlightly ſtrained before it cools; and whenever it is uſed, it ſhould be ſhaken, that the ſediment, which ſubſides when cold, be again mixed with the clear liquor. The decoction is undoubtedly the beſt ſubſtitute for the entire powder, if it is taken in large quantity. The uſual doſe is about two or three ounces, repeated a few times in the day, but it may be taken much more liberally without inconvenience. To increaſe its ſtrength, many practitioners add ſome of the powder to it, which by ſhaking will remain ſuſpended in it long enough for the purpoſe.

The cold infuſion of bark, made by macerating, in a moderate heat, one part of the bark with eight or ten of water for five or ſix hours, is alſo of conſiderable ſervice.

We find in different pharmacopœias an abundance of formulæ for the tincture of bark, all of which have nearly the ſame intention. Though proof ſpirit extracts much of the virtue of the cinchona, no quantity of tincture that could be borne without intoxication, could be depended on in diſeaſes where the cinchona itſelf was the proper remedy. The tincture therefore is only an auxiliary medicine, and is principally employed as a ſtomachic or mixed with the decoction. Two tinctures are in common uſe: the ſimple tincture, made merely with the bark and proof ſpirit; and the compound tincture (firſt brought into uſe by Dr. Huxham), in which the cinchona is combined with ſerpentaria and orange-peel.

When the extract of cinchona was firſt introduced, very ſanguine expectations were entertained of its ſuperior utility. As the inconveniences attending the entire powder were its bulk and the quantity of woody and apparently inert matter which it contained, it was expected that by exhauſting the bark of its ſoluble part, and exhibiting that portion in the condenſed form of extract, every poſſible advantage would be combined. But experience has not confirmed theſe expectations, at leaſt by no means to the full extent; for, whatever may be the cauſe, it is not found that doſes of ten grains of the extract are generally equivalent to forty or fifty of the powder, nor is it often that patients who reject the powder can bear the other in ſufficient quantity. Still, however, the extract is a valuable medicine, but it is chiefly employed in the form of pills as a ſtomachic, and in chronic diſorders, and ſeldom as a ſubſtitute for the powder in the more important caſes.

A very pure extract has long been known in pharmacy, and invented by the count la Garaye, and called after his name, or ſometimes *eſſential ſalt of bark*. The inventor firſt conceived the idea of preparing the ſuppoſed *eſſential* or finer part of the ſoluble matter of the cinchona as well as of other ſubſtances by infuſion in cold water, aſſiſted by violent and long continued agitation. This was peformed by La Garaye in ſmall mills, and with a complicated apparatus, which, however, is not neceſſary. This kind of extract is ſimply prepared by adding cold water to powdered bark, macerating them for two days with frequent ſtirring, and then evaporating very ſlowly the infuſion, which is ſtrongly impregnated with the active and ſenſible properties of the cinchona. The extract thus prepared, if the evaporation be well managed, has a fine granular appearance, ſtrongly reſembling a ſalt, and was taken for one by the inventor. It is ſcarcely ſoluble again in cold water, probably owing to the action of the air during the long evaporation, but it has not been examined in a ſatisfactory way. This preparation is tedious and expenſive, and though it is extolled by ſome writers, it by no means deſerves the high character given to it by the inventor, nor does it appear at all preferable as a medicine to the common extract.

A very valuable analyſis has been made by Fourcroy of one ſpecies of the cinchona from St. Domingo, (publiſhed in the 8th and 9th vol. of the Annales de Chimie,) which contains ſeveral new facts on the nature of the extract of cinchona, and which, therefore, may be with propriety introduced here. Some of the obſervations will, doubtleſs, apply to all the vegetable barks and to vegetable extract in general. The operations of this excellent chemiſt on the cinchona, as far as relate to extract, are the following: A pound (16oz.) of the cinchona reduced to powder was boiled twelve times ſucceſſively for a quarter of an hour, in about 26lbs. of water each time. The firſt decoction was a deep brown red, very bitter, and ſtrongly frothed in boiling. It yielded by evaporation in a gentle heat five ounces ſeven grains of a brown dry extract. The ſecond decoction was much leſs coloured, and gave only nine gros (of 72 grs. each) of extract. The third gave only two grains of extract. The taſte and other ſenſible qualities of the ſeveral decoctions alſo gradually diminiſhed to the twelfth, which was little elſe than pure water. The entire quantity of extract obtained was 9 oz. 56 grains. A ſecond ſeries of decoctions was then made with the ſame quantities, and preciſely in the ſame way, except that each decoction was allowed to cool before evaporation, during which the ſix firſt liquors depoſited in decreaſing quantities a quantity of black tenacious extract, apparently inſoluble in cold water. The ſupernatant liquors were then united, and the whole was evaporated to 2 lbs., and the depoſit on cooling was added to the other extracts, which altogether amounted to two ounces leſs than the quantity obtained in the former way, which two ounces, therefore, were eſtimated to be the quantity of extract retained in the 2 lbs. of clear decoction after cooling. This laſt, on mixture with alcohol, depoſited about an ounce of a whitiſh coheſive maſs, evidently different from the black extract, and which was proved to be a pretty pure mucilage. The black extract was then treated with boiling alcohol, by which all was diſſolved, except about $\frac{1}{15}$th, that remained behind in the form of a *red powder*. This laſt was digeſted in cold water, which diſſolved out of it a third of its weight of mucilage, ſimilar to that precipitated on adding alcohol to the decoction, and the remainder was, as before, a fine red powder inſoluble in cold water, and in alchol hot or cold. The alcoholic ſolution was then let to ſtand in the air for ſome days, when it depoſited a ſmall quantity of brilliant cryſtalline grains. It was then mixed with water, and in ſome hours a number of white flocculi ſeparated. Laſtly, the alcohol and water were totally evaporated, and there remained a large quantity of extract. By repeating this mode of analyſis with the entire extract obtained by the firſt proceſs, procefs, a pound of cinchona was found to yield the following foluble matter:

	oz.	gros.	grains.
Of mucilage - - - -	1	1	0
Cryftalline grains feparated from the folution - - -	0	1	0
Flocculi feparated by adding water to the folution - - -	0	1	12
Red powder infoluble in alcohol -	0	2	0
Extract left at the laft operation -	7	0	44
Lofs - - - - -	0	3	0
Total of extract obtained - -	9	0	56

Of thefe five conftituent parts of the entire extract, or foluble part of the cinchona, the author principally attends to the two latter, namely, the red powder, and the extract left behind after all the other fubftances have been feparated from it. With regard to the three firft, the mucilage very clofely refembled the common gum-mucilages; the cryftalline grains were infoluble in alcohol, and in cold water, but yielded to a large quantity of boiling water, were diffolved in alkalies, and gave fome ammonia by diftillation; and the flocculi refembled the gluten of wheat.

The red powder the author clearly fhews to be different from refin or any of the fuppofed immediate principles of vegetables. It is infoluble both in water and alcohol, but it unites with alkalies immediately and infeparably, and, therefore, effentially differs from the refins. Its colour is extremely durable, and little affected by oxymuriatic acid. The true nature of this refin was attempted to be explained by experiments on the extract.

This extract is, obvioufly from its quantity and its fenfible properties, the moft important part of the foluble portion of the cinchona. When quite dry, it is hard, fhining, and brittle, black, or deep brown, and intenfely bitter. It is totally and permanently foluble in hot alcohol, infoluble in cold water, but foluble in boiling water; from which, however, the greater part feparates on cooling, unlefs very largely diluted.

A fmall portion of the extract was diffolved in a large quantity of water and oxymuriatic acid gas paffed through. The firft effect of the acid was to give the folution a clear red colour, and to feparate a red flocculent powder. More of the gas deprived the liquor of colour, and much lightened that of the powder. After feparating all the red powder, which amounted to $\frac{1}{8}$th of the extract originally employed, the liquor (now faturated with the acid gas), was evaporated and left a black acerb-acid mafs.

The extract, therefore, appears, by this experiment, to be compofed of two parts; the one, capable of being converted by the oxymuriatic acid into this red powder, and the other not. The red powder thus produced artificially was found to refemble exactly that naturally contained in the entire extract, and which appears to be a conftituent part of the cinchona. Hence the author concludes, that the red powder confifts of extract altered by oxygenation, the oxygen in the one cafe of its production being abforbed from the atmofphere by the decoction, during its long evaporation, and in the other, furnifhed by the oxymuriatic acid. In confequence of this hypothefis, he adds, that the quantity of this red powder is in direct proportion to the time of expofure to the atmofphere; and as it may be inferred to be very inert as a medicine, from its fparing folubility, hence the practical direction of preparing the decoction of bark by a hafty boiling, and in a covered veffel.

Thefe experiments, however, by no means warrant the inference that the red powder is nothing but fuper-oxygenated extract, even admitting that the fubftance formed by the oxymuriatic acid is effentially the fame as that feparated fpontaneoufly by expofure to air. The inquiries of other chemifts have fhewn that this fubftance contains lime in one form or other, fince, when calcined, it leaves chiefly carbonat of lime; and alfo, if it is nothing but oxygenated extract, it is not eafy to affign a valid reafon why only a part of any given portion of extract fhould be able to be thus changed.

Thefe are the chief experiments relating to the fubject of extract contained in this elaborate inquiry; and though they are ingenious, and apparently accurate, they certainly fhew that very much remains to be done in this part of chemical analyfis, and that the common diftinction of thefe fubftances into refin, gum, gum-refin, &c. is extremely imperfect and unfatisfactory; though the deficiency of real information on the nature of many of the moft important articles of the vegetable Materia Medica leaves little to the compiler but to repeat the fcanty matter of fact fuch as he finds it.

The cinchona has been, and is conftantly employed in a great variety of difeafes, which we fhall not attempt to enumerate in this place. The general operation of this admirable drug is, to reftore and increafe the general health and ftrength, to improve the appetite, and promote all the functions of the body. This it effects in a gradual way, and moftly without any fenfible operation, except that of ftrengthening the pulfe. Some inconveniences occafionally occur, which either forbid its ufe, or require fome additions to counteract them. Sometimes it increafes the fymptoms of general fever, heat, thirft, reftleffnefs, &c. and in this cafe too, it often is rejected by the ftomach, after having been taken for fome hours. Hence it can feldom be borne, and often does mifchief in acute fever; fo that in curing intermittents by its means it muft be employed only in the perfect intervals between the paroxyfms. Its effects on the bowels are various and oppofite. Often it purges, and as often it brings on a coftive ftate, each of which requires the proper correctives.

Befides the original ufe of the bark in intermittent and remittent fevers, it is fcarcely lefs extenfively or certainly ufeful as an auxiliary to furgery, in fupporting and improving the vis vitæ under extenfive bodily injuries, large ulcerations, compound fractures, and cafes where gangrene is threatened, or actually eftablifhed. In fcrophulous cafes alfo, and indurated and ulcerated glands, it has often a moft happy effect in bringing on healthy fuppuration and granulation of the fore.

The cinchona is fcarcely ever employed externally, except as a ufeful aftringent gargle.

CINCINATO, Romulo, in *Biography*, a Florentine painter, who was born early in the 16th century, and is believed to have been the difciple of F. Salviati. He was one of the principal artifts employed by Philip II. in the Efcurial, where, in the great cloifter, he painted many excellent frefcos; in the church likewife are feveral of his pictures, "particularly one of San Geronimo reading, and another of the fame faint dictating to his difciples; and in the choir two frefco paintings, taken from paffages in the life of San Lorenzo." Many works of his exift at Guadalaxara, in the palace of the Duque del Infantado, a grandee of high family. The moft celebrated of his pictures is a Circumcifion, in the church of the Jefuits at Cuenca, where he fucceeded fo admirably in the fore-fhortening of one of the figures, which is reprefented with its back turned towards the fpectator, that he is reported to have declared that he prized

prized one limb of this figure more than all his works in the Escurial. He died at an advanced age, universally lamented, in the year 1600. Cumberland. Lanzi, Storia Pittorica. Orlandi.

Cincinato, Diego de Romulo, was the son and scholar of the preceding; he entered into the service of Don Fernando Enriquez de Ribera, third duke of Alcala, and went with him to Rome, upon his being appointed ambassador for the purpose of doing homage from Philip IV. to pope Urban VIII. He painted the portrait of his holiness three several times, with such success, that, besides many handsome presents heaped upon him, he received the honour of knighthood from the hand of cardinal Trexo Parriagua, a Spaniard. This happened in the year 1625, and in the year following he died, and was buried in the church of San Lorenzo, at Rome. He left a brother named Francesco, upon whom, at the request of Philip IV. the pope conferred the honour of knighthood, after the death of his brother. Francesco died at Rome, in the year 1636. Cumberland. Lanzi, Storia Pittorica.

CINCINNATI, in *Geography*, a pleasant and flourishing town in the United States of America, in the state of Ohio, and county of Hamilton, seated on the Ohio river, and commanding a picturesque view of the surrounding country. It is opposite to the mouth of Licking river, and the little town of Newport, which is built at the point formed by the junction of that river with the Ohio. The settlement commenced in 1789, and the town was incorporated in 1802. It contains upwards of 300 houses, and has a printing-press which issues a weekly paper. Cincinnati was for several years the seat of government for the north-western territory, and it is in the line of communication with the chain of forts that extend from fort Washington, near the upper end of the town, towards the west. It lies six miles below Columbia, and this as well as the other place are situated between Great and Little Miami rivers. N. lat. 39°. 5′ 54″. W. long. 85° 44′.

Cincinnati, *Society of*, a society formed in the United States of America towards the close of the year 1783, by the officers of the army, just before the disbanding of it; so called after the Roman dictator, Cincinnatus, and intended to perpetuate the memory of the revolution, the mutual friendship, and the union of the states; and also to raise a fund for the relief of poor widows and orphans whose husbands and fathers had fallen during the war, and for their descendants. In October 1783 general Washington subscribed himself president of this order. The general society, which was to meet at least once in three years, was divided into state-societies, which were to meet annually on the 4th of July, the anniversary of American independence. In order to raise a fund for the benevolent purposes of the society, each member was to subscribe one month's pay to the general treasury, and the fund was to be augmented by private donations. The interest only of the money thus raised was to be expended in acts of charity. The members of the institution were to be distinguished by wearing a medal, emblematical of the design of the society. The device was a bald eagle of gold, and it was suspended by a deep blue ribband edged with white, descriptive of the union of America and France. The emblems borne on the breast of the eagle were the following: the principal figure Cincinnatus, and three senators presenting him with a sword and other military ensigns; on a field in the back ground his wife standing at the door of the cottage, and near it a plough and other implements of husbandry; round the whole, "Omnia reliquit servare rempublicam." On the reverse, the sun rising, a city with open gates, and vessels entering the port; fame crowning Cincinnatus with a wreath, inscribed "virtutis premium;" below, hands joining, supporting a heart, with a motto "esto perpetua;" round the whole, "Societas Cincinnatorum instituta, A.D. 1783." The honours and advantages of this society were to be hereditary in the line of the eldest male heirs, and in default of male issue, in that of the collateral male heirs. Honorary members were to be admitted, but without the hereditary advantages of the society, and provided their number should never exceed the ratio of one to four of the officers or their descendants. The ostensible views of this society, however honourable and praise-worthy, could not screen it from popular jealousy; and it was alleged by an able writer, that the principles on which the society was formed would, in process of time, introduce and establish an order of nobility in the country, which would be repugnant to the genius of the republican governments of America, and dangerous to liberty. Early in the year 1784 the provinces of Pennsylvania and Massachusetts declared the institution unjustifiable, and their resolution to discountenance it. The province of Rhode Island proceeded so far as to annul the privileges of all the subjects of its state who should be members of this society, and to declare them incapable of any office under government. In consequence of this alarm, the Cincinnati, in their first general meeting convened at Philadelphia, May 3, 1784, thought proper to new model the institution of their society. They professed to withdraw the claim of hereditary honour, to disclaim all interference with political subjects, and to place their funds under the immediate cognizance of the several legislatures, through the medium of a general charter. Indeed they relinquished without hesitation every thing in their new constitution, except their personal friendships, of which they could not be divested, and the acts of beneficence which it was their intention should flow from them. With these professions, however, they retained their funds, their general meetings, and their ribbands.

Cincinnatus, Lucius Quintius, in *Biography*, an illustrious Roman, who flourished towards the close of the 3d century from the building of the city. Though his means were so small as to induce him to cultivate a small farm with his own hands, yet he was of a patrician family. In the year 292, when the city was in a very disturbed state on account of the dissensions between the tribunes and the senate, Cincinnatus was created consul. He had for some time relinquished all views of ambition, and would gladly have been excused entering upon public life. He was naturally attached to the patrician party, and owing to the banishment of his son Cæso for supporting the cause of the senate, he was still less inclined to keep terms with the plebeians. He reproached the senators for their pusillanimity, and the tribunes of the people for their insolence, and prevented the bringing forward any motion for the Terentian law in favour of the people. He had been elected to his office to complete the year only of the consul Valerius Poplicola, who had been slain in recovering the capitol from Herdonius, an ambitious Sabine, that had rendered himself popular by opposing the laws, and by promising freedom to the slaves, and an ample participation of the spoils of the rich to those in the lower ranks of life. When his time of serving the office of consul was nearly expired, the senators proposed to re-elect him for another year, which he peremptorily refused, as being contrary to their own resolution against the continuation of magistracies to the same person. He had not, however, long retired from public concerns when the city became threatened with imminent dangers from an invading army of the Æqui: Cincinnatus was unanimously created dictator. At that time he was diligently cultivating a small farm acrofs the Tiber. He was found by the perfons deputed from the fenate engaged in ruftic labour; and, after mutual falutations, he was defired to put on his *toga* to hear the commands of the fenate. His wife Racilia quickly brought the garment from their cottage, and as foon as he was dreffed in it, they faluted him dictator, and at the fame time explained to him the nature of the public danger. A veffel was already prepared for his paffage, and he was received on the oppofite bank with every token of refpect and deference. Cincinnatus headed the Roman army, and, after a defperate engagement, the Æqui were obliged to fubmit to a treaty propofed by the conqueror, and to give up their principal officers, arms, and baggage. Cincinnatus divided the fpoils among his foldiers, and returned triumphant to Rome, where he was received as the faviour of the ftate. The fenate would gladly have enriched him, but he declined their offers: he retained his dictatorial authority only till the principal witnefs againft his fon had been convicted of falfe teftimony, and Cæfo recalled, and then abdicated on the fixteenth day the fupreme dignity to which he had been appointed for fix months, having in that fhort time refcued a Roman army from deftruction, and defeated a powerful enemy. "He returned," fays a good hiftorian, "a triumphal hufbandman, having finifhed a war within fifteen days, as if he had been in hafte to refume his interrupted labours." Twenty years after this Cincinnatus was again made dictator, and though then eighty years of age, this veteran poffeffed all the intrepidity and courage of youth. He was now called upon to fupprefs a confpiracy, at the head of which was Spurius Mælius, a rich knight, who had monopolized the corn of Tufcany, and by his liberality to the idle and the poor had feduced a number of partizans to his caufe fufficient to endanger the fafety of the republic. As foon as Cincinnatus had been appointed dictator, he ordered Mælius to appear before him in the forum: the knight, confcious of his guilt, and forefeeing the danger to which he was now expofed, attempted to make his efcape, when he was purfued by Ahala the mafter of the horfe, and killed on the fpot. The dictator applauded the deed, and commanded the confpirator's goods to be fold, his houfe to be demolifhed, and his wealth to be diftributed among the people. Cincinnatus did not long furvive the glory of this action: he died highly refpected by his fellow-citizens, and with the confcioufnefs of having been eminently ufeful to the ftate of which he had fo long been a member.

CINCINNATUS, in *Geography*, the moft fouth-eafterly of the military townfhips in the ftate of New York, in America. It has on the weft Virgil, and Salem in Herkamer county on the eaft, and lies on two branches of Tioughnioga river, a north-weftern branch of the Chenango. The center of the town lies 53 miles S.W. by W. of Cooperftown, and 39 S.E. by S. of the S.E. end of Salt Lake. N. lat. 42° 30′.

CINCIUS ALIMENTUS, LUCIUS, in *Biography*, an early Roman hiftorian and antiquary, who flourifhed during the fecond Punic war. He is now known only from references to his works by other celebrated writers. Cincius is quoted by Livy as of great authority; and from the works of Dionyfius Halicarnaffus, it appears that he wrote a hiftory of the wars of Hannibal in the Greek language. Aulus Gellius has referred to his treatife on military affairs. Macrobius refers to a work which he wrote on the Fafti; and Feftus fpeaks of feveral books of his on fubjects connected with Roman antiquities. From thefe references, there can be no doubt that Cincius was an author, whofe works, had they come down to us, would have done honour to the age in which he lived, and have been a valuable addition to our prefent literary treafures.

CINCLUS, in *Ornithology*, a fpecies of TRINGA, which fee; the flint or ox-eye of Ray and Willughby, the leaft fnipe of Ray and Sloane, the wag-tail of Brown, the fanderling of Albinus, and the purre of Pennant and Latham.

CINCLUS is alfo a fpecies of STURNUS, (which fee), black with a white breaft; the water-ouzel or water-crake of Ray, Willughby, Pennant, and Latham.

CINCLUS *tertius*. See GIAROLO.

CINCTURE, in *Architecture*, the orlo or ring at the top and bottom of a column, which feparates the fhaft at one end from the bafe, and at the other from the capital. The upper cincture is likewife called *collarino*; (fee *Plate* XVI. of *Architecture*). Cincture is alfo ufed to denote the aftragals or other mouldings, which are in fome inftances applied to conceal the joints in the fhaft of a column, as in the baldaquin of St. Peter's, and at the Val-de Grace at Paris.

CINCTUS, in *Ancient Military Language*. This appellation was given to a Roman foldier rated or ceffed as bound to carry arms and fight for his country. At the fame time, the *cingulum* (girdle or belt) was given to him. And the taking of it from him was regarded as a load of ignominy and difgrace.

CINDIA, in *Ancient Geography*, a town of India, placed by Ptolemy on this fide the Ganges.

CINDIA, a town of Caria, in the vicinity of Jaffus and Bargilia.

CINDRAMORUM, an epifcopal town of Afia Minor, in Caria.

CINEFACTION. See CINERATION.

CINEGUILLA, in *Geography*, a town of North America in New Mexico, in the province of Sonora; N. lat. 29° 48′, W. long. 111° 30′. Whilft the Spaniards were penetrating thefe countries during a war of three years, which terminated in 1771, by the final fubmiffion of the natives, they entered a plain at this place, 14 leagues in extent, in which they found gold in grains, at the depth of only 16 inches, of fuch a fize, that fome of them weighed 9 marks, and in fuch quantities, that in a fhort time, with a few labourers, they collected 1000 marks of gold in grains, even without taking time to wafh the earth that had been dug, which appeared to be fo rich, that perfons of fkill computed that it might yield what would be equal in value to a million of pefos. Before the end of the year 1771, more than 2000 perfons were fettled at Cineguilla, under the government of proper magiftrates, and the infpection of feveral ecclefiaftics.

CINERARIA, in *Botany*, (fo called from the cinereous or afh-coloured appearance of many of its fpecies), Linn. gen. 957. Schreb. 1294. Juff. 181. Vent. 2541. Gært. 1021. Clafs and order, *fyngenefia polygamia fuperflua*. Nat. ord. *Compofitæ difcoideæ*, Linn. *Corymbiferæ*, Juff.

Gen. Ch. *Cal.* common fimple, many-leaved; leaves nearly of equal length. *Cor.* compound; hermaphrodite, florets in the difk, tubular, five-cleft, regular; femi-florets female, ligulate, forming the ray when prefent. *Stam.* in the hermaphrodite; filaments filiform, fhort; anthers united in a hollow cylinder, five-cleft at the top. *Pift.* in the hermaphrodite, germ oblong; ftyle filiform, the length of the ftamens; ftigmas two, almoft erect; females, germ oblong; ftyle filiform, fhort; ftigmas two, oblong, bluntifh, revolute. *Peric.* the permanent calyx. *Seeds* linear, quadrangular; down generally capillary, copious. *Rec.* naked, flattifh.

Eff. Ch. Calyx fimple, many-leaved, equal; down generally fimple, receptacle naked.

In

In a few fpecies there are two or three fmall fcales at the bafe of the calyx, by which they fhew an approximation to fenecio, and feem to intimate that there is no natural line of diftinction between the genera. Gærtner afferts, that the fphacelated tips of the calyx-fcales in fenecio do not form a fufficient generic difference. He has therefore founded the diftinction between that genus and cineraria on the form of the leaves, retaining in his genus cineraria only thofe that have undivided leaves, and removing all that have pinnatifid ones to his jacobæa, part of the fenecio of Linnæus. But we prefume that no found botanift will ever agree with him in admitting any thing relative to the leaves into the effential character of a genus.

* *Flowers without a ray.*

Sp. 1. C. *nivea*, Willd. 1. (Doria nivea, Thunb. Prod. 155. nov. gen. p. 163.) "Leaves linear, tomentous; flower generally folitary, terminal; ftem fhrubby." *Root* perennial. *Flowers* peduncled. A native of the Cape of Good Hope. 2. C. *undulata*, Willd. 2. (Doria undulata, Thunberg. C. fpathulata, Lam.?) "Root-leaves elliptical, petioled, undulated, fmooth; flower folitary, terminal." *Root* annual, fibrous. *Root leaves* numerous, curled, revolute at the edges, erect, a finger's length; petioles longer than the leaf, linear, ftriated, fomewhat villous. *Stem* a foot and a half high, folitary, fometimes two, cylindrical, fcabrous, fimple, erect. 3. C. *alata*, Linn. jun. Suppl. 374. Mart. 19. (Doria alata, Thunb.) "Root perennial; ftem herbaceous; leaves inverfely egg-fhaped; flowers in corymbs." *Stem* two feet high, upright, a little branched, angular, with an even furface. *Leaves* quite entire, with an even furface. *Corymbs* at the top of the ftem, leaflefs; calyx fix-cleft, egg-fhaped, with an even furface; florets about fixteen; fome of them in the margin female, naked. A native of the Cape of Good Hope. 4. C. *fpinulofa*, Lam. 19. "Leaves embracing the ftem, fomewhat fpatule-fhaped, fpinous-toothed at the edges, fmooth; corymb panicled." Whole plant fmooth, of a flightly glaucous green colour. *Stem* a foot high or more, herbaceous, full of pith, cylindrical, ftriated, a little branched. *Leaves* alternate, ending in a fhort point; upper ones fmall, almoft lanceolate, entire. *Flowers* yellow, fmall, numerous. A native of Africa, communicated by Sonnerat. 5. C. *perfoliata*, Linn. jun. Suppl. 375. Mart. 23. (Doria perfoliata, Thunb.) "Leaves egg-fhaped, embracing the ftem; peduncles one-flowered, elongated." Whole plant glaucous, inclining to flefh coloured. A native of the Cape of Good Hope. 6. C. *denticulata*, Linn. jun. Sup. 375. Mart. 22. (Doria denticulata, Thunb.) "Leaves lanceolate, fmooth, toothed; flowers panicled." *Leaves* almoft all radical, long; ftem-ones fmall, chiefly at the ramifications. A native of the Cape. 7. C. *ferrata*, Willd. 6. (Doria ferrata, Thunb.) "Leaves inverfely egg-fhaped, oblong, ferrated, tomentous underneath; ftem branched near the top; branches one-flowered." A native of the Cape. 8. C. *elongata*, Mart. 20. Willd. 7. (Doria elongata, Thunb.) "Leaves fomewhat heart-fhaped, bitten; peduncles very long, fubulate-fcaly." *Stem* a foot and a half high; erect, branched, reddifh, tomentous at the ramifications. *Leaves* an inch long, petioled, diftant, unequally crenate, fmooth, rather obtufe; petioles the length of the leaves, a little decurrent at the bafe. *Flowers* yellow, peduncles terminal, one-flowered; calyx quite fimple; leaves from twelve to fourteen, lanceolate, the length of the flower. A native of the Cape. 9. C. *erofa*, Willd. 8. (Doria erofa, Thunb.) "Stem herbaceous, decumbent; leaves lyre-fhaped, toothed, flowers panicled." *Leaves* fcabrous, pubefcent underneath, with minute prominent papillæ; lateral lobes unequal, fimple; terminating one larger, kidney-fhaped, three-lobed. A native of the Cape, near Ribek caftel and Paardeburg. 10. C. *fonchifolia*, Linn. Sp. Pl. 5. Lam. 6. Mart. 5. Willd. 9. (Doria fonchifolia, Thunb. Jacobæa fonchi folio, Breyn. Prod. 3. tab. 21. fig. 1.) "Leaves embracing the ftem, differing in fhape." Linn. *Stem* fmooth, leafy. *Flowers* terminal, large. *Lower leaves* petioled, irregularly lobed; upper ones embracing the ftem, heart-fhaped, acute, entire. A native of the Cape. 11. C. *incifa*, Willd. 10. (Doria incifa, Thunb.) "Leaves oblong, fmooth; lower ones gafh-toothed; upper ones quite entire; flowers terminal." A native of the Cape. 12. C. *pinnatifida*, Willd. 11. (Doria pinnatifida, Thunb.) "Leaves pinnatifid, toothed, fmooth, petioled; flower folitary, terminal." *Stem* a foot high, herbaceous, cylindrical, a little zig-zag, branched. *Branches* alternate, filiform, elongated, leaflefs at the top. *Leaves* three inches long, fcattered, erect; lobes nearly oppofite, egg-fhaped, fcarcely a line long. A native of the Cape. 13. C. *bipinnata*, Willd. 12. (Doria bipinnata, Thunb.) "Leaves twice-pinnated, linear, fmooth; flowers panicled." A native of the Cape.

** *Flowers with a ray.*

14. C. *filiformia*, Willd. 13. Thunb. Prod. 154. "Leaves linear, fmooth; flowers panicled." A native of the Cape. 15. C. *cacaloides*, Linn. jun. fup. 174. Mart. 21. Willd. 14. Thunb. Prod. 154. "Leaves cylindrical, oblong, flefhy; panicle terminal, elongated, few-flowered; peduncles alternate." A native of the Cape. 16. C. *lineata*, Linn. jun. fup. 375. Mart. 24. Willd. 15. Thunb. Prod. 154. "Leaves lanceolate, tomentous underneath, ferrated at the tip, toothed at the bafe." *Stem* a foot high and more, herbaceous, erect, ftriated, hoary. *Leaves* alternate, nearly feffile, three-nerved underneath. *Flowers* with a yellow ray; panicle twice compound, ftiff, much longer than the leaves, fomewhat faftigiate, hoary; calyx fmall; down twice the length of the calyx. A native of the Cape. 17. C. *americana*, Linn. jun. fup. 373. Mart. 18. Willd. 16. "Stem fhrubby; panicles axillary; leaves alternate, petioled, broad-lanceolate, ferrated, fmooth on the upper furface, hoary underneath." Whole plant clothed with a woolly epidermis, which has the appearance of a thin membrane, and is eafily abraded. The branches, petioles, peduncles, and under furface of the leaves, all whitifh. *Stems* woody. *Leaves* veined, with the confiftence of evergreens. *Fowers* with a ray, apparently yellow; peduncles with fcaly bractes, rarely two-flowered; calyx and leaves fo equal as to feem only one, with a few irregular fcales at the bafe. *Leaves* oblong, rather obtufe, flightly heart-fhaped at the bafe, coriaceous. A native of North America, obferved by Mutis. 18. C. *repanda*, Mart. 28. Willd. 17. Forft. Prod. n. 295. (Brachyglottis; Forf. ch. gen. tab. 46.) "Panicle twice compound, divaricated, terminal; leaves oblong, repand-finuate, tomentous underneath; ftem arboreous." *Root* perennial. A native of New Zealand. 19. C. *rotundifolia*, Mart. 27. Willd. 18. Forft. Prod. n. 294. "Panicles few-flowered; leaves petioled, roundifh, egg-fhaped, quite entire, tomentous underneath; ftem arboreous. *Root* perennial. A native of New Zealand. 20. C. *geifolia*, Linn. Sp. Pl. 1. Mart. 1. Lam. 1. Willd. 19. (Othonna glifolia, Kniph. Ant. 5. n. 62. Jacobæa Comm. Hort. 2. tab. 73. Seb. Muf. 1. tab. 22. fig. 3.) "Peduncles branched; leaves kidney-fhaped, rather orbicular, fomewhat lobed, toothed, petioled, Linn. Sp. "Peduncles branched; leaves kidney-fhaped, narrowed, fomewhat lobed, pubefcent; petioles eared at the top. β. "Petioles unequally appendicled, Lam. Jacobæa, Pluk. Mart. tab. 421. fig. 4. *Root* perennial. *Stem* a foot high, or more, much branched, cylindrical, cloth-

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ed with a cottony down. *Leaves* green on the upper surface, hoary underneath. *Flowers* yellow. The variety β is larger, and its petioles furnifhed with more remarkable appendicies. A native of Africa. 21. C. *aurita*, Willd. 20. L'Herit. fert. ang. " Flowers in corymbs; leaves heart fhaped, fomewhat angular, tomentous underneath; petioles with two ears at the bafe." *Root* perennial. *Flowers* purple. 22. C. *cruenta*, Mart. 35. Willd. 21. L'Herit. fert. ang. 26. Hort. Kew. 3. p. 221. Bot. Mag. 406. " Flowers in corymbs; leaves heart-fhaped, angularly toothed, purplifh underneath; petioles winged, eared at the bafe." *Root* perennial. *Stem* herbaceous, two or three feet high. *Flowers* purple. A native of the Canary Iflands, introduced in 1777 by Maffon. 23. C. *cymbalarifolia*, Linn. Amœn. Acad. 6. p. 106. Mart. 2. Lam. 2. " Leaves lyre-fhaped; the end one kidney-fhaped, flightly toothed; upper ftem ones embracing the ftem, lobed, quite entire." *Root* a folid bulb. *Stem* herbaceous, fimple, with an even furface. *Flowers* with a purple ray, peduncled, numerous. There is a variety with fimple trifid leaves, and the lobes trifid. A native of the Cape of Good Hope. 24. C. *angulofa*, Lam. 2. (After Africanus minimus monanthus luteus, Rai. Supp. 16.) " Peduncles fimple; leaves roundifh-angular, petioled; upper ones fomewhat lyrate." *Root* half an inch long, flender, furnifhed with fibres. *Stem* from four to fix inches high, herbaceous, flender, fmooth, branched. *Leaves* fmall, fmooth; petioles almoft capillary, more than an inch long. *Flowers* yellow; peduncles long, fimple, one-flowered; calyx a little pubefcent. A native of the Cape, communicated by Sonnerat to La Marck, who afferts, that it is very diftinct from C. cymbalarifolia, as defcribed by Linnæus in Amœnitates Academicæ. 25. C. *lobata*, Mart. 36. Willd. 23. L'Herit. fert. ang. 26. " Flowers fomewhat in corymbs; leaves roundifh, with many lobes, fmooth; petioles eared at the bafe; calyxes with a few fcales at the bafe." *Root* perennial. A native of the Cape, obferved by Maffon. 26. C. *multiflora*, Willd. 24. L'Herit. fert. ang. 26. " Flowers in cymes; leaves cordate-ovate, tomentous underneath; petioles half-eared. A native of hills in the Canary iflands." *Root* perennial. 27. C. *tuffilaginis*, Willd. 25. L'Herit. fert. ang. 26. " Flowers loofely panicled; leaves kidney-heart-fhaped, with many angles, tomentous underneath; petioles eared at the bafe." *Root* annual. A native of Teneriffe. 28. C. *præcox*, Willd. 26. Cav. Ic. 3. tab. 244. " Flowers in corymbs; leaves heart-fhaped, lobe-toothed, acuminate, fmooth; petioles naked; ftem flefhy." *Root* perennial. *Stem* three or four feet high, about the thicknefs of the human finger. *Leaves* with five or fix deep teeth on each fide, fmooth on both fides. *Flowers* yellow; ray with five florets. A native of Mexico. 29. C. *malvæfolia*, Mart. 34. Willd. 27. L'Herit. fert. ang. 26. " Flowers in cymes; leaves heart-fhaped, angular, a little tomentous underneath: petioles fimple." A native of the Canary iflands, and St. Michael, one of the Azores, introduced by Maffon in 1777. 30. C. *glabra*, Mart. 39. Willd. 28. Swartz. Prod. 113. " Flowers in corymbs; calyxes cylindrical; leaves oblong, acute, a little toothed, nervelefs, fmooth on both fides, fomewhat fucculent; ftem fhrubby." *Root* perennial. A native of Jamaica. 31. C. *difcolor*, Mart. 40. Willd. 28. Swartz. Prod. 113. " Flowers in corymbs; leaves oblong-lanceolate, acuminate, with a few fmall teeth, fmooth, fnowy-tomentous underneath; ftem fhrubby." *Root* perennial. A native of Jamaica. 32. C. *coronata*, Willd. 30. Thunb. Prod. 154. " Leaves inverfely egg-fhaped, crenate, fmooth; flowers terminal; ftem a little fhrubby." *Root* perennial. A native of the Cape of Good Hope. 33. C. *fibirica*, Linn. Sp. Pl. 3. Mart. 3. Lam. 3. Willd. 31. (Jacobæa orientalis, cacaliæ folio; Tourn. Cor. 57. Jacobæaftrum Amm. ruth. tab. 24. Jacobæides uni-crenato folio; Vaill. Act. 1720. p. 300. Solidago n. 139. Gmel. Sib. 2. p. 169.) " Raceme fimple; leaves heart-fhaped, obtufe, finely toothed, with an even furface; ftem quite fimple, one-leafed." Linn. " Flowers in racemes; leaves heart-halbert-fhaped, toothed, fmooth; petioles dilated at the bafe, fheathing." Lam. *Root* perennial. *Stem* a foot and half high, or more, fmooth. *Leaves* with a very fhort point. *Flowers* yellow, in an upright raceme; bractes two at the bafe of the calyx, oblong, the length of the calyx, withering. A native of Siberia, the Levant, and the Pyrenees. 34. C. *glauca*, Linn. Sp. Pl. 4. Mart. 4. Lam. 5. Willd. 32. (Solidago, Gmel. Sib. 2. tab. 74.) " Raceme fimple; leaves fpatulate-heart-fhaped, quite entire, with an even furface; ftem quite fimple." *Root* perennial. *Stem* from three to five feet high, hollow, ftriated. *Leaves* a little flefhy, glaucous; lower ones on enlarged bordered petioles, which embrace the ftem at their bafe. A native of Siberia. 35. C. *paluftris*, Linn. 6. Mart. 10. Lam. 7. Willd. 33. Flor. dan. tab. 573. Eng. bot. 151. (Conyza aquatia laciniata, Bauh. Pin. 266. After paluftris, laciniatus, luteus; Tourn. 483. Othonna paluftris; Linn. it. fcan. fl. fuecica. Solidago, Gmel. Sib. 2. tab. 72.) Marfh. Fleawort. " Flowers in corymbs; leaves broad-lanceolate, tooth-finuated; ftem villous." *Root* perennial, fibrous. *Stems* three feet high, erect, fimple, thick, angular, abundantly leafy. *Leaves* alternate, embracing the ftem, nerved, pale, hairy, often pinnatifid-laciniated, and undulated. *Flowers* bright yellow, with a lemon-coloured ray, numerous; corymbs terminal; peduncles hairy; calyx cylindrical, hairy, yellowifh, not fwelling at the bafe; leaves membranous at the edge; florets of the ray about the fame number as the leaves of the calyx, and a little longer, fomewhat elliptical, toothed at the tip, fpreading; of the difk numerous. *Seeds* furrowed, fmooth; down fcabrous, (filky, Lam.) *Receptacle* pitted. All the hairs of the plant are tranfparent, and finely jointed like a conferva. A native of marfhy ground in England and other parts of Europe, but rare in England. 36. C. *cordifolia*, Linn. jun. Sup. 373. Mart. 6. Lam. 4. Willd. 39. Jacq. Auft. tab. 176, 177. (C. alpina, α, Linn. Sp. Pl. 7. Senecio, Hall. Helv. 63. Jacobæa alpina foliis fubrotundis ferratis, Bauh. Pin. 131. Prod. 70. tab. 69.) " Flowers in panicled corymbs; leaves heart-fhaped, unequally toothed, petioled, pubefcent underneath." Lam. " Panicle few-flowered; ftem fimple; all the leaves petioled, heart-fhaped, doubly toothed; petioles fomewhat toothed at the bafe." Willd. *Root* perennial. *Stem* about a foot high, ftriated, leafy, fimple, or a little branched near the top. *Flowers* yellow; peduncles branched, woolly, furnifhed with fmall fcales; calyx fhort, many-leaved, villous, open. A native of Swifferland and Auftria. Senecio alpinus of the younger Linnæus, (C. alpina, Willd. 40.) has been fuppofed to be C. alpina α of his father: but we think without foundation. The fphacelated tips of the calyx-leaves would furely have prevented Linnæus from making it a cineraria. 37. C. *integrifolia*, Murray, Syft. Veg. 765. Mart. 8. Willd. 37. Jacq. Fl. Auft. tab. 180. Eng. Bot. 152. (C. alpina, γ. Linn. Sp. Pl. 7. C. alpina, Lam. 9. C. campeftris, Willd. 34. Retz. Prod. Flor. Scand. Ed. 2. n. 1027. Hoft, Synop. 464. Jacobæa montana lanuginofa anguftifolia non laciniata, Bauh. Pin. 131. Tourn. 486. Jacobæa pannonica, folio non laciniato, Rai. Syn. 178. Bauh. Hift. vol. ii. 1056.) β. C. alpina, Allion. Ped. vol. i. tab. 38. fig. 2. (C. aurantiaca, Willd. 35. Hoppe Ant. pl. 4.) " Leaves oblong,

long, obsoletely toothed, villous; umbel simple, involucred." Dr. Smith. "Peduncles simple, umbellate; stem-leaves oblong, entire, sessile; root ones egg-shaped, somewhat toothed, lessening into the petiole; stem simple." Lam. "Flowers umbellate; stem simple; leaves tomentous; root-ones egg-shaped, somewhat crenulate; stem-ones lanceolate, quite entire." Willd. *Root* perennial, fibrous. Whole herb cloathed with a white deciduous down. *Stem* about two feet high, furrowed. *Leaves* somewhat revolute; root-ones depressed, larger, and more obtuse; stem-ones alternate, erect, narrower. *Flowers* of a bright gold-colour, in a terminal umbel with few flowers; each peduncle furnished with a short lanceolate bracte at its base; calyx cylindric-hemispherical, smooth; leaves woolly at the base, with a membranous margin; florets of the ray numerous, twice the length of the calyx, elliptic oblong, three-toothed at the tip, spreading. *Seeds* with silky hairs; down scabrous. Stem in β a foot high; all the leaves, especially the stem-ones, larger, more naked on the upper surface; root-ones sometimes with broad teeth. A native of England, Sweden, Austria, France, and Siberia. 38. C. *longifolia*, Murray, Syst. Veg. p. 765. Mart. 9. Willd. 33. Jacq. Flor. Aust. tab. 181. (C. alpina, δ. helenites, Linn. Sp. Pl. 7. Othona, Sp. Pl. Ed. 1. Jacobæa montana polyanthos, Barr. Ic. 226.) "Leaves with five obsolete teeth; all oblong," Mur. "Flowers umbellate-corymbous; stem simple; leaves somewhat toothed; root-ones spatula-shaped; stem-ones oblong-lanceolate. Willd. *Root* biennial. It varies in having the leaves either quite entire, or toothed, smooth or villous. A native of subalpine woods in Thuringia, Austria, Italy, and France. The integrifolia of Murray and Willdenow, to which, however, the latter attributes a perennial root, Jacquin's tab. 179, seems to be only a variety of this species, with the lower stem-leaves, as well as the root-one spatula-shaped; whereas, in C. longifolia, all the stem-leaves are oblong lanceolate. 39. C. *crispa*, Linn. Supp. 376. Mart. 7. Willd. 38. Jacq. Aust. tab. 178. "Flowers umbellate-corymbous; stem simple; leaves toothed; lower ones spatulate-heart-shaped; with winged, finely toothed petioles; upper ones sessile, lanceolate." Willd. *Root* perennial. *Stem* two feet high, erect, furrowed. *Leaves* curled, and waved about the edge; root-ones heart-shaped; stem-ones a little embracing the stem; peduncles and calyxes villous. A native of Austria. 40. C. *aurea*, Linn. Sp. Pl. 8. Mart. 11. Lam. 8. Willd. 41. "Flowers in corymbs; leaves lanceolate, serrated, tomentous underneath." Linn. *Root* perennial. *Stem* villous. *Leaves* slight, villous on the upper surface. *Flowers* yellow, large, with an ample ray; pedicels with a few linear bractes. A native of Siberia. 41. C. *Japonica*, Murray, Syst. Veg. 766. Mart. 26. 41. Willd. 42, Thunb. jap. 317. "Leaves sword-shaped, toothed, tomentous; flowers terminal." *Stem* cylindrical, simple, erect, tomentose. *Leaves* alternate, acute, lessened at both ends, woolly, erect. *Flowers* yellow, solitary, or by threes; calyx woolly. A native of Japan. 42. C. *maritima*, Linn. Sp. Pl. 9. Mart. 12. Lam. 10. Willd. 43. (Jacobæa maritima, Bauh. Pin. 431. Tour. 486.) "Flowers panicled; leaves pinnatifid, tomentous; segments sinuated; stem shrubby." Linn. *Root* perennial. The whole plant remarkable for a very white cottony down, which covers the stem, peduncles, calyxes, petioles, and the under side of the leaves. *Stems* several, two or three feet high, hard, and sometimes continuing through the winter, but not properly woody, cylindrical, leafy, branched. *Leaves* soft; lower ones petioled, egg-shaped, slightly pinnatifid, greenish on the upper surface. *Flowers* yellow, in terminal panicles, on the stem and branches; florets of the ray revolute. A native of the sea-coast of Languedoc and Provence, Italy, and the Levant. It is one of the most specious of the genus, and merits cultivation on account of its beauty. 43. C. *bicolor*, Willd. 44. "Flowers in corymbs; calyxes greyish, pubescent; leaves oblong, pinnatifid at the base, shining, and smooth above, downy underneath; segments somewhat toothed; stem shrubby." It seems only a variety of the preceding species, differing from it in being less woolly. Described by Willdenow from a living plant, but probably the effect of cultivation, as its native country is unknown. 44. C. *canadensis*, Linn. Sp. Pl. 10. Mart. 13. Willd. 45. (Jacobæa maritima, s. cinerea latifolia, Bauh. Pin. 131.) "Flowers panicled; leaves pinnatifid, somewhat villous; segments sinuated; stem herbaceous." Linnæus states this to be the daughter of C. *maritima*; but differing in the leaves not being tomentous, but only somewhat villous, especially underneath; in the ray of the corolla being spreading, not revolute; in the stem being annual, not perennial; and in the calyx being slightly sphacelated at the tip, which it is not in C. *maritima*. A native of Canada. 45. C. *balsamita*, Lam. 11. (Jacobæa orientalis, foliis oblongis non laciniatis incanis, Tourn. Cor. 36.) "Leaves petioled, egg-shaped, crenate-serrated, tomentous; corymb small, compound." *Stem* a foot high, angular, woolly, quite simple, leafy. *Leaves* narrowed into the petiole at the base, cottony, and whitish. A native of the Levant. Specimen preserved in the herbarium of Jussieu. 46. C. *aspera*, Willd. 46. Thunb. Prod. 153. "Leaves linear, pinnated, toothed, tomentous underneath; flowers panicled." A native of the Cape of Good Hope. 47. C. *capillacea*, Linn. jun. Supp. 375. Mart. 14. Willd. 47. "Leaves pinnated; pinnæ capillary, entire." Very like *othonna tagetes*, but its leaves are deeply divided and more slender. 48. C. *minuta*, Mart. 38. Willd. 48. Cav. Icon. i. tab. 33. fig. 3. (Bellis minima, Barr. Ic. 1153. fig. 1.) "Peduncles one flowered; root-leaves smooth, wedge-shaped, with about five teeth; stem-ones pinnated, linear-filiform, hairy; stem hairy." *Root* annual. *Stems* sometimes two or three, two or three inches high, simple, one-flowered beset with long slender hairs. *Root leaves* petioled; stem-ones sessile. *Flower* white. A native of mountainous ground in Spain. 49. C. *linifolia*, Linn. Sp. Pl. 11. Mart. 15. Lam. 14. Willd. 49. Jacq. Hort. Schoen. 3. tab. 308. "Peduncles one-flowered; leaves scattered; stem shrubby." Linn. "Peduncles one-flowered; axillary; leaves linear-awl-shaped, smooth; stem shrubby." Willd. It differs from *senecio linifolia*, in having all the flowers solitary. *Stem* compound, rough. *Flowers* yellow small; peduncles longer than the leaves. A native of the Cape of Good Hope. 50. C. *humifusa*, Mart. 30. Willd. 50. L'Herit. Sert. Ang. 25. (C. pumila, Thunb. Prod. 155.) "Peduncles one-flowered; leaves kidney-shaped, somewhat angular; petioles sometimes eared, sometimes naked at the base." *Root* perennial. A native of the Cape. 51. C. *viscosa*, Mart. 31. Willd. 51. L'Herit. Sert. Ang. 25. Jacq. Frag. 12. tab. 7. fig. 2. (C. pandurata, Thunb.?) "Peduncles one-flowered; leaves pinnatifid-lobed, acute, viscid, somewhat fleshy. *Root* biennial. A native of the Cape. 52. C. *purpurata*, Linn. Mant. 285. Mart. 16. Lam. 16. Willd. 52. "Stem with about two flowers; leaves inversely egg-shaped, somewhat tomentous." *Root* perennial. *Stem* a foot high, herbaceous, simple, furrowed near the bottom. *Leaves* alternate, petioled, obtuse, pubescent above, cottony underneath. *Flowers* with a purple ray; peduncles terminal, as long as the stem, filiform, cottony, erect, one-flowered; calyx-leaves lanceolate, nearly equal,

equal, ſhort, pubeſcent; down feathered. *Receptacle* naked. A native of the Cape. 53. C. *amelloides*, Linn. Sp. Pl. 13. Mart. 17. Lam. 17. Willd. 52. Bot. Mag. 249. (Solidago africana fruteſcens cærulea, hyperici foliis plerumque conjugatis. After africanus fruteſcens, Rai. Supp. 158.) "Peduncles one-flowered; leaves oppoſite, egg-ſhaped, naked; ſtem ſomewhat ſhrubby." *Root* perennial. *Stem* two feet high, purpliſh, rough, dividing into many branches near the root, ſo as to form a low buſhy plant. *Leaves* about an inch long, and a third of an inch broad, thick, ſucculent, ſeſſile, generally two, but ſometimes three or four at a joint. *Flowers* with a yellow diſk and ſky-blue ray. Nearly allied to *amellus lychnitis*, but differing in its naked receptacle. A native of the Cape; and a common inhabitant of our green-houſes, where it flowers moſt of the year. The ſeeds were ſent to Miller in 1753. 54. C. *lanata*, Mart. 29. Lam. 12. Willd. 54. L'Herit. Sert. Ang. 25. Jacq. Collect. iii. tab. 19. fig. 3. Bot. Mag. 53. "Peduncles one-flowered; leaves roundiſh-heart-ſhaped, with ſeven angles, downy underneath." L'Herit. "Leaves roundiſh-angular, on long petioles, white, with down underneath; flowers ſolitary, terminal." Lam. *Root* perennial. *Stems* from twelve to ſix inches high, woody at their baſe, feeble, a little branched, cottony, and whitiſh near the top. *Leaves* alternate, green on their upper ſurface, white and cottony underneath. *Florets* of the ray of a viſcid purple upwards, white near the bottom; calyx cylindrical, ſmooth. A native of the Canary iſlands; introduced by Maſſon in 1780. 55. C. *ſcapiflora*, Willd. 53. L'Herit. Sert. Ang. 25. "Peduncles very long, one-flowered; leaves egg-ſhaped, ſmooth, doubly-toothed." A native of the Cape of Good Hope. 56. C. *laricifolia*, Lam. 15. (Jacobæa Breyn. Cent. tab. 64. Moriſ. Hiſt. 3. tab. 18. fig. 31.) "Flowers erect, lateral and terminal; little branches ſhort, one-flowered; leaves ſcattered, crowded, linear-awl-ſhaped, keeled; ſtem ſhrubby." A ſhrub, ſcarcely a foot high, ſmooth in all its parts. *Stem* cylindrical, with ſlender branches, leafy on its upper part, naked and marked with the ſcars of fallen leaves near the bottom. *Leaves* channelled on their upper ſurface, ſcarcely an inch long. *Flowers* yellow, ſeſſile; florets of the ray few, diſtant from each other; calyx ſimple, but apparently compoſed of two ranks, occaſioned by the preſſure of the upper leaves of the branches. A native of the Cape of Good Hope, communicated by Sonnerat. 57. C. *chamædrifolia*, Lam. 20. "Stem herbaceous, angular, naked near the top; leaves petioled, heart-ſhaped, crenate, hoary underneath." *Stem* from ſix to eight inches high, zig-zag near the baſe; branches two or three near the top, one-flowered, furniſhed with ſmall acute ſcales. *Leaves* ſmall, ſmooth on both ſides, but greyiſh underneath. *Flowers* terminal; calyx ſimple, ſmooth, many-leaved. A native of the Cape. 58. C. *anthemoides*. Lam. 21. "Leaves ſeſſile, deeply pinnatifid; lobes lanceolate-toothed, ſlender; ſtem herbaceous." *Stem* eight or nine inches high, ſtriated, branched, leafy. *Leaves* greeniſh, beſet with a few hairs. *Flowers* yellow; peduncles one-flowered, ſmooth, furniſhed with very ſhort acute ſcales; calyx ſmooth, quite ſimple. 59. C. *haſtifolia*, Lam. 24. Mart. 25. Linn. jun. Suppl. 376. "Leaves halberd-ſhaped; ſegments lateral, bifid, divaricated." *Stem* ſeven inches high, erect. *Leaves* alternate, petioled. *Flowers* yellow; peduncles elongated, furniſhed with awl-ſhaped ſcales; calyx with about ten leaves.

Obſ. According to Juſſieu, C. amelloides recedes from the reſt of the genus, on account of its purple flowers and oppoſite leaves, but neither of theſe can be allowed to form part of a generic character, and if they did, ſeveral other ſpecies muſt be removed. Gærtner has ſeparated C. glauca and C. purpurata, on account of their feathered down, and placed them in a new genus which he calls ſeneciliis, but it may alſo be doubted whether this be of itſelf a ſufficient generic difference. Thoſe ſpecies which have a few ſcales at the baſe of the calyx ſeem more allied to ſenecio, wanting only the ſphacelated tips of the calyx-leaves, and ſhewing, as La Marck obſerves, that there is no ſolid diſtinction between the two genera. As the ſpecies of ſenecio are very numerous, it might facilitate the ſtudies of the young botaniſt, if theſe were formed into a new genus, of which the preſence of the ſcales and the abſence of the ſphacelated tips ſhould form the eſſential character. Or it would anſwer the ſame purpoſe if the whole were thrown into one genus, divided into three ſections. The chief objection is the difficulty of finding trivial names.

C. *othonnites*, Linn. See OTHONNA *fruteſcens*.

— *abrotanifolia*, Berg. See OTHONNA *abrotanifolia*.

Propagation and Culture. Many of the ſpecies are well-known ornaments to our green-houſes, and others are worthy of being introduced. Moſt of them may be increaſed by cuttings, planted in a ſhady border, during the ſummer months, and duly watered. In a month or five weeks they ſhould be tranſplanted into pots, to prevent their roots from ſpreading. But they are too tender to endure the open air in the winter of our climate. C. maritima is hardier, and if the ſlips be planted in a dry rubbiſhy ſoil, they will live out of doors all the winter, and thrive many years; but in rich ground the plants are ſo luxuriant in ſummer as to be killed by the froſt in winter. C. amelloides, and ſome of the others, may alſo be propagated by ſeeds, ſown on a bed of light earth in the beginning of April. When the plants are fit to remove, part of them ſhould be planted in pots, to be ſheltered in winter under a hot-bed frame, and the remainder under a wall in poor ground, where, if the winter prove favourable, they will live. Miller. C. lunata, lately introduced into this country, which far exeeds all others cultivated here, in the beauty of its flower, is a valuable acquiſition to the green-houſe, alſo on account of its hardineſs, its readineſs to flower, and the facility with which it may be propagated. It flowers early in the ſpring, and may be made to continue nearly the whole year. It is particularly liable to be infeſted with aphides, or in the language of gardeners, to become louſy. The only method to have healthy plants is, to procure a conſtant ſucceſſion by cuttings. Theſe ſhould be placed in a pot, and plunged into a bed of tan. Curtis Bot. Mag.

CINERARIUS, in *Antiquity*, an officer retained by the women, whoſe buſineſs it was to provide aſhes proper for tinging the hair with a deep yellow colour. He was otherwiſe called *ciniflo*.

CINERARIUS is alſo uſed to ſignify one who paid a veneration to the relics of martyrs and ſaints.

CINERATION, in *Chemiſtry*, the reduction of wood, or any other combuſtible matter, into aſhes, by means of fire. This, others call *cinefaction*.

CINERES. See ASHES.

CINERES *clavellati*, in *Chemiſtry*, or *Pearlaſh*, is a conſiderably pure ſub-carbonat of Potaſh, which ſee.

CINERES *Ætnæ*, a name given by authors to a duſty and ſaline ſubſtance thrown out of mount Ætna, in form of powder, and reſembling aſhes. After an eruption of this mountain, theſe ſaline aſhes are found ſcattered about the opening itſelf, down the ſides of the mountain, and over the country for ten miles or more round. Thoſe aſhes, which are found thrown to the diſtance of eight or ten miles, are generally taken up in form of a very dry duſt, almoſt inſipid to to the tafte: but what lie upon, and round about the fkirts of the mountain, are very different; they are never dry, though they lie many months expofed to the fun's heat, which is very great there, but always feel damp and wet, and are compofed of larger or fmaller lumps, and not of a fine powder, as the more diftant are. They are of a very ftrongly vitriolic tafte, refembling that of our common green copperas. From this tafte, and from the great quantities of matter refembling a fort of crocus Martis, and with thefe a great abundance of fulphur, which is burnt away, and the vaft quantities which alfo are fublimed about the mouths, and left unburnt, it appears, that the common pyrites is contained in vaft abundance in the bowels of the mountain, fince green vitriol and fulphur are its produce, and nothing is fo eafy as to calcine it with the purple powder refembling crocus Martis, which is the third fubftance fo frequent there. This gives great weight to the opinion of thofe who believe all the eruptions of the burning mountains in the feveral parts of the world to be owing to this mineral. See PYRITES and VOLCANO.

CINERITIOUS, a term applied to things refembling afhes; particularly in point of colour and confiftence.

Thus, the cortical part of the brain is alfo called the *cineritious* part.

CINETTRI or CINITTRI, in *Ancient Geography*, a people of Africa, according to Ptolemy, who inhabited the defert, S.E. of the river Bagradas.

CINEY, in *Geography*. See CHINY.

CINGA, *Cinca*, a river of Hither Spain, which has its fource in the Pyrenées, and running to the fouth, paffed by the territories of the Illergates, in order to difcharge itfelf into the ocean. The inundation of this river, and that of the Sicoris in the plain near Ilerda, proved very injurious to Cæfar, becaufe, by the removal of the bridges, he could not keep up a communication with the town that had joined him. But, in order to effect this purpofe, he engaged all the barks, which he could find along the Iberus.

CINGILIA, a town of Italy, in the country of the Veftini, which was taken by the conful Brutus.

CINGULUM, in *Conchology*, a fpecies of *Conus*, found in the Friendly Iflands.

CINGULUM, in *Geography*, a town of Italy in the Picenum. Cæfar fays that it was built at the expence of Labienus. It is mentioned by Pliny, Cicero, Silius Italicus, and Frontinus. It is now known by the name of *Cingoli* or *Cingolo*.

CINGULUM. See CINCTUS.

CINGULUM *Mundi*, mountains which the ancients alfo called the "Hyperborean mountains." Thefe mountains are probably thofe which the Ruffians call *Ziemnoipoias*.

CINGULUM *Sapientiæ*. See GIRDLE.

CINIFLO, in *Antiquity*, the fame with CINERARIUS.

CINIUM, in *Ancient Geography*, a name given by Pliny to the greater of the Balearic Iflands; the inhabitants of which enjoyed the fame rights with thofe of Latium.

CINNA, LUCIUS CORNELIUS, in *Biography*, an afpiring Roman, who raifed himfelf to the higheft honours of the ftate, by attaching himfelf, during the civil contentions, to the popular faction. In the year of Rome 667, Cinna was elected conful, during the tyranny of Sylla, though he had been the avowed friend of Marius. He had no fooner entered upon his newly acquired office, than he drove Sylla from Rome to his army in Afia. He then attempted to ftrengthen his party by incorporating a number of new citizens into the ancient tribes from the allies. This was oppofed by his colleague Octavius, and the fenators, who yet held the honour of citizenfhip in high eftimation; a bloody battle was fought in the forum between the two parties. Cinna was defeated; he and fix tribunes who had fided with him were expelled the city. They proceeded to depofe him from the confulfhip, and chofe Cornelius Merula in his ftead. Cinna applied for fuccour to the allies, by whom he was furnifhed with money and troops, and, having by his various arts, gained over a large body of Roman foldiers encamped at Capua, he was joined by fuch numbers, that he formed an army of thirty legions. He then invefted Rome, and forced Metellus, in whom the care of defending the capital was lodged, to retire: Merula the new conful refigned his authority, and Cinna was again acknowledged as conful. Not contented with a fimple reftoration to all his honours, he entered Rome with Marius, and the other leaders of his party. At firft, they feemed contented with the deftruction of Octavius, but they afterwards profcribed all thofe who had attained to fenatorial rank, and a great multitude of the nobleft and moft honourable of the Romans were facrificed at the fhrine of their mad ambition. At the expiration of the confular year, Cinna nominated himfelf and Marius confuls for another year. The latter dying foon after the nomination to office, Cinna fhared the authority with the younger Marius, who was no lefs cruel than his father. He made himfelf conful a third time, with Papirius Carbo, and, to ftrengthen his hands, he married his daughter to Julius Cæfar, a man hereafter deftined to act a great part in his country. Intelligence arrived, that Sylla was preparing to return to Rome at the head of a formidable army. Cinna, unwilling that the war fhould be carried on in Italy, determined to meet his rival in Dalmatia; while, however, he was on the point of embarking his troops, a mutiny was excited among them, in which he was flain by his own foldiers, at the port of Ancona, in the year 670. Cinna has been defcribed as one who, having attempted what no good man would have dared, performed what none but a very brave man could have effected.

CINNA, in *Botany*. See AGROSTIS *Cinna*. It is a native of Canada, whence feeds were fent by Kalm.

CINNA, in *Ancient Geography*, a town of Italy, taken, according to Diodorus Siculus, by the Romans from the Samnites.—Alfo, a place of Dalmatia, marked by the Itinerary of Antonine, on the route from Salone to Durazzo, between Birziminium and Scodra.—Alfo, a town of Spain, placed by Ptolemy in Juetania, a country of the Tarragonenfis.—Alfo, a town of Afia, in Perfia Propria, according to Ptolemy.

CINNABAR. See MERCURY.

CINNAMOLOGUS, in *Natural Hiftory*, among the ancients, the name given to a bird which built its neft either in the cinnamon-tree, or upon rocks and precipices, with the broken branches of that tree. The ancients have a great many idle traditions concerning this bird: fome fay it is the phœnix; and others, that it is a peculiar fpecies of fowl. The common opinion of the phœnix building its neft of fpices feems to have given birth to all the idle ftories that we hear of this bird in Pliny, and other credulous authors.

CINNAMOMIFERA REGIO, in *Ancient Geography*, the name of a country of Ethiopia, near Egypt, according to Ptolemy and Strabo. The latter places this country at the commencement of the Torrid Zone, and fays, that Sefoftris, king of Egypt, penetrated fo far.

CINNAMON, in *Botany*. See LAURUS *Cinnamomum*.

CINNAMON. *Cinnamomum*, in the *Materia Medica*. The bark of the cinnamon tree (*Laurus cinnamomum*, Linn.), is the part ufed in medicine It is of a brown red colour, light and thin, and rolled up in long brittle quills. The fmell ſmell is delightfully fragrant, and the taſte is highly pungent and aromatic, with a conſiderable ſweetneſs, and ſome aſtringency. The thinneſt pieces are by much the moſt aromatic. Cinnamon, infuſed in boiling water, in a covered veſſel, gives out much of its grateful aromatic flavour, and forms an agreeable reddiſh-brown infuſion. Alcohol, ſtrong or diluted, extracts the aromatic part more completely, and without artificial heat. The aroma of the cinnamon reſides in an eſſential oil, which is extracted by diſtillation with water, though with ſome difficulty. Oil of cinnamon has a clear golden yellow colour, and a moſt powerfully fragrant ſmell. The taſte is exceſſively fiery, and abſolutely cauſtic, corroding the ſkin very ſpeedily. This oil is heavier than water. It is altogether prepared in Ceylon, and imported. When cinnamon is diſtilled with water juſt ſufficient to cover it in the ſtill, the diſtilled water that comes over is milky and turbid, and has a mild and agreeable flavour of the ſpice. If a large quantity is prepared at once, a few drops of oil collect at the bottom of the water. From a pound of cinnamon about a gallon of ſtrong diſtilled water may be prepared. The watery decoction remaining in the ſtill, yields, on evaporation, a red extract, of a mucilaginous and gently aſtringent taſte, but without any thing aromatic.

Pure alcohol, diſtilled from cinnamon, brings over very little of its flavour; ſo that if an extract is made with this menſtruum, it retains moſt of the rich aroma and pungency of the cinnamon. Proof ſpirit, on the other hand, when diſtilled from this bark, gives a clear, ſtrong, aromatic, ſpirituous water. This, as well as the ſimple water, is much uſed in medicine.

Cinnamon is one of the moſt grateful aromatics that we poſſeſs, and is employed as a cordial, reſtorative, and for all the purpoſes for which aromatics are uſeful. It is ſeldom, if ever, given alone; for the aromatics, though their ſenſible qualities are ſo decided, have but a temporary and uncertain effect on the conſtitution, and contribute but little to the cure of important diſeaſes. But, as an auxiliary in a variety of ways, and to cover the flavour of nauſeous medicines, cinnamon is eminently uſeful, and enters into the compoſition of a vaſt variety of tinctures, confections, cordial mixtures, and the like. A drop of the oil, dropped on a lump of ſugar, is one of the readieſt and moſt powerful ſtimulants in faintings and ſudden debility.

On account of the high price of the cinnamon, the *caſſia* bark, which much reſembles it, is very generally ſubſtituted. The general appearance, ſmell, and flavour, of the two are the ſame, only the aromatic property is much weaker, and it wants much of the grateful ſweetneſs of the real cinnamon. The caſſia may be diſtinguiſhed by the ſmooth ſurface which it exhibits when broken, and by its ſlimy taſte.

This ſubſtitution, though a real inconvenience, in many caſes is of little conſequence in preparing the diſtilled water; for water diſſolves ſo little of the eſſential oil, that, in the uſual proportions, it appears to ſaturate itſelf from the caſſia as completely as from the real cinnamon.

CINNAMON, *clove*, is alſo the bark of a tree growing in Braſil and Madagaſcar; where it is known under the name of *ravendſara*. The Portugueſe call it *cravo de marenham*.

This bark, pulveriſed, is ſometimes ſubſtituted for real cloves, though far ſhort of them in reſpect of flavour.

Saſſafras is ſometimes alſo called *cinnamon-wood*. See SASSAFRAS.

CINNAMON, *white*, which ſome call *coſtus corticus*, or *corticoſus*, or erroneouſly *cortex Winteri*, *Winter's bark*, from the perſon's name who firſt brought it into England, is the bark of a tree, reſembling the olive-tree, frequent in the iſlands of St. Domingo, Guadaloupe, and Madagaſcar; called by the natives *ſimpli*.

This bark, which dries like that of cinnamon, is at firſt browniſh, of a ſharp biting taſte, like pepper, and a ſmell like muſk; as it dries it whitens. Some uſe it in lieu of nutmeg; and in medicine it is uſed as a ſtomachic, and ſometimes as an antiſcorbutic.

The ſame tree alſo yields a gum called *alouch*, ſometimes *bdellium*, which is no diſagreeable perfume. See *Winteranus* CORTEX and WINTERANIA.

CINNAMUM, the name given by many of the old writers on the materia medica to cinnamon. The Arabian writers, when they treat of cinnamon, have three words by which they expreſs it; theſe are *ſelicha*, *daſini*, and *kanſe*.

CINNAMUS, JOHN, in *Biography*, a Greek, who flouriſhed in the 12th century. In his youth he followed the profeſſion of arms, and was preſent at various expeditions in Europe and the Eaſt. After the death of Manuel, he compoſed hiſtories of John Comnenus, and Manuel, his ſon, comprehending their actions from 1118 to 1176. He is characterized by Leo Allatius as an elegant author, who frequently uſes foreign forms of expreſſion, and figures from the ſchools, whence he ſometimes falls into obſcurity. According to Voſſius, his diction is more pure and terſe than that of the modern Greeks in general; and he is an imitator of Xenophon. His hiſtory was firſt printed in Greek and Latin, with notes, at Utrecht, 1652, in 4to. Another edition has been ſince publiſhed in folio by Du Cange, at Paris, with hiſtorical and philological obſervations.

CINNERETH, or KINNERETH, *ſea and lake of*, in *Ancient Geography*, otherwiſe called the lake or water of Geneſareth. See *Sea* of GALILEE.

CINNIANA, or CIRANIA, now *Sitania*, a town of Spain, in Luſitania. Valerius Maximus informs us, that when D. Brutus expreſſed his deſire that the inhabitants ſhould ranſom their city, they returned him anſwer, that they had iron to defend it, but no gold to ranſom it.

CINNORUM *Civitas*, an epiſcopal town of Aſia, in Galatia prima.

CINNUS, in *Ancient Medicine*, a drink made of the decoction of wheat, to which was added ſome flour of barley, honey, and wine.

CINO DU PISTOIA, in *Biography*, ſo called from his native place, but by his family name De' Sigibuldi, an eminent lawyer and poet, flouriſhed in the beginning of the 14th century. He ſtudied law at Padua and Bologna, but with ſo little application or ſucceſs that he was at firſt refuſed the degree. This circumſtance had its proper effect in rouſing his diligence, and he ſoon attained to great profeſſional reputation. He was made principal aſſeſſor to Lewis of Savoy, when ſenator of Rome, to which office he was choſen in 1310. In 1314 he finiſhed a voluminous commentary on the code, and obtained a doctor's degree at Bologna. He was profeſſor at various univerſities, and was intimate with many diſtinguiſhed characters, among whom was Petrarch, who lamented his death in a ſonnet. Beſides the commentary on the code, printed at Frankfort in 1578, Cino commented on ſome parts of the Digeſt. But he derived the greater part of his reputation from his poetical works. By general ſuffrage he is placed among the moſt cultivated Italian poets of the age in which he flouriſhed; and of thoſe who preceded Petrarch, not one is to be compared to him for elegance and ſweetneſs. The moſt complete edition of his works is that of Venice in 1589.

CINOLIS, in *Ancient Geography*, or *Cimolis* of Strabo, a town

town of Aſia, in Galatia. Arrian ſays that it was a commercial and maritime town, at the diſtance of 60 ſtadia from Egineta, and 180 from Stephana. Others repreſent it as a village having a river and harbour.

CINQUAIN, in *Ancient Military Language*, an order of battle compoſed of five battalions or five ſquadrons. To form the cinquain, place the five battalions or five ſquadrons in one line, then make the ſecond and fourth advance to form the van, or *avant garde;* leave the firſt and fifth on the original line or ground as the main body, or *corps de bataille;* and make the third or middle one fall back to form the rear or *arriere-garde.* When the number of regiments or ſquadrons is equal to a multiple of five by any whole number n, or is equal to $5\,n$, they may be formed into the ſame order of battle.

CINQUEFOIL, in *Botany*. See POTENTILLA.

CINQUEFOIL, *baſtard*. See SIBBALDIA *procumbens*.

CINQUEFOIL, *marſh*. See COMARUM *paluſtre*.

CINQUEFOIL is a term in *Heraldry*, to repreſent a leaf of graſs of five points.

CINQUEFOIL *root*, in the *Materia Medica*, the name of a root which uſed to be an ingredient in ſeveral of the officinal compoſitions. The plant which produces it is the common cinquefoil, which grows every where by way-ſides. The root conſiſts of a cortical and ligneous or ſticky part, but the cortical only is uſed. It is eſteemed drying, and aſtringent, and antifebrific. Some have given it in agues in as large doſes as the cortex, and have cured with it. It ſtops fluxes of the bowels, and is good in diſorders of the lungs, and in the *fluor albus* and gonorrhœas, either in men or women. It is, however, very little regarded in the preſent practice. See Phil. Tranſ. vol. xlix. part ii. p. 835.

CINQUEL, in *Geography*, a town of the iſland of Sumatra, on the weſtern coaſt of a river of the ſame name.

CINQUE-MARS, in *Geography*, a town of France, in the department of the Indre and Loire, 10 miles N.W. of Tours.

CINQUE-PORTS, *Quinque portus*, five havens that lie on the eaſt part of England, towards France, thus called by way of eminence, on account of their ſuperior importance, as having been thought by our kings to merit a particular regard, for their preſervation againſt invaſions.

Hence they have a particular policy, and are governed by a keeper, with the title of lord warden of the cinque-ports, which office belongs to the conſtable of Dover; and their repreſentatives are called barons of the Cinque-ports.

They have various franchiſes ſimilar in many reſpects to thoſe of the Counties Palatine, and particularly an excluſive juriſdiction before the mayor and jurats of the ports; their warden having the authority of an admiral among them, and ſending out writs in his own name; and the king's writs do not run there. However, on a judgment in any of the king's courts, if the defendant hath no goods, &c. except in the ports, the plaintiff may get the records certified into chancery, and from thence ſent by *mittimus* to the lord-warden to make execution. 4 Inſt. 223. 3 Leon. 3.

Camden tells us, that William the Conqueror firſt appointed a warden of the Cinque-ports; but king John firſt granted them their privileges; and that upon condition that they ſhould provide eighty ſhips at their own charge for forty days, as often as the king ſhould have occaſion in the wars; he being then ſtreightened for a navy to recover Normandy.

There are alſo ſeveral towns adjoining, to which the privileges of the Cinque-ports extend.

There are ſeveral courts belonging to theſe ports; one before the lord-warden; others within the ports themſelves before the mayor and jurats; another, which is called *curia quinque portuum apud Shepway;* a writ of error lies from the mayor and jurats of each port to the lord-warden in his court of Shepway; and in theſe caſes the mayor and jurats may be fined, and the mayor removed, &c. (4 Inſt. 334. Crompt. Juriſd. 138.) and alſo from this court to the king's bench: and a writ of error lies from all the other juriſdictions to the ſame ſupreme court of judicature, in token of the ſuperiority of the crown when theſe franchiſes were created. All prerogative writs, as thoſe of *habeas corpus*, prohibition, *certiorari*, and *mandamus*, may likewiſe iſſue to all theſe juriſdictions; becauſe the privilege, that the king's writ runs not, muſt be intended between party and party, for there can be no ſuch privilege againſt the king. They have likewiſe a court of chancery, to decide matters of equity; but no original writ iſſues thence.

The Cinque-ports, it has been obſerved, are not "*jura æqualia*," like counties palatine, but are parcel of the county of Kent; ſo that if a writ be brought againſt one for land within the Cinque-ports, and he appears, and pleads to it, and judgment is given againſt him in the common pleas, this judgment ſhall bind him; for the land is not exempted out of the county, and the tenant may waive the benefit of his privilege. Wood's Inſt. 519.

Theſe five ports are Dover, Haſtings, Romney, Hythe, and Sandwich; to which Winchelſea and Rye have been ſince added. Thorn tells us, that Haſtings provided twenty one veſſels, and in each veſſel twenty-one men. To this port belong Seaford, Pevenſey, Hedney, Winchelſea, Rye, Hamine, Wakeſbourn, Creneth, and Forthclipe.—Romney provided five ſhips, and in each twenty-four men. To this belong Bromhal, Lyde, Oſwarſtone, Dangemares, and Romenhal.—Hythe furniſhed five ſhips, and in each twenty-one ſeamen. To this belongs Weſtmeath.—Dover, t[illegible] number as Haſtings. To this belong Folkſto[illegible], F[illegible]ſham, and Marge.—Laſtly, Sandwich furniſhed the [illegible] with Hythe. To this belong Fordiwic, Reculver, Serre, and Deal.

CINQUE-PORT *net*. See NET.

CINQUE-VILLAS, in *Geography* a town of Portugal, in the province of Beira; 2 leagues N.E. of Almeida.

CINQ-MARS, HENRY COIFFIER, *Marquis of*, in *Biography*, born in 1620, was introduced by Richlieu to Louis XIII. for the purpoſe of becoming his favourite, a poſt for which he was well qualified, having an agreeable perſon, and being endowed with ready talents for converſation. He was ſoon promoted to high honours, and the cardinal hoped to have reaped advantage from him whoſe fortune he had made; but in this he was completely diſappointed. Cinq-Mars was ambitious only of his own elevation, and deſtitute of every principle of gratitude; he even thwarted the views of Richlieu, and gladly complied with the king's deſire of being preſent at all the private conferences with the cardinal. This was not agreeable to the miniſter, and he gave his eléve a ſevere lecture on his preſumption for interfering in ſtate affairs, and forbade him from attending at any future councils. He alſo mortified his pride and vanity by queſtioning his pretenſions to a marriage with the princeſs Mary de Gonzaga, afterwards the wife of the king of Poland. On theſe accounts Cinq-Mars reſolved to revenge himſelf on his benefactor, and excited the king's brother, Gaſton, duke of Orleans, to a revolt, in which the duke de Bouillon participated. A treaty was made with Spain in Gaſton's name, by which it was agreed to lay open France to her enemies. In the mean time Cinq-Mars did not fail, at every opportunity, to declaim againſt the cardinal, and urged the king to baniſh him from his court, and to get him aſſaſſinated. The king appeared to reliſh the propoſals. Richlieu, though confined by illnefs, was too penetrating not to difcover his approaching difgrace. Fortunately, at this juncture, he made the difcovery of the treafonable negotiation carried on by the faction with Spain, and immediately informed the king of it. Cinq-Mars was arrefted, and carried to Lyons for trial. Gafton, to make his own peace, furnifhed abundant evidence for the conviction of the late favourite. Cinq-Mars was capitally condemned, together with his friend De Thou, fon of the celebrated hiftorian and prefident, and was beheaded in September 1642, in the 22d year of his age. Gen. Biog.

CINTEGABELLE, in *Geography*, a town of France, in the department of the Upper Garonne, and chief place of a canton, in the diftrict of Muret, feated on the Arriege; 16 miles S. of Touloufe. The place contains 2984, and the canton 8695 inhabitants: the territory includes 195 kiliometres and 8 communes.

CINTRA, a town of Portugal in Eftramadura, feated between the mountains of Cintra, near the mouth of the Tagus, and diftant 4 leagues from Lifbon. The houfes lie difperfed in a picturefque manner over the declivity of the mountain; it has a royal caftle, formerly the refidence of feveral kings; it is faid to have been built by the Moors, and after having been deftroyed by an earthquake in 1655, re-built in the fame ftyle by king Jofeph. The town has four parifh churches, and the number of inhabitants is eftimated at 1900. Cintra is the fummer refidence of the opulent inhabitants of Lifbon, and efpecially of the foreign merchants, and of perfons in high rank under government. The months of Auguft and September, when every thing is parched round Lifbon, are paffed here on mountains that afford plenty of water, verdure, and fhade. In the midft of fummer the nights are cool, and the houfes, which are difperfed among rocks, gardens, and wood, prefent an agreeable retirement. The mountains of Cintra, called by the ancients "Montes Lunæ," lie N.E. and S.E. and terminate in the Cabo de Rocca. They confift of granite compofed of clear-white quartz, a fomewhat reddifh felfpar, and black mica, againft which leans a white or foliaceous limeftone, or a proper ftink-ftone. The fouth fide toward Lifbon is arid, naked, parched up, confifting of bare heaped-up rocks, and affords a wild, defert, dreary profpect. But on the north fide, at the entrance of Cintra, every thing feems to be changed. The whole declivity to a certain height is covered with country-houfes and charming quintas, forming a fhady wood of the fineft trees, fuch as oaks of various kinds, pines, lemons, and other fruit-trees. Streams iffue every where from the rocks, and form cool moffy fpots. Towards the fummit of the mountain naked rocks are accumulated together. On one of the high points, floating, as it were, in the air, is feen a monaftery, and on another the ruins of a Moorifh caftle. Where the quintas ceafe, begins a thick but low coppice of ftrawberry-tree, mock-privet, buck-thorn, and gale or fweet-willow, together with other vegetable inhabitants of the ifland of Madeira. A fine profpect of the well-cultivated valley of Colares, of the great monaftery of Mafra, and of the fea, complete the beauties of the fcene. To the weft of Cintra is a market-town, called *Colares*, (which fee); and on the mountain, towards the weft, is a fmall monaftery of Capuchins, built between rocks, and called "Cork Monaftery," the rocks being cafed with cork. The elevation and vicinity to the fea caufe a great accumulation of clouds and moifture, which render it expedient to have a coating of cork upon the walls. Snow is not uncommon here in winter, although it never lies. Toward Cabo de Rocca the mountains become lower and lower, terminating in a flat, defert, naked, lonely ridge, which forms the cape. The height toward the fea is from 50 to 80 feet, being broken ftraight off, and confifting of granite. Near the extremity is a light-houfe, and not far from it a fmall chapel. On this naked plain the ftorms rage with great violence, the fea burfts with vehemence againft the rocks, and is very deep in their vicinity. From hence are feen the mountains of Mafra, and oppofite is the correfponding cape, Cabo de Efpichel. Farther to the northward is another chain of mountains, parallel to thofe of Cintra, with which it unites by high and detached mountains, the Cabeça de Montachique and others. From the fea thefe mountains appear like a lofty amphitheatre. This chain of mountains confifts of thick and foliaceous limeftone. On the part which runs toward the fea is the caftle of Mafra, built by John V. with its monaftery. Of the fize of this edifice, an idea may be formed from the quantity of metal ufed in every tower for bells, bars, &c. amounting to 14,502 arrobas (each arroba being 32lb.) for each tower.

CINTRE, in *Building*, the mould on which an arch is turned; popularly called *centre*, fometimes alfo *cradle*.

CINYPS, or CINYPHUS, in *Ancient Geography*, a river of Africa, in the Regio Syrtica, or northern part of the prefent kingdom of Tripoli, owing its name, according to Bochart, to the great number of porcupines produced in the adjacent country, derived its ftream from a fountain, or a hill, called "Zachabari," or the hill of the Graces, (as the name imports in the Punic, Phœnician, or Libyan) in the country of the Macæ, and emptied itfelf into the Sinus Syrticus. Pliny and Herodotus intimate that in this region there was a fruitful diftrict called "Cinyphe," which, as well as a city of fome repute mentioned by Scylax, might have been fo called from the river of the fame name. The Macæ, from whofe country the Cinyps flowed, were a pretty potent nation. They fhaved their heads all over, except the middle, where they permitted a lock of hair to grow. When they made war upon any of their neighbours, they wore the fkins of oftriches inftead of armour. In the winter they drove their flocks to the fea-fide, and in fummer to the inland places near fome fountain or river, for the fake of water. They are denominated by the ancients Macæ Cinyphii and Macæ Syrtitæ, from their vicinity to the Cinyps and the Greater Syrtis.

CINYRA, in the *Jewifh Antiquities*, a mufical inftrument. This and the Hebrew *cinnor*, which is generally tranflated *cithara, lyra*, or *pfalterium*, are the fame. It was made of wood, and was played on in the temple of Jerufalem. Jofephus fays, that the cinyra of the temple had ten ftrings, and that it was touched with a bow. In another place he fays that Solomon made a great number of them with a precious kind of metal called *electrum*, wherein he contradicts the Scripture, which informs us that Solomon's *cinnors* were of wood.

CINYRAS, in *Fabulous Hiftory*, the firft king of the ifland of Cyprus, was the grandfon of Pygmalion, and father of Adonis. Paphus, his father, is fuppofed to have been the firft that introduced into the ifland the worfhip of Venus, and is faid to have built the city which bears his name. He had, according to the fable, Adonis by his own daughter Myrrha. Paphus is feigned by the poets to have been the fon of Pygmalion, by a woman, who had before been an ivory ftatue. Pygmalion, they fay, upon his arrival in the ifland of Cyprus, faw that the women lived very licentioufly, and determined never to marry. Afterwards, as he was a famous ftatuary, he made an ivory ftatue of fuch perfection, that, falling in love with it, he prayed the goddefs Venus to procure for him a wife as beautiful as the ftatue he had made. The goddefs heard his prayer, and changed

changed the ſtatue into a fair damſel, by whom he had Paphus, the father of Cinyras. This Cinyras is ſaid to have poſſeſſed immenſe riches, inſomuch that "The wealth of Cinyras" became proverbial, for expreſſing an over-grown eſtate. As the worſhip of Venus was firſt eſtabliſhed in Cyprus by Paphus the father of Cinyras, both he and his deſcendants were buried in the temple of Venus at Paphos, an honour which was granted to no other family. The prieſthood of Venus was likewiſe entailed on their race, a dignity which they preſerved for many ages, after the throne was ſeized by others.

CINYRIA, in *Ancient Geography*, a town of the iſland of Cyprus, famous for the worſhip paid in it to Urania. It did not ſubſiſt in the time of Pliny.

CINYRUS, a mountain of Italy, placed in the Picenum.

CINZANO, in *Geography*, a town of Piedmont; 5 miles S.S.E. of Chivazzo.

CIOLI, Valerio, in *Biography*, a ſculptor of ſome eminence, who was born about the year 1530, at Settignano, a village near Florence, which, from its vicinity to ſome excellent quarries of ſtone, has at all times furniſhed a number of good ſculptors. Valerio was, in his infancy, inſtructed by his father, Simone Cioli, a ſculptor of ſome merit; but, at the age of 15, he was placed under Tribolo, an artiſt of conſiderable reputation, who at that time was employed in works of ſculpture and architecture by the duke Coſimo, at one of his villas near Florence.

Having ſtaid four years with Tribolo, he went to Rome, where he put himſelf under the tuition of Raffaello da Montelupo, one of the beſt imitators of the ſtyle of Michael Angelo; by whom he had indeed been employed in the execution of ſome of the ſtatues for the celebrated monument of Pope Julius II.

Having finiſhed his ſtudies, he was for ſome time employed to reſtore many of the ancient mutilated ſtatues; but he was afterwards choſen for a work which allowed greater ſcope to his abilities; it is the figure of Sculpture, who is repreſented in a diſconſolate attitude, weeping the loſs of the great Michael Angelo Buonaroti, and is one of three ſtatues which adorn his tomb in the church of St. Croce at Florence.

It is to be regretted, that a great part of the life of Cioli was ſacrificed in the execution of the ridiculous groteſque figures in the gardens of Boboli, which, though intended to ornament, are alone calculated to call forth ſentiments of pity or contempt, for the puerile and corrupt taſte which gave them birth. He died, aged upwards of 70, and left a ſon, Simone Cioli, who followed the profeſſion of his father, but who poſſeſſed ſmall talents. Gherardo Silvani was likewiſe his diſciple. Baldinuci, Dec. 1. della Par. 3. del. Sec. 4.

CION, in *Anatomy*, is ſometimes uſed for the uvula.

Cion, or Cyon, in *Gardening*, a young ſhoot, ſprout, or ſprig, put forth by a tree.

Grafting is performed by the application of the cion of one plant upon the ſtock of another.

To produce a ſtock of cions for grafting, planting, &c. the gardeners ſometimes cut off the bodies of trees, a little above the ground, and only leave a ſtump or root ſtanding; in this caſe the redundant ſap will not fail next ſpring to put forth a great number of ſhoots.

In dreſſing dwarf-trees, a great many cions are to be cut off. See Pruning.

CIONE, Orgagna (da) Andrea. See Orgagna.

CIONES, in *Antiquity*, a kind of idols very common, being only oblong ſtones, erected pillar-wiſe; whence alſo they had their name.

CIOS, Esker, in *Ancient Geography*, a river of Thrace, the *Oeſcus* of Pliny, and thus denominated by M. D'Anville, had its ſource in the N.W. part of mount Rhodope, in the country of the Pæonians. It paſſed by mount Hæmus, near its middle, and, purſuing its courſe through the weſtern part of the Triballic plain, emptied itſelf into the Iſter, near one of the two towns which bore the name of Oeſeus.—Alſo, a river of Aſia Minor, in Bithynia, which watered a town of the ſame name, according to Pliny. The town called Cios, was ſituated, ſays Pliny, in the place called Aſcania of Phrygia. Pomponius Mela ſays, that it was ſeated at the bottom of a ſmall gulf, formed by the Propontis; it is called in Greek, "Glio," in Turkiſh, "Kemlik."

The town of Cios had been built, according to Ariſtotle, by Cios, who conducted thither a colony of Mileſians. Euſtathius ſays, that Cios was one of the companions of Hercules. The town was deſtroyed by Philip, father of Perſeus, and king of Macedonia, and its territory ſurrendered to Pruſias, king of Bithynia, who rebuilt it, and gave to it his own name, Pruſias.

CIOTAT, La, in *Geography*, a ſea-port town of France, in the department of the Mouths of the Rhone, and chief place of a canton, in the diſtrict of Marſeilles, ſeated at the bottom of a bay in the Mediterranean, in a country which produces delicious fruit, oil, and excellent wine. The harbour is in the form of a horſe-ſhoe, and defended with ſeveral forts; 4 leagues S.E. of Marſeilles, and $7\frac{1}{2}$ S.S.E. of Aix. The place contains 5770, and the canton 8738 inhabitants; the territory includes $162\frac{1}{2}$ kiliometres, and 4 communes. N. lat. 43° 10′. E. long. 5° 31′.

CIPHER, or Cypher, in *Arithmetic*, one of the numeral characters called figures, and formed thus 0. The word *cipher* is probably derived from the Hebrew ספר, *ſaphar*, *to number*. By the Italians it is written *Zifra*, by the French *Chiffre*, and by the Low Latins *Ciphra*. It is, therefore, more properly ſpelt cipher than cypher.

The arithmetical cipher by itſelf implies a privation of value, or nothing: but when diſpoſed with other figures, ſituated on its left, in common arithmetic, it ſerves to augment each of their values by tens; and in decimal arithmetic, it leſſens the value of each figure to the right thereof, in the ſame proportion. See the article Arithmetic.

A cipher alſo denotes a kind of enigmatical character, compoſed of ſeveral letters interwoven together, fancifully; which repreſent the initial letters of perſons' names, and are frequently uſed on ſeals, coaches, and articles of plate, or other moveables.

Formerly, when merchants and tradeſmen were not allowed to uſe armorial bearings, they had ciphers thus artificially compoſed in their ſtead; which moſtly conſiſted of the firſt letters of their names, curiouſly inter-twined about a croſs, &c. of which many inſtances remain on ancient tombs: but the cuſtom ſtill obtains among perſons of various ranks in life, as an ornamental device, eſpecially on ſeals, or carriages. This practice has, indeed, been increaſed of late, to avoid the annual tax of two guineas impoſed in Great Britain, on thoſe who paint their family arms upon carriages. See Heraldry.

Cipher, in *Diplomatic Affairs*, ſignifies an occult manner of writing, legible to thoſe only who poſſeſs the key or ſecret, and hence the term *Deciphering*, which ſignifies to explain what is written in *cipher*. We believe this art was ſo called from the early cuſtom of uſing arithmetical characters or figures, for the purpoſe of ſecret correſpondence; a practice ſtill very common in the courts of princes, and for the ſkilful management of which a decipherer is attached to the office of the ſecretary of ſtate for foreign affairs. This

This art has been so much cultivated by the moderns, as to have acquired the importance of a distinct science, and is called *cryptology*, *cryptography*, *polygraphy*, *steganography*, &c.

In the present article we shall touch upon all the parts of this science, by whatever names they have been distinguished, although it must be allowed that the term *cipher* is only applicable to private writing. When we consider the noble and pre-eminent advantages of alphabetical writing, an art which so peculiarly distinguishes civilized society from uncultivated barbarians, and the very gradual progress it is likely to have made towards a state of perfection, we cannot reasonably suppose the practice of writing in cipher was common in the remotest ages of antiquity. To communicate our thoughts at a distance, by means of arbitrary and visible marks, was in its rudest form a vast effort of the human mind; and we must imagine that many centuries would elapse, before writing was so perfect and universal as to render it necessary to adopt any more abstruse modes of concealment. See LETTERS, CHARACTER, and WRITING.

A general sentiment has, indeed, prevailed among the literati, that the Egyptians invented hieroglyphics in order to hide and secrete their wisdom from the vulgar; a mistake, which the very learned bishop Warburton, (Divine Legation, b. iv. § 4.) has sufficiently confuted. Nay, we might with as good reason fancy the ancient picture-writing of the Mexicans, or the more refined hieroglyphical characters of the Chinese, to have been contrived for the purposes of secrecy, and not for the diffusion of knowledge! See the article HIEROGLYPHICS.

Letters were undoubtedly a much later invention than emblematical or symbolical writing; and, in their infancy, they must have been so puzzling as to appear endowed with an almost miraculous faculty. But, when this exquisite contrivance had become familiar to the vulgar eye, and would no longer serve to conceal the mysteries of statesmen, or the intrigues of designing subjects, the use of ciphers began to be foreseen. The want of them was at first supplied by artifices of different kinds, but chiefly by newly constructed alphabets; which, being intended only for the use of princes, ambassadors, generals, and other public personages, were not disclosed to the world at large. Even so late as the time of lord chancellor Bacon, and in this free country, it was considered as an aggravation of earl Somerset's crime to employ secret writing. "They made play," says lord Bacon, "of all the world besides themselves; so as they had ciphers and jargons for the king, queen, and all the great men, things seldom used but either by princes and their ambassadors and ministers, or by such as work and practise against, or at least upon, princes." Bacon's Remains; Charge against the Earl of Somerset.

It is too much to be lamented that, on some occasions, disaffected, treacherous, and ill-designing men have greatly abused this curious department of science, by applying it to the basest and most mischievous purposes: but we ask, Is this a reason against using or divulging it? Is it a sufficient plea for suppressing all we know on the subject, and endeavouring to stifle our knowledge, lest it should chance to be perverted? Would not a similar argument hold good for preventing the use of the press itself, and even for destroying books altogether? What useful thing has not been abused? And if this art should be turned to any purpose subversive of society, we have laws and magistrates to punish the offenders. It has been well observed by bishop Wilkins, (in his "Mercury, or The Secret and Swift Messenger,") that "nothing hath occasioned more troubles and contention than the art of writing, which is the reason why the inventor of it is fabled to have sown serpent's teeth; and yet it was but a barbarous act of Thamus, the Egyptian king, therefore, to forbid the learning of letters. We may as well cut out our tongues, because that member is *a world of wickedness!* If all those useful inventions that are liable to abuse, should, on that account, be concealed, there is not any art or science which might lawfully be professed."

The authors who have written either formally or incidentally on the subject of secret-writing, are by no means few in number; but they are not often consulted, nor always very easy to be met with; and it is surprising to find how seldom they are quoted by writers on bibliography and general literature. In the last edition of the Encyclopædia Britannica, and in the article *Chiffres* of the large French Encyclopédie (Departm. Diplomat. tom. i. part ii. p. 538.) mention is made of only three or four (and these not the principal) authors; so that we conceive it may be interesting to point out those who have most distinguished themselves in this science, at different periods, and in various nations. We shall, however, attempt to compress our historical remarks into as narrow a compass as possible.

The art of corresponding by visible signs may be supposed to have existed before the introduction of writing, and might have been practised by gestures or motions of the body; since infants are able to express themselves in this way, before they have acquired the faculty of speaking: but, whether or not the practice of holding secret information by signs of this nature, was carried to any great extent by the ancients, we are unable to say. Ovid takes notice of the art of discoursing thus, in the lines following:

> "Verba superciliis sine voce loquentia dicam.
> Verba leges digitis, verbaque vultus habet."

And again:

> "Sæpe tacens vocem, verbaque vultus habet."

Schottus, in his "Steganographia," exhibits an arthrological alphabet in Latin and German; also Mr. Falconer, in his "Cryptomenysis Patefacta," and Bp. Wilkins in his "Mercury" chap. xiv. have given us a similar one in English.

As to the art of discoursing with the fingers, named dactylogy and cheirology, it has been often commended for its antiquity: since the ancients used to express any number under 100 by the fingers of the left hand; and above 100, and under 1000, by those of the right hand. Moreover, Pierius has particularly described their methods of reckoning from 1 to 9000: and hence Juvenal says,

> "Rex Pylius, magno si quicquam credis Homero,
> Exemplum vitæ fuit à cornice secundæ;
> Fælix nimirum, qui tot per sæcula vitam
> Distulit, atque suos jam dextra computat annos."

To employ this manœuvre for the purposes of secrecy, Schottus has afforded us another alphabet; and so likewise has the celebrated George Dalgarno, in his "Didascalocophus," p. 74, who distinguished himself in the reign of Charles II., by an endeavour to introduce an universal character and philosophical language.

Among the signs for nightly information at a distance, those by fire are extremely common, and have been used by the Chinese, Persians, and other nations, in the remotest times. This species of communication is affirmed by Diodorus Siculus to have been practised by Medea in her conspiracy with Jason, which carries us back three thousand and seventy years; and although there must be some uncertainty on this question, Pliny, in his "History," lib. vii. cap. 56, says it originated with Sinon. "Specularem significationem Trojano bello Sinon invenit." This was the

the ſignal upon which Sinon agreed to unlock the wooden horſe, in the ſiege of Troy, about 1184 years before Chriſt:

> " ——— Flammas cum regia puppis
> Extulerat ————————."
>
> Virgil, Æn. lib. ii. 256.

And, after the taking of Troy, Æſchylus relates, that Agamemnon immediately apprized his queen, Clytemneſtra, of that event by a ſimilar method; which, we ſuppoſe, muſt have been done either by men placed at certain diſtances with lighted torches, which they held up in ſucceſſion, or by a conſiderable number of fires on the tops of hills, denoting the ſimple fact previouſly agreed on between the parties. See Onoſander's Strategicus, cap. 25, where this practice is deſcribed.

The fire-ſignals of the Greeks and Romans are also ſlightly mentioned by Quintus Curtius, Livy, Cæſar, Herodotus, Homer, and Thucydides; likewiſe by Vegetius and Frontinus; but ſtill more in detail by Polybius, and Æneas Tacticus; the latter of whom was contemporary with Ariſtotle, and has left a valuable fragment on the duties of a general, (tranſlated into Latin by Caſaubon,) wherein are many curious remarks on the ſubject of ſecret correſpondence. The Greek ſignals were much improved by Polybius, who, in his hiſtory (Lib. x. cap. 45. p. 296. tom. iii. Lipſ. 1790. edit. Joh. Schweighaeuſer.) attributes the invention to Cleomenes and Democritus, or (more correctly) to Cleoxenus and Democlitus, in words thus rendered: "Poſtrema ratio, cujus auctores ſunt Cleoxenus & Democlitus, ſed quam nos correximus, certa definitaque eſt, adeo ut quidquid exortum fuerit negotii, id poſſis certo facere notum." Prior to that period, the information communicated by torches, flags, ſmoke, or otherwiſe, was very limited, and it was requiſite to ſettle beforehand, what each ſignal ſhould mean; whereas Polybius ſhewed, how to correſpond alphabetically, and to give or receive any ſpecies of intelligence, without this previous concert. The plans of Æneas Tacticus had never arrived at ſuch perfection, and were therefore of comparitively ſmall uſe; though, without doubt, he at leaſt equalled any of his predeceſſors in the facility of his telegraphic communications. Vid. Polyb. L. x. ſub finem.

Polybius has detailed the peculiar invention of Æneas; which conſiſted of a narrow earthen veſſel, filled with water, and having a tube or aperture to let off the fluid: a piece of ſtick is then to be thruſt through a cork, ſo as to float above the ſurface, when it is put into the water; and the upper part of this ſtick is to be marked by ſubdiviſions, of three inches each, upon which are to be written ſuch common events as happen in war. When the water is drawn off from any of theſe veſſels, which muſt agree exactly in ſize, &c. it is evident that the ſticks will ſink lower as the veſſels become empty; ſo that on obſerving the ſpace through which the ſticks deſcend, the correſpondents may (by the help of a ſimilar apparatus) tell which of the expected events has occurred. But Polybius, finding this contrivance adapted only for thoſe few occurrences which had been previouſly written on the ſticks, deſcribes his own method, which was far ſuperior.

We are told, however, that Æneas Tacticus collected together about twenty different modes of writing, which could only be underſtood by perſons who were in the ſecret; part whereof were his own, and part of them invented by others; ſo that this author ſeems to have been well verſed in the art of ſecret correſpondence, as it then exiſted among the ancients.

We ſhall hereafter have occaſion to notice ſome of the ſecret modes of writing recorded by Æneas; but, it will firſt be proper to explain and illuſtrate the telegraphic invention of Polybius himſelf, which is as follows:

Divide the letters of the Greek alphabet, into five parts, each of which will conſiſt of five letters, except the laſt diviſion, which will have only four. Let theſe be fixed on a board in five columns. The man who is to give the ſignals is then to begin by holding up two torches, which he is to keep aloft till the other party has alſo ſhown two. This is only to ſhow that both ſides are ready. Theſe firſt torches are then withdrawn. Both parties are provided with boards, on which the letters are diſpoſed as formerly deſcribed. The perſon then who gives the ſignal is to hold up torches on the left, to point out to the other party from what column he ſhall take the letters as they are pointed out to him. If it is to be from the firſt column, he holds up one torch; if from the ſecond, two; and ſo on for the others. He is next to hold up torches on the right to denote the particular letter of the column that is to be taken. All this muſt have been agreed on before-hand. The man who gives the ſignals muſt have a dioptrical inſtrument (διοπτρον), conſiſting of two tubes, and ſo placed as that, by looking through one of them, he can ſee only the right ſide, and through the other only the left, of him who is to anſwer. The board muſt be ſet up near this inſtrument; and the ſtation on the right and left muſt be ſurrounded with a wall (παραπεφραχθαι) ten feet broad, and about the height of a man, that the torches raiſed above it may give a clear and ſtrong light, and that when taken down they may be completely concealed. Let us now ſuppoſe that this information is to be communicated—*A number of the auxiliaries, about a hundred, have gone over to the enemy.* In the firſt place, words muſt be choſen that will convey the information in the feweſt letters poſſible; as, *A hundred Cretans have deſerted*, Κρητες εκατον αφ' ημων ηυτομολησαν. Having written down this ſentence, it is conveyed in this manner. The firſt letter is a κ, which is in the ſecond column; two torches are therefore to be raiſed on the left hand to inform the perſon who receives the ſignals to look into that particular column. Then five torches are to be held up on the right to mark the letter κ, which is the laſt in the column. Then four torches are to be held up on the left to point out the ρ (*r*), which is in the fourth column, and two on the right to ſhow that it is the ſecond letter of that column. The other letters are pointed out in the ſame manner. Such were the Φρυκτοι or Πυρσεια recommended by Polybius.

As this contrivance deſerves particular attention, and throws great light on a common mode of writing by cipher, we ſhall here attempt to give a further elucidation of it, by another example and a diagram.

Diſpoſe the letters into five rows or columns; place a figure over each of them, and another by the ſide of the five lines: but inſtead of Q, let K be its ſubſtitute: Thus,

1	2	3	4	5	
a	f	k	p	v	1
b	g	l	r	w	2
c	h	m	ſ	x	3
d	i	n	t	y	4
e	j	o	u	z	5

Provide ten torches, and let ſo many be held up towards the right hand as may denote the row in which the letter required is to be found; likewiſe ſo many on the left hand as ſhall point out the place of the ſame letter, reckoning from

from above. Proceed in this operation, till you have completed the word or ſentence to be communicated, as in the underwritten example; where the firſt figure in each pair ſhews the row, and the ſecond denotes the order of the letter. which being duly performed, the ſpectator will receive the following information:

52 . 15 . 41 . 15 . 42 . 24 . 43 . 23 . 12 . 54 . 21 . 11.
w e p e r i ſ h b y f a

33 . 24 . 34 . 15 . 11 . 34 . 14 . 14 . 24 . 43 . 15 . 11.
m i n e a n d d i ſ e a

43 . 15.
ſ e

An intelligent reader will perceive that five lights might do, for the purpoſe of repreſenting theſe five differences, as well as the ten; nay better, only taking care to pauſe ſufficiently after every ſeparate elevation of the torches, whether to the right or left hand. It is worthy of remark, that this very principle for diſtant communication has been recently adopted, in the conſtruction of a day-telegraph at the Admiralty! Although in the latter there are ſix ſigns for the purpoſe of repreſenting figures as well as letters. (See the articles SIGNALS and TELEGRAPH.) But we have advanced enough to ſhew that the ancients, 2000 years ago, knew how to maintain ſecret correſpondence by ſignals. We ſhall next prove that they were alſo acquainted with ſeveral means of *writing by cipher*; although it muſt be confeſſed, that the moderns have greatly improved upon their inventions of this kind.

Le Sieur Guillet de la Guilletiere, in his "Ancient and Modern Lacedemon," endeavours to ſhew that the Spartans were the inventors of writing in cipher; and that their Scytalæ were the firſt rudiments of this art. We ſuppoſe he has taken his account of the σκυτάλη from Plutarch: but as ſeveral modes of ſecret writing mentioned by Æneas Tacticus are entirely different from this, it by no means follows that thoſe of Æneas were ſuggeſted by the former; nay, we are diſpoſed to think, with Scaliger, that a little attention might have developed this cipher with eaſe.

The nature and uſe of the *Scytale*, according to Plutarch, in his life of Lyſander, was this: When the Grecian magiſtrates ſent out an admiral or a general, they prepared two cylindrical pieces of wood with ſo much exactneſs, that they were perfectly equal both in length and thickneſs. One of theſe they kept themſelves, and the other was given to the military officer then employed. When they had any ſecret and important orders to communicate to him, they took a long narrow ſlip of parchment, and rolled it round their own ſtaff, in a ſpiral form, one fold cloſe to another, and then wrote their communication upon the edges of the parchment. This done they took off the ſcroll, and ſent it to the commander; who, on receiving it applied it to his ſtaff, ſo that the broken and imperfect characters now became legible. The parchment as well as the ſtaff was called σκυτάλη. As this contrivance was had recourſe to by the Athenians and Lacedæmonians, in the time of Alcibiades, Pharnabazus, and Lyſander, we are certain it was invented at leaſt four centuries earlier than the Birth of Chriſt.

Although this confuſed ſort of writing, as it would appear upon the unrolled ſlip of parchment, is not a ſufficient ſecurity againſt detection in the preſent ſharp-ſighted age, there are other means of ſecret writing which even Scaliger's eyes (as biſhop Wilkins obſerves in his "Mercury") could not diſcover; "and therefore it was too inconſiderate and magiſterial a ſentence of him, thence to conclude all this kind of learning to be vain and uſeleſs. It is certain," adds the biſhop, "that ſome occaſions may require the exacteſt privacy; and it is as certain, that there may be ſome ways of ſecrecy, which it were madneſs for a man to think he could unfold;" in which opinion he is ſupported by Vegetius, Baptiſta Porta, and lord Bacon, as well as by ſeveral more recent judges; ſo that Scaliger ſhewed greater ſelf-confidence than ſkill, in pretending he could decipher any writing that might be invented. The author of the preſent article (who has only taken up this ſubject as an amuſement) challenges all the Scaligers in Europe to explain various kinds of cipher he has recently contrived, and which elude every rule laid down by his predeceſſors.

The learned Mr. Falconer, and ſome earlier writers on cryptography, have attributed the invention of the Lacedæmonian ſcytale to Archimedes the mathematician; but we have already afforded the reader evidence of its uſe in the days of Alcibiades, Pharnabazus, and Lyſander, who lived nearly two centuries prior to the time of Archimedes; and Plutarch does not ſpeak of this invention as *new*, or as being uſed by the Greeks alone, at that early period. See Plutarch, in his lives of Alcibiades and Lyſander.

We next deſcend to the age of Ariſtotle, about 350 years before Chriſt, when the art of ſecret writing ſeems to have aſſumed a more regular and ſyſtematic form; but the authors of that age and thoſe following, whoſe works have deſcended to poſterity, are ſo few and imperfect as to throw only a faint light on the object of our inquiry. We are ignorant of what was done by Julius Africanus, Laertius, and Philo-Mechanicus, three ancient Grecians, who treated on this ſubject. Æneas Tacticus, and Polybius, are our principal guides; the former of whom was contemporary with Ariſtotle: (vide "Æneæ Vetuſtiſſimi Tactici Commentarius, De tolerandâ Obſidione, Caſaubono interprete," 1610, 8vo.)

Æneas is ſaid by Polybius, to have collected and invented a great number of ſecret modes of correſponding; and among them, we imagine, are included thoſe few which he has briefly recited in the above named work. He ſeems to have approved eſpecially of affixing ſmall dots to the letters of any book or epiſtle, written upon a common ſubject, in ſuch a way as only to denote the characters expreſſive of the ſecret ſentiment, all the reſt being non-ſignificant. He alſo recommends the ſubſtitution of points inſtead of vowels, and gives the two following ſhort ſpecimens:

D :·· :: N ::: S :· ::· S P ::· L C H ·· R, which ſignifies DIONYSIUS PULCHER.

H ·· R · C L :· D ·· S V ·· N :· T ::· which ſtands for the words HERACLIDES VENITO.

This mode may be varied indefinitely; for it is of no importance what arrangement or number of points is ſubſtituted for the vowels; and, although we cannot ſay this is very difficult to decipher, it nevertheleſs demonſtrates the fact of ſecret writing being employed in thoſe remote ages. The ſame author likewiſe mentions the artifice of paſſing a thread through holes in a board or tablet, correſponding with the twenty-four Greek letters; which Guſtavus Selenus (an aſſumed name of the duke of Brunſwick and Luneburg), who publiſhed a folio book on cryptography, A.D. 1624, has therein deſcribed more at large. The order of the threads, expreſſing the alphabetical characters, previouſly ſettled by compact, will repreſent any words we pleaſe.

There is a great affinity between this method, and that of tying knots upon a ſtring at various diſtances from each other, ſo as to agree with a determinate meaſure, graduated for the purpoſe. Few people would ſuſpect any private news or treachery to lie hidden in a piece of knotted thread. Biſhop Wilkins has farther illuſtrated this device, in the 5th and 11th chapters of his "Secret and Swift Meſſenger;" and we have given a repreſentation upon *Plate* II. *fig.* 1. of the graduated meaſure alluded to, with knots

knots tied upon the thread oppoſite to the letters F, L, Y, from which any perſon may learn how to put this plan into execution.

The ſame effect will be produced if, in lieu of the knots, the thread be marked with ink at the proper intervals oppoſite each letter; or, if the tablet, or the meaſure, be applied to paper, and dots are impreſſed upon it under the holes or ſubdiviſions which ſtand for the reſpective letters. The ancients have laid down the principle, which is thus eaſily varied in practice; but the merit of this invention belongs to them rather than to the moderns.

Æneas was acquainted with many other modes of occult writing beſides theſe, ſome of which are alluded to in his Poliorceticus, § xxxi. but the greater number are wholly loſt. And it is truly ſurpriſing, that theſe methods of correſpondence ſhould not have been more univerſally carried into effect by ſucceeding generations, ſo as to have prevented the loſs of them! Surely the telegraphic apparatus of Polybius, with five or ten flambeaux, might have been employed and improved upon, for the moſt important military or national purpoſes; and yet the moderns ſcarcely have dreamed of uſing any ſuch means of alphabetical communication till the preſent age! How obvious it ſeems, that this contrivance of Polybius, with ſome variation in the materials, ſhould be deemed at leaſt as applicable for daily uſe, as it was found to be for nightly obſervations! And, how numerous are the ſpecies of ciphers which a man of common ingenuity would extract from the principles ſuggeſted for ſecret writing in Æneas's little treatiſe!

He likewiſe deſcribes ſeveral ways of fraudulently conveying intelligence into a beſieged town, &c. For example, by the application of a manuſcript to a ſore leg, inſtead of a plaiſter or bandage;—by ſewing up an epiſtle within the ſole of a perſon's ſhoe, or hiding it under the arm-pit;—rolling thin leaves of lead into the form of ear-rings, &c. after having written thereon;—putting a bladder into a bottle of oil, firſt inſcribing upon it, and inflating it ſo as to fill the bottle completely;—or writing on a tablet, and afterwards covering it over with melted wax;—to which are added ſome other ſingular propoſals, ſhewing the fertility of invention exerciſed by the ancients on ſuch occaſions.

But the ſtrangeſt contrivance was that of Hyſtiæus, mentioned by Herodotus; who, while at the Perſian court, ſent to Ariſtagoras in Greece, a ſervant affected with bad eyes, pretending that his hair muſt firſt be ſhorn, and his head ſcarified; in performing which, Hyſtiæus imprinted his ſecret intention, in legible characters, upon the ſervant's head, and kept him in cloſe confinement till the hair grew; when he deſired him to travel to Ariſtagoras for a perfect cure, who, on the man's arrival, repeated the ſhaving, and thus obtained the ſecret information tranſmitted by means of the ignorant meſſenger.

As a meſſage may be concealed by adopting any arbitrary marks, (for inſtance the dots of Æneas) inſtead of letters, ſo likewiſe by changing their powers, and ſubſtituting one character for another; which is ſaid to have been practiſed in that kind of cabbaliſm which the Jewiſh rabbies call צירוף, or combination. Biſhop Wilkins has cited examples of this ſort among the Hebrews; and it was alſo practiſed among the Romans, as Suetonius relates of Julius Cæſar and Octavius Auguſtus; the former of whom wrote the fourth letter inſtead of the firſt, *i. e.* D for A, the fifth for the ſecond, the ſixth for the third, &c. &c.; and Auguſtus wrote after the ſame method, only by putting the ſecond for the firſt, and the third for the ſecond, *i. e.* B for A, C for B, D for C; which confounds the general appearance of the writing, but is not ſufficiently intricate to eſcape the ſcrutinizing eye of a modern decipherer. However imperfect and inadequate this ancient mode may be, it is quite as good as three-fourths of thoſe ciphers which the principal courts of Europe truſted to, until after the ſixteenth century! It is a matter of indifference, whether we change the powers of the letters, or invent a new-formed alphabet for ſecret writing; as the ſame rules for deciphering one of them will equally well apply to the other. And yet we find, for many centuries after the Auguſtan age, that kings and ambaſſadors contented themſelves with only changing the form of their alphabets, as if this were any ſecurity againſt detection! It demonſtrates how little men addicted themſelves to this ſubject as a SCIENCE, while they felt an indiſpenſable neceſſity for having recourſe to it as an ART.

We do not indeed affirm, that there is ſo much reaſon now to complain of the negligence of princes and ſtateſmen in this reſpect, as there was formerly; but we are in poſſeſſion of certain facts, which ſhew that the words of lord chancellor Bacon are not entirely inapplicable to our own times, viz. "If the ciphers in uſe were good and truſty, ſeveral of them would abſolutely elude the labour of the decipherer; and yet remain commodious enough, ſo as to be readily wrote and read; but through the ignorance and unſkilfulneſs of ſecretaries and clerks, in the courts of princes, the moſt important affairs are generally committed to weak and treacherous ciphers." We have much cauſe to doubt, whether any court in Europe, even at this time (1807), can lay claim to a cipher, having the three eſſential properties required by lord Bacon; "1ſt, That it be eaſy to write and read; 2d, That it be truſty and undecipherable; 3d, That it be clear of ſuſpicion." But we refrain from divulging all we believe on this delicate topic:—*Verbum ſapienti ſat eſt.* It may be ſaid, that no individual ought to diſcloſe an inſcrutable cipher, unleſs he is compelled by imperious circumſtances.

The practice of tranſpoſing the ordinary letters of the alphabet, to perplex the reader, was not only reſorted to by the Romans, but alſo by the Greeks, Syracuſans, Carthaginians, and perhaps by other enlightened nations. The ancient Gauls, Saxons, Normans, &c. uſed more commonly to employ new and uncouth alphabetical characters for ſecret writing; many examples of which were collected by Trithemius, and the other ſyſtematic authors on polygraphy, in the 15th and 16th centuries.

But the method of repreſenting whole words or ſyllables by arbitrary marks, ſaid to have been firſt introduced by the old poet Ennius, was much more perplexing, and was encouraged by Mæcenas, Cicero, Seneca the elder, Philargirus, Fannius, Aquila, and Tyro: thouſands of theſe ſyllabic characters may be ſeen in Valerius Probus, Paulus Diaconus, Goltzius, and (in 200 folio pages) at the end of Gruter's Inſcriptions.

Although thoſe Tyronian characters, as they are uſually named, were not alphabetical, we obſerve among them a great many bearing a conſiderable reſemblance to each other, when they denoted words beginning or ending with the ſame Latin particles; ſo that this kind of ταχυγραφια, or βραχυγραφια, was not compoſed entirely at random, but according to ſome preconceived ſyſtem.

The Tyronian *notæ*, we are told by literary perſons, were augmented in the time of Seneca to the number of thirteen thouſand! And ſo completely did they anſwer the purpoſe of ſecret writing during the monkiſh ages, that an old copy of a pſalter, found inſcribed with theſe characters, was ignorantly entitled "Pſalterium in Lingua Armenica." Nay, pope Julius II. employed learned men, without ſucceſs, to decipher them.

Herman Hugo, in his work "De Origine Scribendi," maintains

maintains an opinion of this writing having been ufed among the ancient Hebrews, and that it is alluded to in Pfalm xlv. 1, and Daniel v. 25; but this needs further evidence, and is no better fupported than the opinion fome men hold of Englifh fhort-hand, which is alphabetical, having originated from the Tyronian characters, which are not alphabetical.

Another ancient fort of writing employed among the Romans more than any nation befides, was that of abbreviating words or fyllables, by omitting the final letters, and fometimes placing points or dafhes in their ftead. Thefe figlæ, as they were called, from the word figillæ, ufed to be chiefly infcribed on ftatues, arms, coins, public records, monuments, &c. for the fake of brevity, rather than of fecrecy; and, therefore, do not particularly come under our confideration in the prefent article, although moft authors upon Cryptography have taken notice of the SIGLÆ. (Vide Waltheri Lexicon Diplomaticum, 1752, and Gerrard's Siglarium Romanum, 1792.)

To bring thefe hiftorical remarks towards a conclufion, we fhall now refer to the chief modern writers on the fubject of *ciphers*, whofe names have come to our knowledge; fome of whom, indeed, have treated more formally and copioufly on the art of fecret-writing than others, but all of them deferve mention, and may be confulted with advantage. We prefix an afterifm * to the names of a few authors who, in our judgment, have principally diftinguifhed themfelves, and merit an attentive examination.

The firft writer among the moderns, and the man who may be faid to have led the way in fecret writing, for we have no work of any importance before his time, was the * Abbé Trithemius, a Benedictine, whofe erudition and acumen were fuch, that he was fufpected of magical practices in the exercife of this art. He compofed two extenfive treatifes; one of which, entitled "Polygraphia," was publifhed in the year 1499, but the other, called "Stenographia," was not printed during his life. He alfo made fome progrefs towards the completion of a third work at the inftigation of the emperor Maximilian. His "Polygraphia" was tranflated into the French language by Gabriel de Collange, during the year 1561; but, prior to its appearance, three other authors had written on this topic; viz. Palatino, in 1540, Bellafo, in 1553, and Glauburg, in 1560: and in the year 1563, the public were prefented with another original treatife, by * Baptifta Porta, an author of confiderable merit. Nearly about the fame period, this fubject was handled by Cardanus and Bibliander; afterwards by * Blaife de Vigenere, Walchius, Ifaac Cafaubon, * Schottus, * Guftavus Selenus, Gerrard Voffius, Herman Hugo, Schwenter *alias* * Hercules à Sunde, Wecker, Niceron, * Lord Bacon, Cafpi, Seeländer, * J. Balthafar Friderici, Comiers, Bafaccioni, La Fin, Dalgarno, Becher, Hiller, * Bifhop Wilkins, J. Nicholaus, Buxtorff, Caramuel, Wolfgang, * Falconer, Horfley, P. Crinitus, Erneft Eidel, J. Gefory, J. C. Amman, Ozanam, * Breithaupt, * Conradus, Dutton, Davys, Ware, Gravefande, Twifs, De Vaines, Cafpi, Carpentier, Bifhop Warburton, Staniflaus Mink, Lucatello, Kircher, Pafchius, Morhof, * Thickneffe, Hutton, Hooper, Aftle: to whom fhould be added the mathematician * Dr. Wallis, whofe valuable MSS. on this fubject are depofited in the Bodleian library; and the celebrated Marquis of Worcefter, whofe unpublifhed performance, written A. D. 1659, may be feen in the Harleian library, No. 2428. We have named the unedited works of thefe two Englifhmen, becaufe Dr. Wallis's papers have been often quoted or referred to by authors, and fome of them, indeed, have been printed fince his death; and becaufe the Marquis of Worcefter's "Centurie of Inventions," § 3d and 4th, contain an evident allufion to the fubject of the above MS. which was not difcovered to be his lordfhip's, until we lately recognized and verified it at the Britifh Mufeum.

Several authors who have treated largely on diplomatic affairs, likewife give fome account of writing by cipher; among whom we ought efpecially to notice the editors of the "Nouveau Traité de Diplomatique," tome iii. p. ii. §. iv. ch. x. and the article CHIFFRES in the Encyclop. Method:— "Economie Politique et Diplomatique." But, we confefs, that our expectations have been fometimes difappointed in works of that nature; for where we hoped to find the fcience handled moft learnedly and copioufly, we have found only meagre and trifling obfervations.

This remark alfo applies to what is written, or rather ftolen, upon the fubject of cipher, in the fucceffive editions of the Encyclopædia Britannica; wherein we find merely a long extract from Dr. Hooper's "Recreations," without acknowledgment, or any attempt at improvement! That article might, perhaps, be well enough adapted for the purpofe it was originally defigned, viz. as a "recreation" for fchoolboys; but cannot be regarded as an ornament to the great national work, into which it has been furreptitioufly tranfplanted.

Lord Bacon refers the practice of writing by cipher to the art of grammar, noting it as a deficient branch of knowledge; and, in reference thereto, it is treated by moft of thofe authors who have written on grammar; "that art," fays bifhop Wilkins, "in its true latitude, comprehending all the ways of difcourfe, whether by fpeech, or by writing, or by gefture, together with the feveral circumftances pertaining to them. So that, befides the ufefulnefs of this fubject" (viz. ciphering) "for fome fpecial occafions, it doth alfo belong unto one of the liberal arts." Now, among "the ways of difcourfe" which have been greatly improved and new-modelled of late years, we ought to mention the art of correfponding by *fignals at fea*; an art which the moderns have carried to fo great a pitch of excellence, that naval officers, in different fhips, can difcourfe with each other on almoft any topic of importance relative to their military duties. We fhall here add only a few words concerning naval fignals, as this topic will be hereafter difcuffed at large in a feparate article. See SIGNALS.

Whether the renowned fea-officers of ancient Greece and Rome had a fyftem of fignals analogous to that of Polybius by land, is a queftion which we want evidence to refolve; but we are not without proofs of their ufing fome fort of fignals, however fimple and inadequate we might now account them. Thus, we read when Ægeus fent his fon to Crete, that it was determined to difplay a white flag if the fhip conveyed back Thefeus in fafety; and in the hiftory of the Punic wars, mention is often made of certain rude methods of correfpondence; befides which, Ammianus Marcellinus fpeaks of the *vexillarii* and *fpeculatores*, and fome of the ancient coins reprefent both flags and ftreamers. Again, there is a direct allufion to fignals on fhip-board, by Virgil, Æn. iii. 519.—

> "Poftquam cuncta videt cœlo conftare fereno,
> Dat clarum è puppi fignum."

Alfo in Æneid ii. 255, before quoted; which implies that Agamemnon from his fhip, and Sinon from the citadel, gave fignals mutually to each other, whereby they were enabled to co-operate. But probably thefe methods were as different from the fignals by which the operations of modern navies are regulated, as the Chinefe hieroglyphics are different from our alphabetical characters. It was eafy to erect a flag, difplay a torch, or blow a trumpet; but to multiply and combine thefe or fuch like fignals by fea, fo as to form letters,

letters, words, and ſentences (either immediately or through the intervention of numbers) was a ſcience to which the ancients ſeem not to have attained.

From the inceſſant changes of poſition in ſhips at ſea, it is impoſſible to put in execution the ſame means of conveying intelligence as we have adopted by land; and, beſides this difficulty, the ſpace which can be ſpared for the diſplay of flags by day, and lights in the dark, is exceedingly limited on ſhips under ſail. The principle, therefore, by which naval communications are chiefly governed, conſiſts in the repreſentation of arithmetical numbers; for which purpoſe ten or twelve different flags, &c. are ſufficient, and fewer than ten would be inconvenient. (See the "Telegraphic Signals, or Marine Vocabulary," printed by Sir Home Popham in 1804, for the uſe of the Eaſt India captains.) By the artful combination of a few pendants or flags, naval officers can thus deſignate ſeveral thouſand figures, words, and ſentences, which are entered in oppoſite columns for the ſake of eaſy reference; and by night they can exhibit lanthorns, blue-lights, falſe-fires, or rockets, with the occaſional report of guns, in ſuch a way as to keep up a regular correſpondence. The lights diſplayed for ſignals in the dark, muſt always be arranged perpendicularly, to avoid any apparent change of their relative poſition, when viewed from ſeveral ſhips at a time.

For example: a ſingle light will repreſent 1; two, three, and four lights, placed vertically, may repreſent 2, 3, and 4; three lights over each other, two of which are placed at a certain diſtance below, and the upper one thrice as far above them, will denote figure 5; three perpendicular lights, reverſing the laſt order, may ſtand for 6; four lights, the two at each extreme being at a common diſtance, and a triple ſpace between the middle two, will repreſent 7; four lights, the three lowermoſt ones at a common diſtance, and the upper thrice as far, will ſignify 8; four lights, the three uppermoſt at a common diſtance, and the lower one at a triple diſtance, may denote 9; a falſe-fire, or a blue light, will ſtand for 0 or 10; and by the ſucceſſive exhibition of theſe, as they are wanted, any number of figures, denoting particular inſtructions or communications, can be made with the utmoſt certainty and preciſion. To render this example more clear, we ſubjoin the reſpective ſituations of the lights as deſcribed above: viz.

Lights.		Fig.
o	ſtands for	1
o o	- -	2
o o o	- -	3
o o o o	- -	4
o ⋮ o o	- -	5
o o ⋮ o	- -	6
o o ⋮ o o	ſtand for	7
o ⋮ o o o	- -	8
o o o ⋮ o	- -	9
A falſe fire	-	10

The greateſt impediment in executing this plan, will be the proper adjuſtment of the lights, ſo that they may be diſtinctly perceived. They ſhould be placed at leaſt fifteen or twenty feet apart; and the beſt ſituation for the ſignals repreſenting 5, 6, 7, 8, 9, will uſually be to hoiſt the upper lamp or lamps at the mizen-peak, and the lowermoſt at the enſign ſtaff: but if thoſe ſituations ſhould not be viſible from the other ſhips, let the upper lamps be hoiſted to one of the maſts'-head, and the lower ones to the ſhrouds of the ſame maſt.

By this method, then, it appears that only four lamps are ſufficient for nightly communications at ſea; and upon ſhore, or when a ſhip lies quiet at anchor, a ſtill ſmaller number of ſignals would be adequate to every exigency, as we ſhall evince preſently. Some laudable endeavours have been made to diſtinguiſh the lamps by different coloured glaſſes: but, at a great diſtance, theſe colours could not be diſcriminated with certainty, or the lights have been too feeble when ſeen through denſe glaſſes; in conſequence of which this project has wholly failed of ſucceſs, and can never be revived, except by mere ſpeculators.

Another mode of correſponding by *cipher*, (for all theſe modes come under this general denomination,) is by ſtriking on two or three bells of various ſizes; or by as many different kinds of audible ſounds of any other ſort, ſuch as, 1, a drum; 2, a fife; and, 3, a trumpet. We prefer to uſe three, for alphabetical purpoſes, which may be combined as follows, ſo as to repreſent each letter.

A	is repreſented by		111	N	is repreſented by		222
B	-	-	112	O	-	-	223
C	-	-	113	P	-	-	231
D	-	-	121	Q	-	-	232
E	-	-	122	R	-	-	233
F	-	-	123	S	-	-	311
G	-	-	131	T	-	-	312
H	-	-	132	U	-	-	313
I	-	-	133	V	-	-	321
J	-	-	211	W	-	-	322
K	-	-	212	X	-	-	323
L	-	-	213	Y	-	-	321
M	-	-	221	Z	-	-	322
				Blank, or Nothing		—	333

It muſt be remembered, that the three different ſounds ſtand for only one letter; and that a ſufficient pauſe muſt intervene after each letter, in order to prevent any confuſion. To keep an exact memorandum of this cipher, it will be neceſſary for the auditor to write either the figures, as above, or three alphabetical characters inſtead of them: for inſtance, D for drum, F for fife, and T for trumpet; but, in the uſe of three flags, ſuppoſe red, blue, and white, the letters R, B, and W, would be ſubſtituted.

This method of alphabetical notation is greatly preferable to the uſe of only two ſignals, becauſe it is more diſtinct and eaſy to remember; whereas, if we uſe but two ſigns, they muſt be often repeated, and combined for each letter, (*i. e.* at leaſt five times) as in the cipher of which the following is an example:

A	B	C	D	E	F	G
11111,	11112,	11121,	11122,	11211,	11212,	21221,
H	I	J	K	L	M	N
11222,	12111,	12112,	12122,	12211,	12212,	12221,
O	P	Q	R	S	T	U
12222,	21111,	21112,	21121,	21122,	21211,	21212,
V	W	X	Y	Z	Nothing	
21221,	12121,	22212,	22221,	22122,	21222	

From

From the preceding alphabets may be feen how diftinctly any perfon can exprefs his mind by two or three fignals, addreffed either to the eye or the ear; and in correfponding with thefe ciphers, it will be found very convenient to interpofe the 333, or 21222 (which denotes a blank) between every word, in order to prevent the confufion that might arife from an accidental error. The effect will be the fame, whether the writer make ufe of arithmetical characters, letters, dots, lines, mathematical diagrams, or any other fign which admits of two or three differences. We fhall here add a fpecimen in dots, according to this laft alphabet of figures; where the period ftands for 1, and the colon for 2: the words thus reprefented fhall be the writer's name.

W I L L I A M — B L A I R

.:.:. .:... .::.. .::.. .:... ..... .::.: :.::: ....: .::.. ..... .:... : .:.

The objection which may be ftarted againft both thefe ciphers is, that they are too laborious, and not incapable of being deciphered by perfons of fkill in this art. The writer does not recommend the above mode of dot-writing as very expeditious, but as fimple; he knows it, however, to be much lefs operofe than many ciphers fubmitted to the public, and he can affirm that it is fully as difficult to decipher, as the celebrated plan of Lord Bacon, which he calls writing *omnia per omnia*. But, as an example of more ready and undecipherable writing by dots, of his own invention, the author refers to *Plate* III; whereon he has ventured to engrave the key itfelf, and yet defies any of his readers to explain the principle by which it is compofed, or to give him a fimilar piece of writing.

The moft legible and common ciphers in ufe, confift of a new alphabet, or of the ufual characters tranfpofed fo as to alter their powers: of this latter kind was the cipher of Julius Cæfar and Auguftus; viz.

For	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
Write	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c
Or	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a

Julius Cæfar's method "Per quartam elementarum literam" is not only mentioned by Suetonius and Aulus Gellius, but perhaps is alluded to in Ovid's fourth Epiftle:—

"His arcana notis terra pelagoque feruntur;"

which is paying this fpecies of fecret-writing a higher compliment than it would now be thought to merit: for, certainly, there is no great fkill required to decipher it; but the ancients had not then directed their attention particularly to this fubject, or they might have difcovered its imperfections.

The learned Montfaucon, in his "Palæographia Græca," lib. i. p. 36. edit. Paris, 1708, makes the following remark on the ftate of cryptography among the Greeks: "Κρυπτογραφίαν, five arcanum fcribendi modum, apud Græcos frequentatum obfervamus. Κρυπτογραφίαν vero duplici modo fieri deprehendimus, per commutationem fcilicet literarum, ac per novam & inufitatam characterum formam: utriufque fcribendi rationis alphabeta varia, cum exemplis exhibemus in fpeciminibus undecimi fæculi libro quarto; ubi quamplurima non minus fingularia, quam utilia & occulta, recenfebuntur." Accordingly, he gives, at pp. 87, 286, 288, various alphabets and fpecimens of occult writing, by tranfpofition or malformation of the common Greek letters; and efpecially as it was practifed by Amanuenfes in the eleventh and following centuries. It is certain, too, that the fame practice prevailed in much earlier times, even before the age of Æneas Tacticus; and, therefore, the Roman emperors moft probably learned this art from the Greeks. (Vide Palæographia Græca, l. iv. c. v. de Κρυπτογραφία.) But there is great reafon to believe, that all thefe ancient modes of writing were decipherable by the ordinary rules of analyfis in fuch cafes. We fhall, hereafter, point out the rules neceffary to be obferved in deciphering; and lay down a few directions for the application of common fenfe, where the fpecies of occult writing does not admit of any pofitive rule in its developement.

We have now carried our hiftory of this art down to a period, in which we take leave of the Greeks and Romans. Before we proceed, it may be expected that we fhould illuftrate thefe remarks by more examples: but, fince it would be very expenfive to the proprietors of the Cyclopædia, and no peculiar advantage to the inquifitive reader, if we were to engrave all the arbitrary characters with which fecret-writing has been performed, we fhall fubftitute in their place fuch marks and figures as are found in the printing-office; which will equally well illuftrate the principles and practice of the Greeks and Romans, in regard to the art of cryptography.

The methods of Julius Cæfar and Auguftus are too obvious to dwell upon: it is only required of the writer to put the fecond, third, fourth, or any other, letter of the alphabet, inftead of that which he generally writes; as in the words following, No. I. where we fubftitute the fourth letter for the firft, &c. viz.

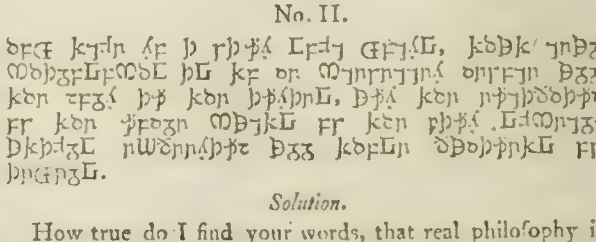
No. I.

Multi, et pene infiniti, funt fcribendi modi.

Pxowl, hw fhqh lqilqlwl, vxqw vfulehqgl prgl.

In the fubfequent examples we ufe characters of different kinds in lieu of the common Roman letters. A fpecimen is compofed for each of the principal European languages, in all of which the fame mode of deciphering is applicable; for it is a matter of perfect indifference to a decipherer what form the characters affume, provided they anfwer (one for one) to the common alphabet, and are neither more nor lefs in quantity.

No. II.

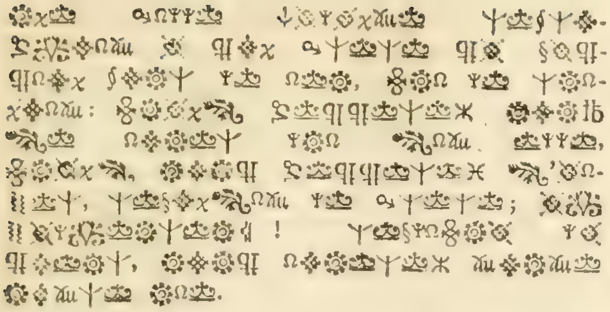


Solution.

How true do I find your words, that real philofophy is to be preferred before all the gold in the Indies, and the enriching of the noble parts of the mind fuperlatively exceeding all thofe cabinets of jewels.

No. III.

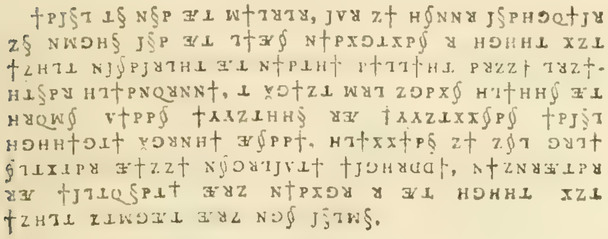
No. III.



Solution.

Une fille galante reprochoit a son frere sa passion pour le jeu, qui le ruinoit : quand cesserez vous de jouer, lui dit elle, quand vous cesserez d'aimer, repondit le frere ; ah malheureux ! repliqua la sœur, vous jouerez toute votre vie.

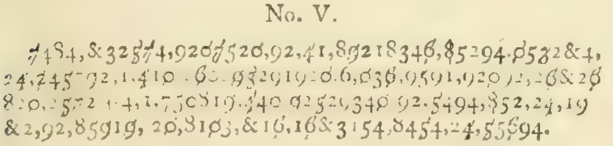
No. IV.



Solution.

Ancor io son di parere, che la tosse contumace lo sputo con di rado sanguigno e tutti gli altri sconcerti di sanita narrati nella relatione transmessa, i quali per lungo tratto di tempo hanno afflitto ed affliggono ancor tuttavia questa Donna, traggano la lor vera origine dalla Soverchia acutezza, salsedine ed acrimonia del sangue e di tutti gli altri liquidi del suo corpo.

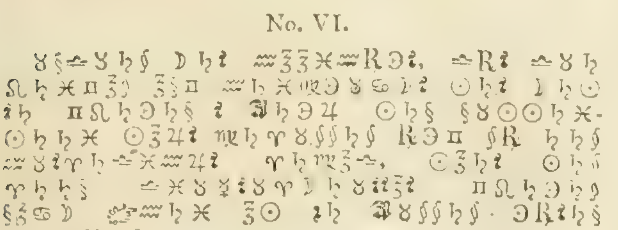
No. V.



Solution.

Poco tiempo despues de la creacion quedó sujeto el hombre à las enfermedades y sin duda desde entences empezó à buscar los remedios : de modo que el arte de curar es casi tan antiguo como el mundo.

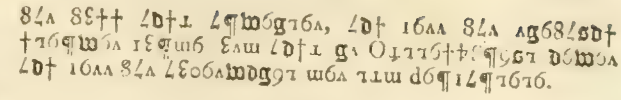
No. VI.



Solution.

Indien het voorvalt, dat die person ons verblicht met hem te spelen, 't welk men nimmermeer moet beginnen als na een uitgedrukt gebod, moet men geen driftigheit tot spelen noch yver om te winnen laten blyken.

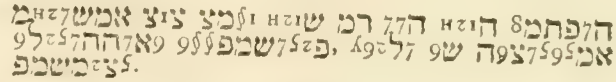
No. VII.



Solution.

Man muss also arbeiten, als wenn man niemahls sterben würde und also in Gottesfurcht leben als wenn man augenblict den tod verwartete.

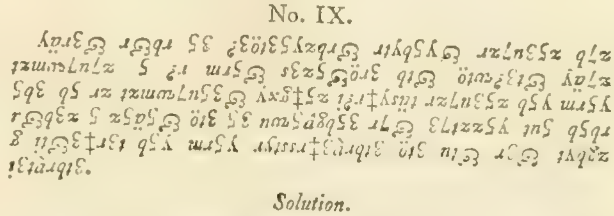
No. VIII.



Solution.

Equidem non nego quod ex iis quos febris acutissima aggreditur, pauci ad sanitatem redeunt.

No. IX.



Solution.

Ὑμεῖς ἔστε οἱ δικαιοῦντες ἑαυτοὺς ἐνώπιον τῶν ἀνθρώπων ὁ δὲ Θεὸς γινώσκει τὰς καρδίας ὑμῶν ὅτι τὸ ἐν ἀνθρώποις ὑψηλὸν βδέλυγμα ἐνώπιον τοῦ Θεοῦ ἔστιν ὁ νόμος καὶ οἱ προφῆται ἕως Ἰωάννου ἀπὸ τότε ἡ βασιλεία τοῦ Θεοῦ εὐαγγελίζεται καὶ πᾶς εἰς αὐτὴν βιάζεται.

In the beginning of the fifth century of the Christian æra, Pharamond, and other reigning princes, invented characters of singular forms ; and, during the eighth and ninth century, Charlemagne kept up a private correspondence with his agents in the north of Europe by similar modes of deception. Some of these alphabets, including that of Pharamond, are preserved by the noble duke Selenus, and by Trithemius. We have selected and exhibited (as a specimen of such inventions) one of those employed by Charlemagne, in *Plate* I. *figure* 1 ; under which is seen *fig.* 2. the form of another secret-alphabet, used in England during the reign of Alfred, copied from a MS. in the Bodleian library. (Vide "Astle's Origin and Progress of Writing, chap. vi. 2d edit. Lond. 1803.") Rudolphus IV. archduke of Austria, who lived in the 14th century, was also much versed in the practice of occult writing ; but there is no complete cryptographical work extant, of earlier date than that of Trithemius, composed under the sanction of Maximilian, at the end of the 15th century : soon after which period, Frederic II. Elector palatine, was induced, by a superstitious outcry against the author, of having practised diabolical mysteries, to commit the original MS. of Trithemius's curious book to the flames ! ! !

In *Plate* I. *fig.* 6, we have represented the cipher used by cardinal Wolsey, at the court of Vienna, in 1524.—*Fig.* 7, is the cipher which sir Thomas Smith employed at Paris, in 1563.—*Fig.* 8, is sir Thomas Chaloner's cipher from Madrid, in 1564.—*Fig.* 9, is that of sir Edward Stafford, from Madrid, in 1586. And, among the royal MSS. deposited in the British Museum, we have met with various other ciphers of the same period ; so that they had then become of general use in the different European courts.

The form of these ciphers, it will be observed, was very arbitrary and capricious : but the mode of secret-writing underwent

underwent a confiderable change in the next century, by the frequent adoption of arithmetical figures inftead of letters; as we perceive, for example, among the confidential epiftles of Charles I. to his fon. (Vide MSS. N° 132, and 6988 Bibl. Harl.) We fubjoin part of one of this unfortunate monarch's letters, dated Aug. 1ft, 1648, as a fpecimen of that kind of cryptography; and, for an explanation of many more of them, we refer to Dr. Wallis's unpublifhed collection in the Bodleian library at Oxford:

"I thought that 379 : 361 : 185 : 28 : 2 : 239 : 59 : 60 : 93 : 5 : 214 : 126 : 379 : 90 : 37 : 1 : 258 : 6 : 2 : 212 : 370 : 196 : 379 : 245 : 339 : 245 : 339 : 363 : 329 : 165 : 246 : 16 : 50 : 212 : 196 : 444 : 149 : 13 : 44 : 32 : 14 : 26 : 10 : 78 : 43 : 65 : 329 : 331 : 380 : 17 : 48 : 29 : 338 : 77 : 214 : 339 : 93 : 85 : 6 : 23 : 220 : 78 : 57 : 152 : 5 : 65 : I command you, &c."

In another letter, the king writes to his fon from Newport, (Nov. 7th, 1648,) and adds, "Let none decipher this but yourfelf, or my lord Culpeper;" fo that this cipher was, doubtlefs, regarded as very faithful, and was, perhaps, entrufted to only a few confidential perfons about his majefty. Somewhat prior to that critical time, however, we find Charles I. ufing a cipher which could by no means be depended on for fecrecy. We allude to an alphabet chiefly compofed of 24 fhort ftrokes, varioufly fituated upon a line; and by which, April 5th, 1646, he wrote to the earl of Glamorgan, afterwards the marquis of Worcefter. See Royal Letters, Bibl. Harl. vol. iii. 118, 119, &c.

We have exhibited this Ogham-like alphabet in *Plate* I. *fig.* 4. It has been often referred to of late, as a curious and very fimple invention. (See Biograph. Britan. vol. i. page 433, Art. Bales): and it was the accidental fight of this alphabet in the year 1804, which firft caufed the author of the prefent article to inveftigate the nature of ciphers; for, till then he had never once thought or read on the fubject. During the courfe of this examination, he difcovered (in Bibl. Harl. N° 2428.) the marquis of Worcefter's peculiar, and hitherto inexplicable, mode of writing; which feems to be briefly defcribed in the 3d and 4th of his lordfhip's "Centurie of Inventions:" of which, likewife, there is in the Britifh Mufeum a fair manufcript copy, dated "from Auguft ye 29th, to Sept. ye 21th, 1659."

We here extract the marquis's words regarding this cipher, from pages 5th and 6th of his "Inventions;" which were firft written by him in 1655, but not printed till 1663, as we learn from the work itfelf. "A cypher and character fo contrived, that one line, without returns and circumflexes, ftands for each and every of the 24 letters; and as ready to be made for the one letter as the other."

"This invention, fo refined and fo abbreviated, that a point only fheweth diftinctly and fignificantly any of the 24 letters; and thefe very points to be made with two pens, fo that no time will be loft; but, as one finger rifeth, the other may make the following letter; never clogging the memory with feveral figures for words and combinations of letters; which, with eafe and void of confufion, are thus fpeedily and punctually, letter for letter, fet down by naked and not multiplied points. And nothing can be lefs than a point; the mathematical definition of it being, *Cujus pars nulla*. And a motion no fwifter imaginable than *femiquavers* or *relifhes*, yet applicable to this manner of writing."

This cipher was one of the extraordinary inventions for which the marquis applied to parliament, in hopes of a remuneration; but as he was not known to have either printed an account of it, or to have left any explanation of it in writing, many fhrewd conjectures were afterwards made touching the nature of this noble author's contrivance. We fhall notice one of thefe gueffes, before we proceed to give a farther defcription of it. (See Gent. Magazine, vol. xviii. p. 55.) An anonymous gentleman propofes "to rule his paper with quarternions of lines, as if for mufic, and to let the points reprefenting the letters be placed on, or between thefe lines; one-half of the alphabet to afcend in the fcale, and to be done with common ink; the other half to defcend, and to be done with red ink; the red ink pen in one hand, and the black in the other." The propofal, however, does not at all correfpond with what we believe to have been intended by the marquis of Worcefter: it is alfo much too complex and tedious for ordinary practice, and would be far from anfwering the purpofes of a faithful cipher.

As this nobleman was one of the moft ingenious and extraordinary perfonages of his time, and may even be confidered as a prodigy in mechanical aquirements, we take the liberty of ftating all we know of his difcoveries in fecret writing; partly divulged by himfelf, in his very fcarce volume of "Inventions;" and partly collected from a MS. in the Harleian Library, No. 2428, which bears clear internal marks of its origin, although it was not fuppofed to be his, until we lately convinced the Librarian. "The one-line cypher" and mode of dot-writing are thus entitled, in the above manufcript: "An explanation of the moft exact and moft compendious way of fhort writing; and an example given by way of queftions and refolves upon each fignificant point, proving how and why it ftands for fuch and fuch a letter, in order alphabetically placed in every page."—His method of writing is fhewn in *fig.* 5. *Plate* I. An engraved page is given to write upon, in which are made horizontal rows of octangular fquares or chequers; and a ftrait line is to be drawn from the centre towards the circumference of thefe fquares, in different pofitions and of various lengths, for each letter of the alphabet. Thus *A* is a fhort horizontal ftroke, made to the right hand, and not touching the circumference; *I* is the fame ftroke paffing clofe to the circumference; *R* is the fame ftroke, going beyond the circumference; *E*, *N*, and *W*, are reprefented by a fimilar ftroke, in the oppofite direction, but varying in their lengths. By a like method, he fuggefts that we may write with a dot or fingle point only; which is to be placed at a certain diftance, and in a certain direction, from the centre of the octagon, for each letter of the alphabet.

The Marquis propofes this contrivance for the purpofe of writing with fecrecy, as well as with brevity; and leaves it to the will of any perfon to change the value or name of the letters, as it may fuit his fancy or intention: "The points to be written," fays he, "and reade as they precede or as they are the one above the other;" and for the fake of expedition as well as "for hufbanding of paper," he advifes "to omit all needleffe and unfounding letters," as we do in fhort-hand writing.

This ingenious plan is better adapted for fecret writing, than for fhort-hand; and yet we do not think it would be difficult to decipher any thing written in this way, unlefs the writer were to change the power of his letters very frequently, becaufe he would not otherwife be able to elude the common rules for deciphering.

That the Marquis had turned his attention particularly to this fubject, is ftrikingly evident from the following paffages, contained in his very curious book; entitled, — "A Centurie of the Names and Scantlings of Inventions by me already practiced."

No. 5. "A way by a circular motion, either along a rule or ring-wife, to vary any alphabet, even this of points; fo that the felf-fame point individually placed, without the leaft additional mark or variation of place, fhall ftand for

for all the 24 letters, and not for the fame letter twice in ten fheets writing; yet as eafily and certainly read and known as if it ftood but for one and the felf-fame letter conftantly fignified."

No. 6. "How at a window, as far as eye can difcover black from white, a man may hold difcourfe with his correfpondent, without noife made or notice taken; being according to occafion given and means afforded, *ex re natâ*, and no need of provifion before hand; though much better if forfeen, and means prepared for it, and a premeditated courfe taken by mutual confent of parties."

No. 7. "A way to do it by night as well as by day, though as dark as pitch is black."

No. 32. "How to compofe an univerfal character methodical and eafie to be written, yet intelligible in any language; fo that if an Englifhman write it in Englifh, a French-man, Italian, Spaniard, Irifh, Welfh, being fcollars, yea, Grecian or Hebritian, fhall as perfectly underftand it in their owne tongue, as if they were perfect Englifh; diftinguifhing the verbs from nouns, the numbers, tenfes, and cafes as properly expreffed in their own language as it was written in Englifh."

No. 33. "To write with a needle and thred, white or any colour upon white, or any other colour; fo that one ftitch fhall fignificantly fhew any letter, and as readily and as eafily fhew the one letter as the other, and fit for any language."

No. 34. "To write by a knotted filk ftring, fo that every knot fhall fignify any letter, with comma, full point, or interrogation, and as legible as with pen and ink upon white paper."

No. 35. "The like by the fringe of gloves."

No. 36. "By ftringing of bracelets."

No. 37. "Pinck'd gloves."

No. 38. "By holes in the bottom of a fieve."

No. 39. "By a lattin or plate lanthorn."

Nos. { 40. "By the fmell." 41. "By the tafte." 42. "By the touch." } "And by thefe three fenfes as perfectly, diftinctly, and unconfufedly, yea as readily, as by the fight."

No. 43. "How to vary each of thefe, fo that ten thoufand may know them, and yet keep the underftanding-part from any but their correfpondent."

No. 51. "A rule of gradation, which, with eafe and method, reduceth all things to a private correfpondence, moft ufeful for fecret intelligence."

No. 52. "How to fignify words and a perfect difcourfe by jangling of bells of any parifh-church, or by any mufical inftrument within hearing; in a feeming way of tuning it, or of an unfkilful beginner."

No. 75. "How a tape or ribbon-weaver may fet down a whole difcourfe, without knowing a letter, or interweaving any thing fufpicious of other fecret than a new-fafhion ribbon."

No. 76. "How to write in the dark as ftraight as by day light."

Our limits, for this article, do not allow us to enter into the merits of every propofal made public, for fecret correfpondence: but, having before obferved that arithmetical figures had become very common in the reign of Charles I. inftead of the ciphers previoufly employed, we fhall here offer a few remarks on their ufe. The celebrated and profound mathematician, Dr. Wallis, deciphered a great number of intercepted letters, written in figures, about the period of that King's unhappy controverfy. We have already faid, that copies of thefe deciphered papers are depofited in the Bodleian library, at Oxford; and in the prefatory obfervations to that collection, Dr. Wallis declares his judgment of them in thefe words: "I would not defire to ufe a better cipher than moft of thofe * * * *. I do fcarcely believe that it will be an eafy matter to contrive a way more intricate than the *figure-cipher*, ordinarily now in practice, with the like convenience for ufe: and, if any affect fome more perplexed than thefe, I doubt not but his fuppofed better way will be equally obnoxious to a difcovery; or elfe will be extremely tedious in ufe, both to him that writes by it, and to him that is to read it, that it will not admit of any tolerable difpatch." (See alfo Mr. Davy's Effay on Deciphering, p. 17.—General Dictionary, vol. x. p. 93; and Biographia Britannica, Art. *Wallis*.) This acute author was very different from Scaliger, in his opinion of fecret writing: for, while the latter ridiculed the idea of infcribing what could never be developed, becaufe he was able to decipher the Lacedæmonian Scytale; Dr. Wallis, on the contrary, who had gone fifty times deeper in this fcience than Scaliger, admits "there may be a cipher fo intricate as fhall be beyond the art of man to difclofe."

No perfon except Vieta, (a French mathematician, who was employed by Francis I.) had difcovered near fo much fkill in deciphering, as Dr. Wallis. He feems not to have known of what Vieta did in this way, nor had he any aid from other perfons in his refearches: we are, therefore, difpofed to pay the greateft deference to his judgment as a decipherer; but we beg leave to obferve, that it does not follow he fhould know all the poffibilities of this multiform art. He confidered the "figure-cipher" as extremely intricate; we doubt not, that others may be contrived equally fo; and that fuperadded to this quality, a cipher may be adapted for greater difpatch, "both to him that writes by it and to him that is to read it." Befides which, we think it even practicable to invent a cipher, exclufive of its having thofe properties, which fhall not be much expofed to fufpicion; and this, we conceive with Lord Bacon, to be a very effential requifite in certain fituations of the writer and reader, though not fo in all circumftances.

There is a method of employing figures, common enough in the prefent day, which was much recommended by Baptift Porta and Cardanus; and therefore not a novel invention: but Blaife de Vigenere, whofe treatife on ciphers was publifhed at Paris in 1587, has pointed out the inconveniences of this method; which confifts in referring to words or fentences by the correfponding pages and lines of fome rare printed book, in the poffeffion of the confederate parties. Now, fays Vigenere, (p. 208.) this plan is too laborious, and flow in operation, for bufinefs requiring to be defcribed in detail; it will not always provide the words fought for, at leaft without an immenfe deal of pains, perhaps after examining through fome hundred pages; and, unlefs a dictionary be ufed, the names of perfons, places, or profeffions, can be found in no book whatever: befides which, many accidents may lead to a difcovery of the key or book fo confided in; and many others may happen to deprive us of that refource, or to render it inconvenient to depend on fuch a ftratagem. The writing, moreover, is always liable to fufpicion, if intercepted. So that this plan is wholly unfit for extenfive correfpondence, as in diplomatic affairs; and ought rather to be accounted a childifh than a fcientific invention, however it has been fanctioned by modern practice, among military commanders and officers of ftate.

We do not object altogether againft the ufe of figures and numeral characters, as if they were unfit, *on account of their form*, to be adopted in cryptographical writing; but we object to the above manner of applying them, becaufe as numerals,

rals, denoting only the pages or lines of a book, theſe figures cannot be written with any tolerable expedition, and muſt be a perpetual check to the reader's progreſs in deciphering. This method, it muſt be acknowledged, poſſeſſes the property of being undecipherable without the key: for, let us ſuppoſe (in writing the example given by Mr. Thickneſſe) "That the parties agree to correſpond by Newton's firſt edition of Milton; and thereby direct each other, in their letters, to ſuch a page, ſuch a line, and ſuch a word; it may be aſked, Who would be able to find out, that their writing page 7, line 2, words 3, 4, 5, and vol. ii. page 8, line 19, word 4, —the ſame page, line 9, words 3, 4, and 5—was to ſay 'The weſtern empire is degenerated into licentiouſneſs?' without being told that theſe words will be found in the firſt and ſecond volume of Farneworth's tranſlation of Machiavel's works: the firſt three words from his hiſtory of Florence, and the remainder from his political diſcourſes on the firſt Decad of Livy." All this will be granted; but as the property of being intricate is not the only one we ſhould look for in a good cipher, we conclude again by obſerving, that the above plan is puerile and unſcientific to the laſt degree; conſequently, that it is wholly unfit for men of buſineſs, or for any beſides incidental occaſions, where very little writing is required.

By referring to a dictionary, indeed, theſe objections are partly leſſened, becauſe the words may be found with greater facility than in other books; but even ſuch a reſource is very inſufficient for all occaſions, and it ſtill muſt prove a moſt tedious and operoſe employment, in writing only ten or a dozen lines. The French Encyclopédiſts deſcribe a much more feaſible mode of writing by figures, which, nevertheleſs, we cannot approve as the beſt method of cyphering. It is this:

The correſpondents agree on a ſet of figures to repreſent all the letters of the alphabet, and alſo a great many words or phraſes. Several ways may be adopted for the repreſentation of any important letter, or phraſe, of frequent occurrence; ſuch as the five vowels, or the words France, emperor, king of this and that nation, ſtates-general, cardinal ſo and ſo, the allied armies, an ambaſſador's name, &c. &c. &c. All theſe different words are to be claſſed and arranged in ſuch a manner as to be eaſily found, both in writing and deciphering; and another claſſification muſt be made, in which the figures ſtand firſt, and the words in an oppoſite column. The ſentences and entire paragraphs, which are of prime importance in a diſpatch, ſhould be written wholly in cipher, without any intermixture of common letters; becauſe, by the aid of particles and connecting words, the terms of greater conſequence, on which the ſenſe hinges, will often be diſcovered, and the matter in debate or agitation will thus be underſtood. It is alſo proper to write the lines ſo far apart, that the decipherer may ſubſcribe the figures when he reads the diſpatch; as in the following ſpecimens:

Le miniſtre d'ici eſt tout dévoué aux intérêts de la France:
102 25 44 9 1200 70 350 888
c'eſt le fruit de dix mille Louïs ſemées à propos.
54 5 20 60 101 19 501 80
The negociation is interrupted by the pertinacity and
2 999 4 10 50 1000 14
unreaſonableneſs of the duke, who probably has received
350 31 86 5 77 680
private inſtructions from his court.
1110 21 89 231

Means may be deviſed for detecting the unfaithfulneſs of a ſubordinate ſecretary, who is ſuppoſed to have communicated his cipher to a foreign power. The court may demand of its miniſter abroad, or the miniſter require of his court, ſomething quite the reverſe of what is deſired, it being previouſly agreed by the cabinet that a certain mark or private ſign denotes oppoſition or annihilation, with reſpect to the particular thing annexed to the ſaid ſign. This ſpecial mark may be called the annulling ſign, and will ſerve for various important uſes; as has often been proved in conducting naval ſignals, where the enemy was within ſight, or where any miſtake happened to ariſe in the courſe of a correſpondence. By the help of ſuch an artifice, when a cipher has been accidentally diſcovered, or traitorouſly diſcloſed, a ſkilful negociator will be able to deceive the enemy, and lead him into inextricable errors, which may finally turn to the advantage of his own cauſe.

Sir J. Ware, colonel Vallancey, and Mr. Aſtle give remarkable accounts of the Iriſh ſteganography, by means of peculiar alphabets, called by the barbarous name of Ogums, or Oghams, of which there are three kinds: the firſt is compoſed of ſtrokes and marks, that derive their power from certain poſitions with reſpect to one horizontal line, over, or under, or upon, which they are drawn; this principal line ſerving for a rule or guide, its upper part being named the left, and its under part the right. The characters or ſhort ſtrokes, by their number or ſituation, repreſent, not only ſingle vowels and conſonants, but alſo diphthongs and triphthongs.

In our *Plate* I. *fig.* 3. is ſeen one of the moſt ſimple Oghams, copied from Sir J. Ware's "Antiquities of Ireland" (vol. ii. p. 20.), which would not be very difficult to decipher; becauſe, although the number of diagonal and perpendicular marks is conſiderable, it muſt be obvious how many of them repreſent one letter, and it will be ſeen that they make up but twenty-ſix in all. The marks for diphthongs and triphthongs do not occur in ancient manuſcripts, the vowels being repreſented ſingly, as *ae*, not *æ*, &c. Therefore an Ogham having diphthongs, ſuch as that we have ſelected, cannot be regarded as of ancient date.

The ſecond and third kinds of Ogham uſed by the Iriſh differ chiefly in this: that the letter *b* or *c* is placed firſt, inſtead of *a*; or, that the mark for one of thoſe letters is ſubſtituted for all the vowels, by doubling or reverſing it, and by its frequent repetition, ſo as to confuſe the writing. (See "Tractatus apud Hibernos veteres, de occultis ſcribendi formulis, ſeu Artificiis Hibernicè Ogum dictis;" a MS. lately given to the Britiſh Muſeum by the Rev. Dr. Miller.)

Several ſpecimens of Iriſh Oghams are engraved in the ſecond edition of Mr. Aſtle's Hiſtory of Writing; a work replete with intereſting matter on various points connected with that ſubject in general, but extremely deficient on ſhort-writing (ſtenography), and ſecret-writing (cryptography). Upon theſe two departments of the art, we feel a deſire, if opportunity ſhould permit, of laying before the public ſome reſults of our own inveſtigations and practice; though we cannot indulge the vain opinion of our feeble efforts, which Trithemius entertained of his learned labours: (Præf. ad Maximil. Imperatorem, Polygr. p. 100.) "In manibus jam habeo grande opus, quod ſi unquam fuerit publicatum, totus mundus mirabitur." See the article STENOGRAPHY.

It might be thought an injuſtice to the memory of the profound and noble chancellor Bacon, not to ſtate in detail whatever his lordſhip has written upon ciphers; as ſome men of acknowledged ability (for inſtance, biſhop Wilkins and Mr. Falconer), have conſidered his propoſal ſuperior to every other. Mr. Falconer calls it "the moſt ingenious method extant;" and the biſhop of Cheſter ſays, "This way of writing is juſtly to be preferred before any other, as contain-

 ing

ing in it more eminently all thoſe conditions that are deſirable in ſuch kind of inventions, viz.

" 1. 'Tis not very laborious either to read or write.
" 2. 'Tis very difficult to be deciphered.
" 3. 'Tis void of ſuſpicion."

We find alſo the following encomium in Mr. Thickneſſe's Treatiſe; "Thoſe who are acquainted with lord Bacon's great depth of capacity, will readily agree with me that a ſecret method of writing contrived by a man of his amazing penetration, muſt be ſuperior to all others, as indeed it is, and contains the higheſt degree of cypher."

We copy the illuſtrious Verulam's own propoſal, out of Dr. Shaw's edition of his works, vol. i. p. 141—145.

"There are ſeveral kinds of cyphers; as the *ſimple;* thoſe mixed with non-ſignificants; thoſe conſiſting of two kinds of characters; *wheel-cyphers, key-cyphers, word-cyphers,* &c. There are three properties required in cyphers, viz.; (1.) that they be eaſy to write and read; (2.) that they be truſty and undecypherable; and, (3.) if poſſible, clear of ſuſpicion. For, if a letter ſhould come into the hands of ſuch as have a power over the writer, or receiver, tho' the cypher itſelf be truſty, and impoſſible to decypher, 'tis ſtill ſubject to examination and queſtion; unleſs there be no room to ſuſpect or examine it.

" There is a new and uſeful invention, to elude the examination of a cypher, viz.; to have two alphabets, the one of ſignificant, and the other of non-ſignificant letters; and folding up two writings together; the one conveying the ſecret, whilſt the other is ſuch as the writer might probably ſend without danger. In caſe of a ſtrict examination about the cypher, the bearer is to produce the non-ſignificant alphabet for the true; and the true for the non-ſignificant: by which means the examiner would fall upon the outward writing; and finding it probable, ſuſpect nothing of the inner.

" But to prevent all ſuſpicion, we ſhall here annex a cypher of our own, which has the higheſt perfection of a cypher; that of ſignifying omnia per omnia; any thing by every thing; provided only the matter included be five times leſs than that which includes it; without any other condition or limitation. The invention is this; firſt let all the letters of the alphabet be reſolved into two only, by repetition and tranſpoſition: for a tranſpoſition of two letters, thro' five places, or different arrangements, will denote two and thirty differences; and conſequently fewer, or four and twenty, the number of letters in our alphabet; as in the following example:

" A biliteral alphabet, conſiſting only of *a* and *b* changed through five places, ſo as to repreſent all the letters of the common alphabet.

A = aaaaa	I = abaaa	R = baaaa
B = aaaab	K = abaab	S = baaab
C = aaaba	L = ababa	T = baaba
D = aaabb	M = ababb	V = baabb
E = aabaa	N = abbaa	W = babaa
F = aabab	O = abbab	X = babab
G = aabba	P = abbba	Y = babba
H = aabbb	Q = abbbb	Z = babbb

" Thus, in order to write an *A*, you write five *a's*, or aaaaa; and to write a *B*, you write four *a's*, and one *b*, or aaaab; and ſo of the reſt.

" And here, by the way, we gain no ſmall advantage; as this contrivance ſhews a method of expreſſing, and ſignifying one's mind, to any diſtance, by objects that are either viſible or audible; provided only the objects are but capable of two differences; as bells, ſpeaking-trumpets, fire-works, cannon, &c. But for writing, let the included letter be reſolved into this biliteral alphabet: ſuppoſe that letter were the word *Fly*; it is thus reſolved:

F	L	Y.
aabab	ababa	babba.

" Let there be alſo at hand two other common alphabets, differing only from each other in the make of their letters, ſo that, as well the capital as the ſmall be differently ſhaped, or cut, at every one's diſcretion: as thus for example, in Roman and Italick; each Roman letter conſtantly repreſenting A, and each Italick letter *B*.

" The firſt, or Roman Alphabet.

A, a.	K, k.	T, t.
B, b.	L, l.	V, v.
C, c.	M, m.	U, u.
D, d.	N, n.	W, w.
E, e.	O, o.	X, x.
F, f.	P, p.	Y, y.
G, g.	Q, q.	Z, z.
H, h.	R, r.	
I, i.	S, s.	

All the letters of this Roman Alphabet are read, or decyphered, by tranſlating them into the letter A, only.

" The ſecond, or Italick Alphabet.

A, a.	*K, k.*	*T, t.*
B, b.	*L, l.*	*V, v.*
C, c.	*M, m.*	*U, u.*
D, d.	*N, n.*	*W, w.*
E, e.	*O, o.*	*X, x.*
F, f.	*P, p.*	*Y, y.*
G, g.	*Q, q.*	*Z, z.*
H, h.	*R, r.*	
I, i.	*S, s.*	

" All the letters of this Italick alphabet are read by tranſlating them into the letter *B*, only.

" Now adjuſt or fit any external double-faced writing, letter by letter, to the internal writing, firſt made biliterate; and afterwards write it down for the letter, or epiſtle, to be ſent. Suppoſe the external writing were, *Stay till I come to you;* and the internal one were *Fly;* then, as we ſaw above, the word *Fly*, reſolved by means of the biliteral alphabet, is

F	L	Y
aabab	ababa	babba,

whereto I fit, letter by letter, the words, *Stay till I come to you;* obſerving the uſe of my two alphabets of differently ſhaped letters: thus,

aabab ababa babba
St*ayt* i*l* i co *me to* you.

" Having now adjuſted my writing, according to all my alphabets, I ſend it to my correſpondent; who reads the ſecret meaning, by tranſlating the Roman letters into *a's*, and the Italick ones into *b's*, according to the Roman and Italick

Italick alphabets; and comparing each combination of five of them with the biliteral alphabet.

"This doctrine of cyphers has introduced another, relative to it; viz. the art of decyphering, without the alphabet of the cypher, or knowing the rules whereby it was formed. This indeed is a work of labour and ingenuity, devoted, as well as the former, to the secret service of princes. Yet, by a diligent precaution, it may be render'd useless; tho', as matters now stand, 'tis highly serviceable. For, if the cyphers in use were good and trusty, several of them would absolutely elude the labour of the decypherer; and yet remain commodious enough, so as to be readily wrote and read: but through the ignorance and unskilfulness of secretaries and clerks, in the courts of princes, the most important affairs are generally committed to weak and treacherous cyphers."

It becomes us to offer our opinion with extreme diffidence, in presuming to criticise the production of a man so highly distinguished for his capacity and acuteness. But we cannot refrain from believing, that this contrivance of lord Bacon will appear to most persons too operose and slow of execution for public business; of which, indeed, we desire no better proof, than that it has met with so little encouragement from official and regular practice. It must always be deemed a serious inconvenience attending his lordship's plan, that it requires, at least, five times more labour than is requisite in ordinary writing. Whereas, if a triformed alphabet were to be invented in lieu of this, and regulated by another alphabet composed of three letters instead of two, the secret writing would then bear only a triple proportion to common writing, and the trouble of an amanuensis might thus be greatly diminished.

A second point on which we beg leave to express our doubts, is, Whether this cipher be infallibly secure against the scrutinizing eye of a diligent examiner? For, if the reader were to place a mark of distinction between every fifth character, reckoning the five as one letter, we ask, Why might not this writing be liable to a discovery as well as any simple cipher, and on the same general principles? Nay, Mr. Falconer himself confesses it may, notwithstanding the compliment he pays to the noble author for his ingenuity and learning. Nevertheless, we think it will be granted on all hands, that lord Bacon's mode, if it had not been published, would have possessed one rare and valuable property, beyond the ciphers previously invented, namely, that of being scarcely at all exposed to suspicion; and therefore, in this respect, it is entitled to especial attention and praise.

Bishop Wilkins avails himself of the fact, that two signs repeated, as in lord Bacon's alphabet, or three combined in a certain order, will serve to communicate our thoughts; and he improves upon it in the following manner: Let there be two bells of different notes, or one bell and some other loud sound, as that of a musket, horn, drum, &c. According to the plan of a biliteral alphabet, a man may express any letter by two such different sounds, repeating them five times. But if the sounds were capable of a triple difference, then each letter may be expressed by a threefold sound; and if they contain a quintuple difference, or consisted of five sounding instruments, every letter might be signified by two of them only; as we have shewn already with two flambeaux, and as will be further obvious from our subsequent remarks.

He quotes a story from John Baptist Porta, in lib. i. cap. 6. of his work, "De Furtivis Literarum Notis, vulgo de Ziferis," who relates, that when the citizens at the siege of Navarre were reduced to the greatest extremity, they communicated their wants to their distant friends by discharging various kinds of cannon in the night time, according to a predetermined order; by which means they obtained such supplies as they needed, and preserved their city. But the most curious proposal for the management of sounds in correspondence, is that of expressing letters and words by the ordinary notes of a musical instrument; which bishop Wilkins believed might be adapted "for a universal language, and the writing of them for a universal character," not by expressing words, "but things and notions." Then, says he, "there might be such a general language as should be equally speakable by all nations and people."

We are not sanguine enough to expect the learned bishop's plan, of recovering the world from the Babel-confusion, will very quickly take effect; and, certainly, the specimen of musical writing which he has exhibited is very unlikely to answer that purpose. Mr. Thicknesse thinks, "writing performed by an harmonic alphabet would be the most void of suspicion of all others:" both he and the bishop have therefore given an alphabet of this kind, and they both presume on his lordship being "the only writer who has mentioned the method of writing by musical notes;" wherein, however, they are both mistaken. For Augustus, the duke of Brunswick (*alias* Gustavus Selenus,) in his "System of Cryptography," lib. vi. cap. 19. exhibits various specimens of writing in that way; and does not claim the invention himself, but ascribes it to count Frederic of Oetingen. Nay, it is pretty clear that Trithemius was not ignorant of this device; since he declares, in his epistle to Bostius, A. D. 1499, that he could discourse by playing on the organ or singing, "ludendum in organo vel cantandum," which seems to be the proposal above mentioned, or something very like it.

That we may not appear to have slighted so curious a proposal, we will offer a few remarks on this subject; and beg our readers to consult *Plate* II. *figs.* 2, 3, 4, and 5; where we have given an harmonic alphabet, and several specimens of musical writing, in illustration of the present article.

If four or five characters be amply sufficient, by combination and repetition, to denote every word or idea we can express, it is certain that seven musical sounds are more than sufficient for the same purpose. But we must learn to distinguish between these sounds, as they would be represented in ordinary writing, and the scientific arrangement of them, so as to form a musical composition: for those two results may happen to be as different from each other, as the chattering of a magpie and the orations of Cicero, or as the jumbling of letters in a box, and the adjustment of them by a typographer.

It is true that the seven musical notes are enough in respect to number, (for seven notes will afford 5040 varieties or combinations, without repeating any of them); but we are not therefore to conclude, that they can be made to coalesce and harmonize, according to the precise order and relation we should wish to use them in alphabetical writing.

Articulate sounds are represented on paper, &c. by certain substitutes called letters, which possess whatever quality we may choose to impose on them: but harmonic tones are not at all controulable by arbitrary laws; their inherent powers are fixed by nature; they cannot, therefore, be made subservient to our pre-conceived methods of speech, or our established notation by letters; and, if they are compelled to associate with these, it must be managed by the subversion of our common language, and adapting its structure to the natural qualities of musical sounds. This being our opinion, we should as soon expect a man to converse in two

two different languages at once, or the wind to blow in two opposite directions, as the laws of harmony to obey any existing plans of articulation and writing. See the article HARMONY.

Having thus freely given our deliberate view of this subject, we lay before the reader some observations of Mr. Philip Thicknesse, who has laboured more earnestly than any other author to enlist the powers of harmony into the service of cryptographers. As his opinion differs from our own, we do him the justice to adduce his words at full length. In the specimens of musical composition, however, we have corrected several of that gentleman's errors; so that his remarks will not suffer any loss, from our officiousness.

"Bishop Wilkins, in his chapter relative to a language consisting of tunes and musical notes, without any articulate sound, says, 'If the musical instrument that is used for this purpose, be able to express the ordinary notes, not only according to their different tones, but their times also, then may each letter of the alphabet be rendered by a single sound; whence it will follow, that a man may frame a language, consisting only of tunes, and such inarticulate sounds, as no letters can express, which kind of speech is fancied to be usual amongst the lunary inhabitants; who, as Domingo Gonsales hath discovered, have contrived the letters of the alphabet upon the notes after some such order.' But the specimen the bishop has given, (by writing *Gloria Deo soli* by minums, on musical lines,) will instantly appear to any one the least conversant with music, that being without harmony or time, it must have no meaning, or that some hidden matter is thereby disguised. I shall therefore endeavour to write down an alphabet by musical notes, in such a manner, that even a master of music shall not suspect it is to convey any meaning, but that which is obvious; and I am persuaded an alphabet of musical notes may be so contrived, that the notes shall not only convey the harmony, but the very words of the song, so that a music-master, (which is too often his design) may instruct his female pupil, not only how to play upon an instrument, but how to play the fool at the same time, and impose upon her parents or guardians, by hearkening to his folly, impertinence, and wickedness. When a music-master has once taught his female pupil to understand a musical alphabet, and she will permit him to carry on a secret correspondence, he may send her daily a lesson which she may repent having learned as long as she lives.

"In the plate annexed, I have given a musical alphabet (*Plate* II. *fig.* 2.), and under it a specimen to explain more fully my meaning (See *Plate* II. *fig.* 3.). If a music master be required to play it, he will certainly think it an odd, as well as a very indifferent composition; but neither he, nor any other person, will suspect that the notes convey also the two following harmonious lines from Dr. Goldsmith's "Deserted Village:"

> 'Near yonder copse where once the garden smil'd,
> And still where many a garden-flow'r grows wild.'

"Now, it may be so ordered, that the plain notes, *i. e.* the crotchets and minums alone, compose the alphabet, and that neither flats nor sharps, nor the smaller notes between, (which may be placed as mere graces, and meant to deceive) have any thing to do with the reading; so that the decypherer would not so readily know how to proceed, and many people there are, who will think it impossible to be made out without the key; yet I am persuaded, one who possesses a very moderate turn for such business, would read it in a very short time.

"If the words of a song could be thus conveyed by the notes, as well as the air, it would, exclusive of the contrivance, be of infinite service and ease to ladies who sing: indeed, it seems, to those who are not acquainted with music, almost inconceivable, how a person at first sight, shall be able to read the bass and treble cliff, together with the words, and play two parts and sing one, at the same time. It is certain that two musicians might, by a very little application, carry on a correspondence with their instruments: they are all in possession of the seven notes which express *a, b, c, d, e, f, g;* and know by ear exactly when either of those notes are toned; and they are only to settle a correspondence of tones for the remaining part of the alphabet: and thus, a little practice might enable two fiddlers to carry on a correspondence, which would greatly astonish those who did not know how the matter was conducted. Indeed, this is no more than what is called *dactylogy*, or *talking on the fingers*, which I have seen done, and understood as quick, and readily almost, as common conversation.

"A secret correspondence may be carried on by musical notes, or by communicating the words of a song, by the same vehicle which points out the time and harmony, and this may be done (without having any knowledge of musical compositions) by any common piece of music whatever. To do this an alphabet must be formed, as in *Plate* II. *fig.* 2, or in any other manner; for it may be contrived much better for the purpose.

"Then take any piece of music (but such as is composed of the greatest variety of notes will be best) and copy it out upon ruled music paper, leaving one row of blank lines between, *i. e.* those lines on which the second or bass is usually written. When you have copied the whole out, draw straight lines on the bass cliff, exactly under those which divide the time in the treble. Suppose you would write, 'My time, O ye Muses,' &c. look for the note which is *m* in your alphabet, and then for *y;* now, suppose there are eight or ten notes between the *m* and the *y*, then those are to be marked as nulls on the bass cliff, just under each note, by that mark which in music imports a rest, which is this ㄱ, and the confederate who has the key, knowing that the rest-notes are nulls, only makes use of those which are open, or which may be pointed out, by inserting other notes exactly under them in the bass cliff: and if the under notes are placed three notes lower on the lines than those in the treble are, they will in that case be in harmony, and the rests between, being in such an order, will prevent any suspicion, except to those who understand music; and yet even those who do, would hardly suspect that the notes of lady Coventry's minuet implied, as it might, an assignation in Grosvenor-square: or, instead of the rests being under the nulls, as they will of course be very frequently, they might be placed only under those notes which convey the reading, and then the bass cliff would appear as busy as the treble, and tend the more to perplex the decipherer, as he could not be sure, but both lines were employed to conceal the private writing; indeed where letters fall very distant from each other in the treble, it might be supplied, and frequently too, on the bass cliff, and signified by a dot, or some other musical character, placed near the treble, more immediately above it. A letter thus written in cipher would disconcert even a good decipherer, and throw him out of the methodical way of coming at the secret contents: indeed, I rather think it must be come at more from ingenuity than method.

"This, however, is a hint only, how this kind of cipher may be completely made use of, rather than a perfect method; but I am persuaded, that a good composer of music would be able to write any common epistle, with the assistance of the treble and bass cliff, so as to have very few null-

 notes;

notes; and the ſecret meaning inſtantly obtained by thoſe who are in poſſeſſion of the harmonic alphabet. Or, ſuppoſe every crotchet or minum, which is to expreſs a letter, is written with the tail of the note downwards, and all the nulls upwards; this indeed, might occaſion ſome awkwardneſs in the appearance of the muſic, but it would not tend at all to a diſcovery: but ſtill, what I think practicable is, that an harmonic alphabet may be ſo contrived by a good compoſer of muſic, that every note ſhall be expreſſive of a letter, and convey the words of the ſong as perfectly to the eye, as they do the harmony to the ear. The compoſer of an harmonic alphabet, ſhould be careful to include thoſe notes which are moſt frequently uſed, into his alphabet; and thoſe, I think, are on or between the five ruled muſic lines; but he muſt carefully avoid having any of thoſe notes, already ſo well known, to expreſs *a*, *b*, *c*, *d*, *e*, *f*, *g*, keeping their proper place; for that would be the firſt conſideration of an ingenious decipherer.

"Now, if this art of writing ſecretly by muſical notes, was to be practiſed, I queſtion whether a decipherer, to be expert in his art, muſt not only be a maſter of languages, but even a diſciple of Apollo. However, according to the muſical alphabet annexed, provided a letter is written by it, and the active notes well corded between with nulls, upon the ſame lines, which might be known to be ſuch, by the tail being turned up or down, or characterized by the mark for a beat, a ſhake, a trill, a pauſe, a flat, or a ſharp, it would be ſcarce poſſible for a decipherer to make out, with certainty, the ſenſe; and this method, unpubliſhed, would be leaſt liable to ſuſpicion; for who, that examined a ſuſpected meſſenger, would think an old ſong, without words, in which perhaps the meſſenger's tobacco or ſnuff might be put, contained the ſecret he was to convey? Nor could an ordinary meſſenger, either by bribes or threats, diſcover any thing more, than that the bearer was ſtrictly charged to deliver that piece of muſic, into which he puts his tobacco, to ſuch a particular perſon.

"It may ſeem at firſt difficult to remember what letters the notes imply, and I ſhould have thought ſo too, had not the making out of the alphabet only, impreſſed my mind with the remembrance of every letter; and yet I cannot boaſt of having a good memory; but upon trying the experiment in my family, I find that it is attainable, by writing them down two or three times, without any farther trouble. Indeed, to remember a name, or a word, it is beſt done by writing it down, though it be only with the finger upon a table, without any mark, as the having turned the form of the letters by the hand, will greatly aſſiſt the memory.

"Biſhop Wilkins thinks it poſſible, that if inarticulate ſounds can be contrived, to expreſs not only letters and words, but things and notions, then there might be ſuch a general language formed, as might be equally ſpeakable by men of all nations, and ſo reſtore to us what we loſt by the ſecond general curſe; which is yet manifeſted unto us, he ſays, not only in the confuſion of writing, but alſo in ſpeech. But I am apprehenſive this univerſal language may ſleep quietly with the "flying chariot," the ſame author was once ſo buſy in conſtructing.

"In the ſpecimen given (on *Plate* II. *fig.* 3.) of ſecret writing by the harmonic alphabet, it muſt be obſerved, that every note implies a letter alſo; and, conſequently, under ſuch a reſtraint, it can only have the appearance, and be the picture of muſic without the harmony: yet it is ſuch a picture as muſt paſs unſuſpected by all who do not underſtand muſic perfectly, and by many who do; at leaſt thoſe who do would moſt likely conſider it only a wretched attempt to compoſe muſic, without ſuſpecting that the notes conveyed two lines of true poetic harmony, from that ſweet poem of Dr. Goldſmith's, "The Deſerted Village;" and, therefore, this method is, in one reſpect, to be preferred to every other yet practiſed, of ſecret writing; *i. e.* that it is leaſt liable to ſuſpicion. An itinerant fidler, or muſician, with his dog's-eared muſic book in his pocket, might get admittance into, or from a town beſieged, unſuſpected. A tune might be pricked down in his book, among many others, and he might be deſired to give a copy of it to any particular perſon where he is going, without ſuſpecting the miſchief, or good office, he is employed to execute, and conſequently unable to betray the ſecret; and though ſuſpicion ſhould ariſe, how will the decipherer know which, among a great number of muſical airs, conceal the ſecret information?

"In this caſe, a good decipherer ſhould be a good muſician alſo, that he may pick out the moſt uncouth and conſtrained compoſition; for that would moſt likely prove to be the harmonic epiſtle. Therefore, to obviate this, and to render the matter leſs liable to ſuſpicion, and much more difficult to be deciphered, (in *Plate* II., *fig.* 4.) an air, compoſed of treble and baſs, according to the rules of true compoſition, is given. In this plate there are a great number of null notes to fill up, and to complete the harmony. The confederate, who is in poſſeſſion of the key and alphabet, will know the null notes by their tails being all turned upwards; and therefore, he paſſes over them, and takes down in order from the baſs and treble cliff thoſe only which are turned downwards, a circumſtance which would greatly perplex the decipherer; firſt, to find out whether all the notes were active; ſecondly, whether the baſs and treble cliff were both employed; and, laſtly, which were the null notes: yet this method is not without ſome inconveniences, and ſuch as would create ſuſpicion or ſurpriſe, in an examiner who underſtands muſic. For, being confined to turn all the nulls one way, and the active notes the other, it muſt ſometimes happen, that both muſt be occaſionally conſtrained, and the tails frequently turned contrary to the uſual practice of writing muſic.

"It is poſſible to render this method of writing ſtill more ſecret, by placing a very thin baſs under the treble, and to put reſts, &c. under ſome of the active notes, and to point out the other by a mixture of liquor (of which there are many) that would not appear till the paper is held to the fire, dipped in water, or fine duſt thrown over it; and, under all theſe impediments, it would be very difficult to come at the ſecret matter: yet it is what a good decipherer would not, I believe, give up as a thing not to be done.

"Were I, however, under a neceſſity to ſend a letter of the utmoſt importance, which was to paſs through the hands, or under the inſpection of cautious examiners, I ſhould think a good piece of harmonic compoſition, without any words annexed to it, the ſafeſt and moſt ſecret vehicle to convey it under. In letters, where it is neceſſary to be particular, as to the day, month, or even the hour, that may be done by a kind of ſhort hand: for it would be very unſafe to write, though in cyphers, *Dear Sir*, at the top of a letter; or *your humble ſervant* at the bottom; or even the month, the year, or the day of the month, as thoſe words would be firſt examined by a decipherer. To avoid any of theſe clues, therefore, where the month and the day are to be given, it may be conveyed according to the Quaker's *bye-way*,—Let the twelve firſt muſic lines be conſidered to ſtand for the twelve months of the year, and then counting from the firſt, to the thirty-firſt, the days of the month. If therefore I would date my letter the 8th of April, a ſmall dot on the fourth line preceding the firſt note, as in *Plate* II. *fig.* 4. would

would imply the *fourth month*, and a little daſh acroſs the eighth line, in the ſame manner, would ſhew it to be dated the *eighth day* of the *fourth month*; and a little *x* from the firſt to the twelfth line, would imply any particular hour in the day; or an *o* the hour of the night.

"It is very certain, that if ſuch a ſentence as the ſpecimen in *Pl.* II. *fig.* 4, contains, can be conveyed by a few lines of muſic, a long letter may eaſily be framed, within the compaſs of an Italian air in ſcore; nay, that *any* Italian piece of muſic of a tolerable length, may, by writing it with the tails properly turned up or down, according to the ſpecimen here given, be made the vehicle of a letter, or a piece of important information; and ſtill more eaſily might a good compoſer convey the words, and the harmony alſo, by the ſame characters.

"I am convinced that a good compoſer of muſic, either by framing the harmony by the alphabet, or the alphabet by the harmony, may not only render every note active, but by harmonic alphabets, might write two letters on different ſubjects, one in the treble cliff, and the other in the baſs; and it is evident, therefore, from the ſpecimen I have given, that the words of a ſong may be conveyed by the harmony; for any judicious ſinger, by dividing properly the words, and repeating them, as is uſual in ſinging ſongs, may ſing thoſe in due time, with the air which conveys them: and though I confeſs I ſee much harm might ariſe from it, yet it may be right to obſerve, by the bye, that an harmonic letter thus written could not eaſily be brought *home* with any degree of certainty (eſpecially where null notes are employed) ſo as to convict the writer in a court of juſtice; yet I cannot think myſelf guilty of an injury to ſociety, in pointing this method out, as it may be productive of much good, as well as of miſchief; for ſecret writing is abſolutely neceſſary on many important occaſions of ſtate."

"It therefore might be right for foreign embaſſadors, or princeſſes, who are ſeparated from their families, by foreign alliances, to be in poſſeſſion of ſome kind of muſical alphabet, by which they may write, or receive letters, which are not ſuſpected to be ſo. The preſent mode, I believe, is, to do all this buſineſs, by what is obviouſly writing in cipher; and that too, by ſome method which has long been in uſe, the key to which, I have *more* than reaſon to believe, moſt of the princes in Europe are in poſſeſſion of. I will hardly believe that the K —— of ——, for inſtance, is a ſtranger to every mode of cryptographical writing by the ſeveral princes and ſtates in Europe. How often do we hear of a courier being murdered, and his diſpatches carried off? and for what other purpoſe but information? and without the key, to decipher letters ſo written, to what purpoſe ſhould they be intercepted by ſuch a deed? I have conſidered every method of ſecret writing which I have heard of, either of ancient or modern practice, and I ſubmit it to the reader's conſideration, whether writing by an harmonic alphabet is not, of all others, the moſt void of ſuſpicion: perhaps I ſhould ſay *was not*; becauſe, having publiſhed it, the ſecret is divulged."

The reader is now in poſſeſſion of all the arguments by which Mr. Thickneſſe endeavours to recommend the practice of muſical writing; and we doubt not that this author has done his beſt, in compoſing the ſpecimens alluded to: but we will venture to predict, that no good judge of muſical compoſition would miſtake his pieces for the productions of a *maſter*.—We have added, in *Plate* II. *fig.* 5. another ſpecimen by a different hand, copied from the Encyclopædia Britannica; which, however, contains only the treble, and is as unſupportably poor and unharmonious as *fig.* 3.—We allow that *fig.* 4, having both the baſs and the treble, looks more like muſic, after the alterations we have made; but if it were perfectly corrected in the mechanical part, it ſtill would be called bad harmony and a puerile compoſition by any real judge of muſic. This latter piece might very poſſibly paſs without ſuſpicion; and then, it ſignifies nothing what faults it contains: only, let it not be held up for imitation, while the tails of ſome notes are turned the wrong way, the treble and baſs ill adjuſted to each other, and the ſeveral component parts of the ſpecimen do not (or, at leaſt, did not, before we amended it) accord truly in time!

If the difficulty of conducting a correſpondence in this way be ſo great, and the labour of compoſing it ſo conſiderable, we ſhould rather give the preference to Lord Bacon's idea of a bi-formed alphabet; which is not more liable to ſuſpicion than the muſical cipher, and is much leſs intricate, as well as better adapted for the uſe of perſons unſkilled in harmonics.

The mere circumſtance of expoſure to *ſuſpicion* may eaſily be ſhunned, by interlining, or writing acroſs any common epiſtle with diluted acids; as for inſtance, with one part of oil of vitriol, mixed in ten parts of water, which will be rendered viſible only when the paper is held to a fire. Authors mention the ſame peculiarity in a ſaturated ſolution of *ſal ammoniac*, and the juice of onions; or, we may write with a ſtrong decoction of galls, which will not be apparent, until the paper has been waſhed over with a ſolution of copperas. (See the article INK.) Another method of preventing ſuſpicion, inſiſted on by Schottus and others, is this:

Take two pieces of paſteboard or ſtiff paper, through which cut long ſquares, at different diſtances, as you will ſee in the following example. One of theſe pieces you keep yourſelf, and the other you give to your correſpondent. When you would ſend him any ſecret intelligence, you lay the paſteboard upon a paper of the ſame ſize; and in the ſpaces cut out, you write only what you would have underſtood by him, and then fill up the intermediate ſpaces with ſomewhat that makes a different ſenſe with thoſe words.

$\boxed{\text{I ſhall be}}$ much obliged to you, as reading $\boxed{\text{alone}}$ engages my attention $\boxed{\text{at}}$ preſent, if you will lend me any one of the $\boxed{\text{eight}}$ volumes of the Spectator. I hope you will excuſe $\boxed{\text{this}}$ freedom; but for a winter's $\boxed{\text{evening,}}$ I $\boxed{\text{don't}}$ know a better entertainment. If I $\boxed{\text{fail}}$ to return it ſoon, never truſt me for the time $\boxed{\text{to come.}}$

A paper of this ſort may be placed four different ways, either by putting the bottom at the top, or by turning it over; and by theſe means the ſuperfluous words may be the more eaſily adapted to the ſenſe of the others.

This is an eligible cipher, ſo far as it is free from ſuſpicion, but it will do only for ſhort meſſages: for if the ſpaces be frequent, it will be very difficult to make the concealed and obvious meanings agree together; and if the ſenſe be not clear, the writing will be liable to ſuſpicion.

It would be an endleſs taſk, which we by no means attempt, to lay before our readers all, or even half, the various methods propoſed for ſecret writing. By far the greater number of them, eſpecially the more ancient ones, are inſecure; and however their reſpective inventors may have held them up to public notice, the art of deciphering has of late been ſo ably cultivated, that very few indeed are entitled to full confidence in a time of extremity. Mr. J. Falconer, who has ſhewn uncommon induſtry and acumen in this way, believed "that the moſt ſure cipher, practicable in a current converſe, may make a diſcovery;" and "if you once underſtand the rules for deciphering in one language, (ſays he) he) you may really and without reservation, in a few hours, understand as much of any other language as is needful to reduce it out of cipher." With like confidence, the learned Conrad, author of "Cryptographia Denudata" thinks this branch of the art is so completely *infallible* "that the explication of any secret writing may be securely undertaken for a large wager." We will endeavour to condense the best rules given for this purpose, not only by both the above authors, but by other persons skilled in deciphering; to which we shall add, occasionally, some practical remarks of our own.

A writer in the Gentleman's Magazine, (June 1761), although he acknowledges himself "not versed in secret alphabets," but who "happened to hit upon one" which gave him an high opinion of his own abilities, was so presumptuous as to affirm "it might be demonstrated that there never hath been invented, and that it is impossible to invent, another cypher which shall not be inferior to his by very many degrees." This overweaning conceit is not at all uncommon in such cases. Persons who have never studiously applied to this subject, are apt to fancy the art of writing by cipher is easily acquired, and that what they "happened to hit upon," perhaps without mature deliberation, is incapable of a disclosure: whereas they who have most seriously weighed all the subtleties of this art, confess that it is a very difficult matter to write by any alphabet, admitting of a current use, without hazarding a discovery of the secret.

The two earliest systematic authors, whose cryptographic labours have descended to posterity, *viz.* Trithemius and J. Baptist Porta, appear to have entertained very high notions of their respective discoveries; but before the end of the sixteenth century, it was found that no method then invented could escape detection, when submitted to the examination of Vieta. (See Dict. Moreri, art. *Vieta*). The modes of writing employed more than forty years afterwards, from A.D. 1642 to 1652, when our countryman Wallis flourished, were also deemed inscrutable by their respective advocates, until this able mathematician proved the contrary. And although some general rules may be laid down for the assistance of decipherers, it is to be observed, "that every new cypher, being contrived in a new way, does not admit any constant method of finding it out; but, (says Dr. Wallis) he that will do any thing in deciphering, must first furnish himself with patience and sagacity; and make the best conjectures he can, till he happen upon something that he may conclude with for truth." (See Davys' Essay on Deciphering, &c. 4to. 1737.) Many writers have handled this science with great learning and ability: but, for an enumeration of them, we refer to Breithaupt's "Ars Decifratoria," 1737; wherein will be seen a regular history of its progress, especially as it relates to deciphering on the continent.

Dr. Wallis properly remarks, that "all persons are not qualified or capable of acquiring the art of deciphering, and that a certain degree of acumen is requisite for this purpose; indeed, those who are equal to the task, are not always willing to give the labour and time necessary to accomplish their design." (Letter to Leibnitz, Jan. 16, 169$\frac{8}{9}$). We are therefore not to wonder that so few persons attain to a moderate degree of excellency, or even endeavour to cultivate this art, in any single age. It is not only requisite that a student should meet with a quantity of writing suitable to the difficulty of the cipher he examines, "without which," says Dr. Wallis, "he may easily fail of success;" but he must obtain all the collateral information possible, relative to the language in which the cipher may probably be written,—the period in which it was composed,—the device mostly used in that period,—the quarter from whence it comes,—the place whither it was destined,—the person for whom it was intended,—and such other external circumstances as will lead to a discovery of the business in agitation; for a decipherer needs all the incidental aids within his reach: he must learn to fortify himself previous to the engagement, "& consilium in arena capere."

We have mentioned the Lacedæmonian scytale as one of the most ancient ways of secret correspondence, (but not invented by Archimedes, as Trithemius and others suppose); and, therefore, it may be proper first to shew the means of frustrating the design of that contrivance. Mr. Falconer, after Scaliger, proposes to join the edges of the paper together by a serpentine revolution, so as to unite both portions of the divided letter, which will give the circumference of the scytale to frame a staff by; or you may add piece to piece, says he, after the first letter is joined, until the solution has been completed. But Mr. Thicknesse wonders that Scaliger did not think of a much more ready method; that is, by cutting the scroll quite through the middle between the half letters, and then, by applying the two broken edges of the letters together, on a table, they will appear perfect so as to expose the reading.

Something like the plan of Polybius, for corresponding by flambeaux, is generally practised during a war at St. Roak, a high situation near Gibraltar, to inform the governor of Cadiz of the number of men of war off Gibraltar, or the number which have sailed out of the bay, &c. which might be disconcerted by exhibiting the same kind of lights at the signal house on Gibraltar-hill, at precisely the same time when the Spaniards shewed theirs. Mr. Thicknesse tells us, the Spaniards, by those lights, expressed letters and figures; nay, that he had even acquired their method in some measure, but dared not disclose it to the English governor, "fearing a court-martial and a cashirement: for I do insist upon it," adds he, "that a governor so ignorant or indolent as not to defeat such a kind of correspondence, would be wicked or foolish enough to punish any officer who presumed to dictate to him," as it would be called. "Yet every information of this kind may be defeated, and false alarms given to the Spaniards at Cadiz, by a governor who would take half the trouble to serve his country which he does to enrich himself and distress those under his command." See p. 33, of "A Treatise on the Art of Decyphering," 1772.

In examining a piece of writing performed by newly invented characters, we should endeavour to ascertain whether the number of them corresponds, or nearly so, with the ordinary number of alphabetical letters. We may sometimes detect a weakness in the writer, of having selected his most simple marks either for the vowels or the first letters in the alphabet, and his complex marks for the consonants or the letters most remote from *a*, *b*, *c*, &c. We must observe which of the characters, whether taken singly or combined, occur the oftenest in the whole specimen; and of these, probably, the most frequent will represent *e*, *a*, *i*, *o*; *e* being much more common than the rest of the vowels, but *u* and *y* are even less frequent than many consonants.

Endeavour next to ascertain the beginning and ending of words, which are sometimes distinguished by spaces, or points, or nulls, interposed; but, however it be done, you must expect these signs to occur after every few letters, and the frequency of their occurrence may serve as some guide.

When you have found out the distinction between words, take particular notice of the order, number, frequency, and combination of the letters in each word; and first examine the characters of which the shortest monosyllables are composed. Remember, 1. That no word can be without a vowel: a word of one letter must therefore be a vowel, or a consonant with an apostrophe. 2. That the vowels are more

more frequently doubled at the beginning of words, than the conſonants; indeed, the latter are only doubled in the beginning of Spaniſh and Welſh words. 3. That the vowels moſtly exceed the conſonants in ſhort words; and when the double conſonants are preceded by a ſingle letter, that letter is a vowel. 4. That the ſingle conſonant which precedes or follows double conſonants, is *l*, *m*, *n*, or *r*. 5. That the letter *q* is always followed by *u*; and when two different characters occur, the latter of which is often joined with other letters, but the former never found alone, nor joined with any than the latter, thoſe characters ſtand for *qu*, which two, except in a few Scotch names, are always followed by a vowel. 6. That although every language has ſomething peculiar in its ſtructure, the foregoing obſervations will apply to all the ſpecimens we have given of the European tongues in the ſeveral parts of this article. See eſpecially the ſeries of examples above, in eight different languages.

In the Engliſh, let it be remarked, that *and* and *the* are more often found than any other words; *h* is frequently preceded by *w*, *c*, *ſ*, and *t*; *y* is ſeldom uſed in the middle of a word; the double letters *ll* and *ſs* appear frequently at the end of words; *ed*, *ty*, *ly*, *ing*, and *tion*, are very common terminations; *em*, *in*, *con*, and *com*, are frequent prepoſitions; *a*, *i*, and *o*, may ſtand alone; *o* is often followed with *u*; *e* is much more frequent in the beginning and end of words than in the middle; and in Engliſh, the *e* is continually employed, as in *yes*, *yet*, *her*, *never*, *me*, *we*, *the*, *he*, *ſhe*, *they*, *ye*, *fee*, *ſee*, *be*, *ever*, *ſpeed*, *need*, *deference*, *excel*, *exceſs*, &c. Though this will not hold good in the Latin, as *e*, and *i*, are equally frequent in the latter, and next to theſe, *a* and *u*; but *o* not ſo common as any of them: and yet, in the Spaniſh and Italian, *o* occurs very frequently. When you meet with a character doubled, in the middle of a word of four letters, it will be neceſſary to conſider what words of four ſyllables are ſo ſpelt. It is probable the vowels *e* or *o*, are theſe; as *meet*, *feel*, *good*, *book*, *look*, &c. In polyſyllables, where a double character appears in the middle of a word, it is for the moſt part a conſonant; and if ſo, the preceding letter is always a vowel.

Obſerve alſo, that *i*, in Engliſh, never terminates a word, nor *a* or *u* except in *flea*, *ſea*, *you*, or *thou*: again, by comparing the frequency of the letters, you will generally find *e* occur the ofteneſt; next, *o*, then *a*, and *i*; but *u*, and *y*, are not ſo often uſed as ſome of the conſonants, eſpecially *s* and *t*. Among the vowels, *e* and *o* are often doubled; the reſt ſcarce ever; and *e* and *y* often terminate words, but *y* is much leſs frequent, and conſequently eaſily diſtinguiſhed.

To find out one conſonant from another, you muſt alſo obſerve the frequency of *d*, *h*, *n*, *r*, *ſ*, *t*; and next to thoſe, *c*, *f*, *g*, *l*, *m*, *w*; in a third rank may be placed *b*, *k*, *p*, and laſtly *q*, *x*, *z*. This remark, however, belongs to Engliſh: for in Latin common conſonants the are *l*, *r*, *ſ*, *t*; next *c*, *f*, *m*, *n*; then, *d*, *g*, *h*, *p*, *q*; and laſtly, *b*, *x*, *z*. But the firſt difficulty is to come at the knowledge of three or four letters, therefore where a word of four letters hath the firſt and fourth the ſame, it is moſt likely to be *that*: to diſcover which look for another of four letters, beginning with the two firſt, and ending with two others, and it will probably prove to be *this*; and more eſpecially if you find another with three letters, beginning with the firſt two, for in that caſe it muſt be *the*. Now having found out in any part of the cipher theſe three words, *that*, *this*, and *the*, place them over the characters which you know to be *t*, *h*, *a*, *i*, *ſ*, *e*, and then conſider what letters are deficient, and what words, from the number of letters which compoſe them, they are moſt likely to be. You will thus find ſuch ready and ſurpriſing intimations from the above ſix deſerters, previouſly apprehended, that you will ſoon be in poſſeſſion of the whole battalion.

Where words of two letters appear of the ſame characters, differently placed, it is moſt likely one is *on*, the other *no*: ſo *of*, and *for*, and *from*, diſcover and convict each other; and *th* are very often uſed in the beginning of Engliſh words, as, *the*, *that*, *this*, *them*, *theſe*, *their*, *thirſt*, *thwart*, &c. &c.

Beſides theſe peculiarities, Mr. Falconer points out the following, as applicable to the Engliſh:

Beginning a word is regularly followed by

A	moſt of the letters.
B	a, e, i, l, o, r, u, y.
C	a, e, h, i, l, o, r, u.
D	a, e, i, o, r, u.
E	moſt of the letters.
F	a, e, i, l, o, r, u, and ſometimes y.
G	a, e, h, i, l, n, o, r, u, y.
H	vowels only.
I	moſt of the letters.
K	a, e, i, n.
L	vowels only.
M	vowels only.
N	vowels only.
O	moſt of the letters.
P	a, e, h, i, l, o, r, ſ, ſometimes t, u, y.
Q	only by u, and QU by a, e, i, o.
R	a, e, ſometimes h, i, o, u, y.
S	a, c, e, h, i, k, l, m, n, o, p, q, t, u, w, y.
T	a, e, h, i, o, r, u, w, y.
U	ſometimes d, and g, l, m, n, p, ſometimes r, ſ, t, x.
V	vowels only.
W	a, e, h, i, o, r, y.
X	ſometimes a, or e.
Y	e, ſometimes i, o.
Z	e, ſometimes o.

It would be too prolix in us to give an equally minute account of the particularities in other languages; but the inquiſitive reader will find them very well ſpecified, in the "Cryptographia Denudata" of D. A. Conrad, 8vo. Lug. Bat. 1739, and in the latter part of Breithaupt's "Ars Decifratoria, ſive Scientia occultas Scripturas ſolvendi et legendi," Helmſt. 12mo. 1737.

To exerciſe the Engliſh ſcholar, we here ſubjoin one example of plain ciphering, in which two figures anſwer to each letter:

39. 38,31,21,35. 35,14,20,18,21,19,20,35,34. 20,38,39,19. 32,35,31,18,35,18. 22,39,20,38. 13,31,14,24. 20,38,39,14, 37,19. 31,19. 20,15. 20,38,35. 13,31,14,31,37,39,14.37. 15,36. 20,38,35. 31,36,36,31,39,18. 18,35,17,21,39,19,39, 20,35. 36,15,18. 24,15,21. 20,15. 11,14,15,22. 18,35,13, 35,13,32,35,18. 20,38,31,20. 15,14, 14,15. 31,33,33,15, 21,14,20. 24,15,21. 36,31,39,12. 20,15. 13,35,35,20. 13, 35. 31,20. 14,39,14,35. 20,15. 13,15,18,18. 15,22,19. 14, 39,37,38,20. 36,15,18. 22,35. 13,21,19,20. 14,15,20. 14, 15,22. 34,35,12,31,24. 20,38,35. 19,21,18,16,18,39,25.35. 15,36. 20,38,35. 33,31,19,20,12,35. 22,38,35,14. 20,38, 39,14,37,19. 31,18,35. 39,21,19,20. 18,39,16,35. 36,15, 18. 35,23,35,33,21,20,39,15,14.

By practiſing the foregoing rules, the ſtudent will find that this method of ſecret writing in plain cipher, may with as much eaſe, if not with as much ſpeed, be deciphered as written.

In all caſes, begin firſt to decipher the ſingle characters and ſhorteſt

ſhorteſt monoſyllables; mark down on a ſeparate paper any correſponding letters and ſigns you diſcover, and count the different characters throughout the piece in order to compare their frequency, &c. It will generally, if not always, happen that the moſt frequent is *e*.

We ſhall now conſider ſome ways of fruſtrating theſe rules, and the methods of procedure in ſuch caſes. The firſt we notice, is that of writing not only without any diſtinction between the words, but alſo by altering their relative poſition: this was the late Earl of Argyle's method, and it was then thought abſolutely undecipherable. See "An Account of the Diſcoveries made in Scotland of Conſpiracies againſt his Majeſty's Government." Mr. Thickneſſe ſays, he has ſeen many ways of explaining this cipher, but, he thinks, the beſt is to mark the concurrence of *proper* words. Take this as a ſpecimen:

I	*know*	*not*	*the*	*grounds*	*our*	*friends*	have
gone	upon	which	hath	occaſioned	them	to	offer
ſo	little	money	as	I	hear	neither	know
I	what	aſſiſtance	they	do	intend	to	give
and	'till	I	know	both	I	will	neither
refuſe	my	ſervice	nor	do	ſo	much	as
object	againſt	any	thing	is	reſolved	'till	I
firſt	hear	what	Mr.	Red	or	any	other
you	ſend	ſhall	ſay	only	in	the	mean
time	I	reſolve	to	let	you	know	as
much	of	the	grounds	I	go	on	as
is	poſſible	at	this	diſtance	and	in	this
way	I	did	truly	in	my	propoſition	mention
the	very	leaſt	ſum	I	thought	could	do
our	buſineſs	effectually	not	half	of	what	I
would	*have*	*thought*	*requiſite*	*in*	*an*	*other*	*juncture*, &c.

When Lord Argyle had written a letter, of which the above is a part of one, he filled up the ſpaces with any words which occurred, and then it appeared thus:

I gone ſo I and refuſe object firſt you time much is way the our would have buſineſs very I poſſible of *I* ſend here againſt my 'till what little upon *know not* which money aſſiſtance I ſervice any what ſhall reſolve *the* at did leaſt effectually thought requiſite not ſum truly this *grounds* to ſay Mr. Thing nor know they as hath grounds occaſioned I do both do is Red only let I diſtance in I half in an of thought my and go you in or reſolved ſo I intend he or them *our friends*, &c. &c. &c.

Now as we obſerved above, mark but the concurrence of proper words, and eſpecially if they be at equal diſtances (and ſo his letter is written) then the number of words between theſe is the column; and thus the buſineſs is done: there may indeed be a proper coincidence by chance; but if you lay hold of ſuch only as aree quidiſtant, they muſt develope the matter where the writer goes down one column and up another. And this is a much readier and more certain method, than that laid down by *Falconer*.

The earl of Argyle was much uſed to write alſo without diſtinguiſhing words; "but," ſays Mr. Falconer, "you may nevertheleſs diſtinguiſh between vowels and conſonants, and each of theſe amongſt themſelves: nay, you may make ſuppoſitions for words; and having found two or three letters, or one word, your difficulty is over: ſo that the rules already laid down, will be ſufficient for deciphering the remainder."

Notwithſtanding Mr. Falconer's extreme confidence, we believe it would be no eaſy thing to diſtinguiſh one word from another, and one letter from another, whether vowels or conſonants, in a ſpecies of writing we ourſelves have invented; of which ſome examples occur at the end of this article, and in *Plate* III.

The inſertion of nulls, or non-ſignificant letters, is another mode of confuſing the cipher; and, to overcome this difficulty, it is requiſite,

1ſt, That you take the number of the different characters in the epiſtle; and if that exceed the number of the alphabet, it is probable mutes are intermixed with the ſignificant letters. We have ſaid probable, becauſe there may be characters inſerted to expreſs relatives and ſyllables, &c.

2. Obſerve the frequency of the ſeveral characters, and by this means you may diſtinguiſh thoſe nulls from ſignificant letters; for it is obvious, that if many inſignificant characters be uſed, they ſhall not be frequent; at leaſt moſt of them ſhall be but rarely inſerted, which will do no great feats: if only a few in number, and conſequently their places the more frequent, they are yet by ſuppoſition diſtinguiſhable from the vowels and conſonants of moſt uſe in writing; eſpecially if you conſider the order and coherence amongſt the ſeveral characters. This admits of no particular rules; nor will the judicious need any.

3. After you have found out the real alphabet, or all the mutes, there is no new difficulty.

There is an invention of ſecrecy much inſiſted on (though none of the ſwifteſt) by the author of the "Secret and Swift Meſſenger," and others; which is, beyond any yet mentioned, for intricacy, wherein each particular line, word, or letter, is written by a new alphabet: but the cited author himſelf acknowledges it too tedious for a current correſpondence, which cannot be entertained this way, but at a vaſt expence of time and trouble, to put it in, or take it out of cipher, even by the key. And ſecret information, in ſeveral exigencies, muſt be ſpeedy, or it will be unprofitable; ſo that in effect it is impracticable for the end it is deſigned.

However, leſt it ſhould obtain too much credit, if ſuppoſed undecipherable, its difficulties are conſidered by Mr. Falconer.

And, firſt, the way of writing by it is this: the confederates determine upon ſome word or ſentence, that ſhall lock and unlock their miſſives; or the key may be ſent in the letter, in ſome word or ſentence privately marked, or by compact agreed on, ſuch as the firſt or laſt line, &c. to ſerve for the key. Suppoſe, ſays Mr. Falconer, it ſhould be "Policy's preheminence," there muſt be ſeveral alphabets framed for each of its letters in the manner following:

1	A	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	w	x	y	z
2	P	q	r	s	t	u	w	x	y	z	a	b	c	d	e	f	g	h	h	k	l	m	n	o
3	O	p	q	r	ſ	t	v	w	x	y	z	a	b	c	d	e	t	g	i	i	k	l	m	n
4	L	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k
5	I	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g	h
6	C	d	e	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b
7	Y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x
8	S	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r
9	P	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o
10	R	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q
11	E	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d
12	H	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g
13	E	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d
14	M	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l
15	I	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g	h
16	N	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m
17	E	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d
18	N	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m
19	C	d	e	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b
20	E	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d

If they agree, that the lines only ſhall be written by a new alphabet, the firſt line ſhall be made according to the firſt alphabet A.P. the ſecond line according to the ſecond alphabet, viz. A.O. the third alphabet is A.L. &c. the firſt line being an index ſucceſſively to all the reſt. And when they have gone through the table, they may begin anew, or go backwards again, &c.

If words are only written by one alphabet, then every new word is written by a new alphabet; and ſo of letters. We have hereunto ſubjoined an example for each, viz.

I. *Example in the line.*

Ypb vdgrts id ztte ixt hdaſytgh
idcb wofr rihm obr rihm rxſh:
dfaawi fd, zc cſpi gtww cpfzwe ez
cqn nwuxg bynnmrtg. Qibcn.

I am forced to keep the ſoldiers
upon hard duty and hard diet:
ſupply us, or they will revolt to
the enemy ſpeedily. Haſte.

Solution.

1. When there is only one alphabet uſed for a line, the writing might be diſcovered as in plain cipher, if you make a new operation for each line. But there may be other ways to decipher any ſuch writing: for,

2. If you find out but one letter in a line, (and that may certainly be done by a few ſuppoſitions) it will of itſelf give an alphabet for that whole line, as you may perceive by the counter-table, which follows; for, the confederate's table being framed, ſo as the firſt line may be an index to all the reſt of the lines which are ordered by ſome word or ſentence that is the key, every letter of ſuch a word or ſentence muſt be once ſuppoſed to ſtand for A. Now in the counter-table you ſee all the letters in the alphabet to be once ſuppoſed A: therefore you need only to ſearch for I in the upper line of it, and try in what line Y is oppoſite to it; and thoſe two lines give you an alphabet. Or ſet down the letter found under the letter that expreſſeth its true power, and completing the laſt line, you have the alphabet; *e. g.* if you ſuppoſed Y, in the example given, to expreſs the power of I, firſt write down the twenty-four letters in their uſual order, and under I place Y; then, going on in order, your alphabet is this for the firſt line:

A b c d e f g h i k l m n o p q r s t u w x y z
P q r ſ t u w x y z a b c d e f g h i k l m n o

1	A	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z
2	B	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a
3	C	d	e	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b
4	D	e	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c
5	E	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d
6	F	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e
7	G	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f
8	H	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g
9	I	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g	h
10	K	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i
11	L	m	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k
12	M	n	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l
13	N	o	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m
14	O	p	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n
15	P	q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o
16	Q	r	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p
17	R	ſ	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q
18	S	t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r
19	T	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	ſ
20	V	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t
21	W	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u
22	X	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w
23	Y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x
24	Z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y

This *Counter Table* needs not much explanation, being but an exhibition of ſuch alphabets as you may frame by yourſelf upon every new ſuppoſition.

Having found one alphabet for the firſt line, you have likewiſe by this means the firſt letter of the key. *E.g.* In the fifteenth line of the table, Y ſtanding againſt I, and P beginning that line (as you may perceive) P muſt be the firſt letter of the key; and if you peruſe the foregoing collection of what letters can be joined in the beginning of words, you will find *a*, *e*, *h*, *i*, *l*, or *o*, &c. muſt follow P: ſo that at worſt, to get another alphabet for the next line, it will coſt but ſo much pains as to make trial of all thoſe letters by ſuppoſition; as firſt, what letter in the firſt line is againſt *i*, in the fifth line beginning with E, (for A cannot regularly follow P in this particular method, elſe the letters in the ſecond line of the writing ſhould have their uſual ſignification without any tranſpoſition;) and finding that E cannot be the ſecond letter of the key, becauſe the cipher from that ſuppoſition is in as great confuſion as ever, next try what letter is oppoſite to *i* in the line H. Still ſuppoſing a-new, until you find the ſecond line to produce ſenſe. And ſo of all the reſt.

Or you may take the ſame meaſures from the letters or ſyllables found, in the writing itſelf.

Or you may proceed to find the alphabet of the ſecond, third, or any other line, as you did for the firſt, *viz.* ſearching after the power of ſome letter in the ſecond line, by the ordinary rules; and, according to the greateſt probability, in that ſearch, from the frequency of the letter, or other help, to make trial by your counter-table.

II. *Example in the words.*

Y oa qzcnpo cx mggr rfc lgdwbxkl
kedc zriv hzyc hvl mewh puqf:
bdyytg hf, ſw gvrl ylnn wizſpy id
hws pypxi bynnmrtg. Kcvwg.

Solution.

When the alphabet is changed at every word, you may either make ſuppoſitions from words, or from letters that fall in the end or beginning of the ſeveral words in the writing, until you have made ſome progreſs in the letters of the key; and then proceed as before.

You may likewiſe find out by ſuppoſition, the number of letters in the key, &c. which will much facilitate the work. Thus:

1. Having found an alphabet for the firſt, ſecond, or indeed any word near the beginning of the epiſtle, go through all the immediate following words, until you find another that is deciphered by the ſame alphabet.

2. From the laſt found word count the like number, and you have a new word decipherable by the found alphabet: and thus you may go on until you have once gone through the whole writing, marking the whole ſeries with ſome peculiar mark: and then,

3. Begin the epiſtle again at ſome word immediately before or after that which was firſt found, and count forwards as before, until you come to the end of the epiſtle.

4. Afterwards obſerve the ſame method, until you have diſtinguiſhed the whole writing, giving each reſpective ſeries of words ſome particular mark of diſtinction. And in the end, having found out but one letter in ſuch a ſeries of words, it gives an alphabet to decipher all that ſeries by, as was obſerved in lines, &c. *E.g.* Y therefore, the firſt word in the example, expreſſing the power of I, you ſhall find the twentieth word *id* decipherable by its alphabet, *viz.* A. P. and conſequently *hws*, the one-and-twentieth word in the writing, but twentieth after *oa* the ſecond word, to have one alphabet with it; and in the ſame order *pypxi* to have one alphabet with *qzcnpo*; and *bynnmrtg* and *cx* to be denoted by the ſame alphabet, &c.

Now if the writing were long (as it muſt be to contain *Propoſals*, *Emergencies*, and other circumſtances) the uſe of the foregoing obſervations will be evident.

But there is an exception to theſe rules; for you will ſee in the example, that the firſt word Y and the ſeventh word *Lydwbxkl* are written by the ſame alphabet, but not the ſeventh from that, viz. *puqf*, nor the ſeventh from *oa*, viz. *kedc*, &c. and the reaſon is, becauſe the letter P is twice repeated in the words of the key. So that when you find this happen in deciphering, leave ſuch words, and go to the next, until you find the true number of letters that make up the key by the former rule; and then this difficulty becomes a help in the operation, &c.

III. *Example in the letters.*

Y ox oqpvtv yw oqnc yvg xdzorgpl
kgſn mmaq hhwc pbo qcpw ſaib:
xgycpl xx, df eqgw oycp, zigxyy gq
yxs pwgkq hgimhvtl. Mnvyh.

Solution.

To decipher this laſt kind of ſecret writing, you muſt begin with ſuppoſitions; and,

1. Extracting out of it the monoſyllables, &c. you may ſuppoſe all the words in it of three letters ſucceſſively to ſtand for *the*, or *and*, &c. and you may prove your ſeveral ſuppoſitions thus: *viz.* 1. Mark down the powers ſuppoſed. 2. Obſerve in what lines of your counter-table the letters expreſſed in the cipher are oppoſed to them in a perpendicular line. 3. Obſerve the firſt letters of thoſe lines, and you will ſoon find whether they can be joined to make up a part of the key: *e g.* let *yvg* in the firſt line of the example be ſuppoſed *the*; *y* is oppoſite to *t* in line fifth, beginning with E; *h* to *v* line thirteen, beginning N; and *e* to *g*, line third, beginning C. So that having found *enc* in the beginning of theſe ſeveral lines, it is probably ſome part of the key.

2. You may proceed in the ſame manner to other monoſyllables, &c. in any part of the epiſtle; or you may conſider what letters can follow *enc*: and thus *e* being moſt probable, look in that line of your table beginning with E, for *x* the following letter in the cipher, and its oppoſite letter in the upper line, which is S; and afterwards you may go on with probable ſuppoſitions, either from the letters found in the key or in the writing.

Perhaps theſe methods will not ſo readily give you the entire key, yet they are good helps.

You may otherwiſe begin your ſuppoſitions with the firſt letters in the writing; and, for that end, we have heretofore added, in alphabetical order, the letters which can be joined to each other to begin words.

And, from all together, you may in a ſhort time find out the number of letters in the key; and here that is of as much uſe as in the other ways of writing by the key character, ſince thereby you have the ſeveral returns of each alphabet.

When the alphabet is changed for every word or letter, the frequency of the letters will not agree with that in an epiſtle written in plain cipher, where one character always expreſſes the ſame power: for, as to this laſt, you ſhall but rarely find two or three characters of the ſame frequency; but by a continual altering of the alphabet you ſhall have a great

great many. *E.g.* In the last example you have no less than seven different letters twice repeated, viz. *a, b, d, k, f, t, z*, three letters thrice repeated, two letters four times repeated, three letters five times repeated, three letters seven times repeated, and two letters nine times repeated.

Again, in one line of an epistle where the alphabets are continually altered, you shall have more differing characters than in two, where one alphabet is only used in the whole writing. In the example you have the complete number of the alphabet; whereas in the writing,

viz. I am forced to keep the soldiers
upon hard duty and hard diet:
supply us, or they will revolt to
the enemy speedily. Haste.

there are wanting, *b, g, q, x, z.*

We have already observed, that this method of cryptography requires too much time to be put in practice: but besides, it is not only impracticable upon that score, (for by the least mistake in writing, it is so confounded, that the confederate with his key shall never set it in order again) but withal, it is liable to suspicion: so that it has none of those things required in secret writing, except that there is difficulty in deciphering it; and that not insuperable, as is made apparent.

For many of the subsequent, as well as preceding observations, we are indebted to Mr. Falconer; an author we have had frequent occasion to commend, and who particularly excelled in such intricate discussions. As that gentleman's work is very scarce, we shall render the public a service in making some parts of it better known, by these copious extracts.

We next mention the mode of communicating any secret intention with ordinary letters, by the aid of a few figures; which, Schottus says, was the invention of count Gronsfeld, and seems to elude the common rules for deciphering.

1. The confederates dispose the letters of the alphabet in a line or circle, over which they place any number of figures, *e. g.* 436, in this manner.

4 3 6

a b c d e f g h i k l m n o p q r s t u w x y z.

2. They write their secret intentions on a paper apart, and over the tops of the letters they place the number of figures agreed on. Let the words be these:

"The governor of the city is beyond corruption, so that we may conclude there is nothing of briberie will serve the turn."

Which words, according to the example, will stand thus:

436 43643643 64 364 3643 64 364364 3643643643
The governor of the city is beyond corruption,

64 3643 64 364 36436436 43643 64 3643643 64
so that we may conclude there is nothing of

36436436 4364 36436 436 4364.
briberie will serve the turn.

3. Observe what figure stands over the first letter of the writing, (*viz.* T.) which is 4, and counting forward as many letters, write down the fourth, *viz. x*; again see what figure is over the second letter (*viz. h.*) which figure is 3; then counting three letters from *h*, the third is *k*; next write down the sixth letter from *e*, which is also *k*: and so they proceed, always observing the letters in the writing to be secretly communicated, and the figures above it, until they come to the end of the epistle. The example being finished, will stand thus:

xkk kqahtsrt ti wnh eoxa ow dkbqsg etvtasworp yr wndw bh ofb etqeqyfk xkkvg ow ptxkoqi ti dxmdkvlk zlqo vkvxk xkk xxxq.

Solution.

To decipher this kind of secret-writing, you may,

1. Transcribe the cipher out of the epistle, keeping the lines and letters at such a distance from one another, that each letter may admit of a figure distinctly above it.

2. Endeavour to find the number of figures in the key which must be inquired into by several suppositions.

3. The number of figures being supposed, *e. g.* 3, take any three figures, *e. g.* 123, and place them above the tops of the letters in cipher in this order:

123 12312312 31 231 2312 31 231231 2312312312
xkk kqahtsrt ti wnh eoxa ow dkbqsg etvtasworp

31 2312 31 231 23123123 12312 31 2312312 31
yr wndw bh ofb etqeqyfk xkkvg ow ptxkoqi ti

23123123 1231 23123 123 1231.
dxmdkvlk zlqo vkvxk xkk xxxq.

4. Observe where the same character and the same figure happen to fall together, and you will find that thus it always expresseth the same power as in the example; K with 3 placed above it has the power of E through the whole writing; X with 1 upon the top of it signifies H, &c. But,

5. The same letter, when its figure is altered, cannot express the same power: *e. g.* Q with 1, expresses N; but Q with 2 signifies O, and Q with 3, L, &c.

6. One and the same letter will be expressed by different characters: *e. g.* Q with 2, R with 1, and T with 3, express severally O in the writing.

7. Two letters of the same power cannot be joined together in the same character; and, consequently, where you find any character double in a writing of this nature, it expresses different powers.

8. Having made these or the like general remarks, you may proceed to discover particular syllables or words, as in the preceding paragraphs; and having one, you will find with it the true numbers that are contained in the key, at least some of them, which will discover the rest.

It is almost superfluous to add, that in your several operations you must count the letters backwards, since regularly the cipher is written forwards: but because the cipher may be otherwise contrived, you may try both ways, &c.

Of secret writing by points, lines, &c.

The secrecy in an epistle may consist in points, lines, &c. which are distinguishable one from another by their place, not their figure; all of the same situation (whatever the nature of the figure be) expressing the same character. *e. g.* Suppose the paper to be written upon be secretly divided into 24 equal parts, according to the breadth of a plate upon which the letters are described; and then by application of this to the epistle, it is easy to conceive the way of writing it. This is published in the "Secret and Swift Messenger," p. 92. But it contains no great nor new intricacy; for you may extract the points, &c. that fall in the first perpendicular line in any character, and the points that are in the next perpendicular line by a differing character, and those points in the third line by a third character; and so for all the rest, until you come to an end, or rather the side of the epistle, towards the right hand; and then it is resolvable by the common rules.

 Having

Having now removed the moſt material difficulties, ariſing from a change in the powers of the letters; we proceed to

Secret writing, by altering the places of the letters where their powers remain the ſame.

Biſhop Wilkins obſerves, that the difference of characters men uſe in the world, is part of the general curſe upon their once one tongue; and from a parity of reaſon we may infer, that the different methods of writing thoſe characters is ſo too.

The Oriental languages, Hebrew, Chaldaic, Samaritan, Syriac, Arabic, Perſian, Coptic, &c. are written from the right hand to the left. Only the Ethiopic and Armenian proceed from the left to the right hand; as alſo do all the Occidental languages, Greek, Latin, French, Spaniſh, Italian, German, Engliſh, Sclavonic, &c.

At firſt the Greeks wrote from the left to the right hand, and again from the right to the left, forward and backward. Hence *literas exarare* ſignifies *to write*, a metaphor taken from plowing the ground.

Thus the ſenſe of an epiſtle in a known language might be perplexed, if the writing ſhould be contrived after the method of writing ſome foreign tongue. And we have this example from the "Secret and Swift Meſſenger."

T	i	l	w	e	l	d	f	e
h	t	l	ſ	ſ	o	o	t	i
e	ſ	e	u	h	h	u	ſ	l
p	h	n	t	a	o	t	o	h	p
e	t	c	ſ	l	t	t	h	a	p
ſ	o	r	g	l	e	h	t	n	u
t	d	e	n	n	l	e	i	d	f
i	e	a	o	o	b	ſ	w	ſ	y
l	e	ſ	m	t	a	i	e	p	d
e	n	e	a	b	e	e	g	e	e

Here the rows are introduced inſtead of the lines. And if you begin at the firſt letter towards the left hand, and read down that row of letters; then read the next upward, and the following down again; and ſo to the end, you will find theſe words: "The peſtilence doth ſtill increaſe among us; we ſhall not be able to hold out the ſiege without freſh and ſpeedy ſupplie."

This is the ordinary way of writing among the inhabitants of China and Japan. It only needs expoſure, in order to be detected when it occurs.

Another remarkable kind of cryptography conſiſts in altering the places of letters by combination. But it is deſirable, before we proceed, to ſhew how many different ways any given number of letters may be combined, or varied in their relative poſition; for which purpoſe, we ſubjoin a table. (See likewiſe the articles ALTERNATION and CHANGES.) Our calculation is, however, carried no higher than the number of changes in an alphabet conſiſting of 36 letters and figures. Schottus has computed that a thouſand millions of men, in as many years, could not write down the different tranſpoſitions of only 24 letters, if each of them completed 40 pages a day, and every page contained 40 permutations; and Mr. Falconer has ſhewn that this is vaſtly too low a ſuppoſition! So that thoſe tranſpoſitions, inſcribed on a ſcroll, would reach far beyond the planet Mercury!

How much farther then would a chain reach of 36 letters, in their immenſely numerous combinations? For example, in ſuch an alphabet as this, which is adapted for the telegraph at the Admiralty, *viz.*

1	a	b	c	d	e
2	f	g	h	[illegible]	j
3	k	l	m	[illegible]	o
4	[illegible]	q	[illegible]	[illegible]	t
5	u	[illegible]	[illegible]	x	y
:	6	,	8	9	z

A Table of Changes in the relative Poſition of 36 Letters

1 =	1
2 =	2
3 =	6
4 =	24
5 =	120
6 =	720
7 =	5040
8 =	40320
9 =	362889
10 =	3628800
11 =	39916800
12 =	479001600
13 =	6227020800
14 =	87178291200
15 =	1307674368000
16 =	20922789888000
17 =	355687428096000
18 =	6402373705728000
19 =	121645100408832000
20 =	2432902008176640000
21 =	51090942171709440000
22 =	1124000727777607680000
23 =	25852016738884976640000
24 =	620448401733239439360000
25 =	15511210043330985984000000
26 =	403291461126605635584000000
27 =	10888869450418352160768000000
28 =	304888344611713860501504000000
29 =	8841761993739701954543616000000
30 =	265252859812191058636308480000000
31 =	8222838654177922817725562880000000
32 =	263130836933693530167218012160000000
33 =	8683317618811886495518194401280000000
34 =	295232799039604140847618609643520000000
35 =	10333147966386144929666651337523200000000
36 =	371993326789901217467999448150835200000000

Here are 42 places of figures, which may be read thus:

ſextillions	quintillions	quadrillions	trillions	billions	millions	units
371993	326789	901217	467999	448150	835200	000000

i. e. Three hundred and ſeventy-one thouſand nine hundred and ninety-three ſextillions,
Three hundred and twenty-ſix thouſaud ſeven hundred and eighty-nine quintillions,
Nine hundred and one thouſand two hundred and ſeventeen quadrillions,
Four hundred and ſixty-ſeven thouſand nine hundred and ninety-nine trillions,
Four hundred and forty-eight thouſand one hundred and fifty billions,
Eight hundred and thirty-five thouſand two hundred millions.

To write ſecretly by the method here propoſed, a certain number of letters are combined to lock and unlock the epiſtle.

epiſtle. 1. The differences of writing down the poſitions, as, which ſhall be firſt, which ſecond, which third, &c. in order, may be varied to a vaſt number: *e. g.* three letters A, B, C, having ſix regular ways of combination, theſe ſix poſitions are capable of 720 ſeveral orders; for the rows may be combined amongſt themſelves, the ſame way as letters. Therefore,

2. The order of the rows is agreed upon at parting.

3. The number of letters combined, which is the key, may be expreſſed in the epiſtle by ſome mathematical figure, as △ for three letters, □ for four, &c. or by ſome other private mark.

4. They frame a rectangular table of as many columns as there are letters combined.

5. The letters ſo combined are placed in their natural order upon the top of the table.

6. Having determined of how many lines the table ſhall conſiſt, the order of the combinations agreed upon is ſet down in a row, in the firſt column towards the left hand; as you may ſee in the ſubjoined table.

7. The table being thus prepared for writing, they obſerve the order of their combinations, and write according to its direction.

8. When they have placed one letter in every column of all the lines, they begin again, and ſo go on until the writing is finiſhed.

9. Laſtly, they take the letters out of the table according to their partitions, as ſo many barbarous words, upon a paper apart, and ſend it to the confidant.

Example.

Let the key for the number of letters combined be a triangle; and the ſubject of the writing,

"We are big with expectation to know the ſucceſs you have had, whether the arms you have undertaken for will be ready upon occaſion. Let your next be written by the ſquare key."

Form of the Table for Writing.

Order of Poſitions.	A	B	C
1 CBA	*a t ſ a ſ k d e t*	*e c e h m a a l i y*	*w e h e r t e n r e*
2 CAB	*e t c w o n u y y*	*b i c h u ſ p o t*	*r a u d y e y t b*
3 ACB	*i o e e h o o u h*	*w t ſ h v w o n s*	*g n ſ t a r n r e*
4 BCA	*h n u t n l a t a*	*i o y e e i c e q*	*t k o r u l c x u*
5 BAC	*x w a e e e i e e*	*e o h h d b ſ b r*	*p t v a r r o w k*

A further Explanation of this Table.

CBA, being the firſt poſition, *w*, the firſt letter in the writing is placed under C in the laſt column; and *e*, being the ſecond letter, is put under B in the next column; and *a*, the third letter, under A.

CAB, being the ſecond poſition, the fourth letter in the writing, *r*, falls in the ſecond line under C; the fifth letter, *e*, under A; and the ſixth, *b*, under B in its column, all in the ſame line.

ACB, being the third poſition, the ſeventh letter in the epiſtle, *i*, is put under A in the third line; the eighth letter, *g*, under C; and the ninth letter, *w*, in the column B.

And ſo they go through the writing, always beginning again, when they are at the end of the table, ſo long as there is any thing to write.

The writing taken out of the table will ſtand thus:

△ *Atſaskdet. ecehmaaliy. wehertenre.*

etcwonuyy. bichuſpot. raudyeytb. ioeehoouh.

wtshvwons. gnstarnre. hnutnlata. ioyeeiceq.

tkorulcxu. xwaeeeiee. eohhdbsbr. ptvarrowk.

The terminal letters may be ſo marked to prevent confuſion.

We have inſiſted the more upon this method, becauſe the manner of combining, and the way of writing by ſuch combinations being once perfectly underſtood, the rules for deciphering may be the more ſuccinct, and the more eaſily comprehended.

Solution.

1. If the figure of the key be prefixed to the epiſtle, expreſſing the number of letters combined, take as many letters out of the firſt places of ſeeming words in the epiſtle as ſhall be equal to that number ſo expreſſed, and you may ſoon find out their true order without the trouble of a new combination; though the trouble of combining is not ſo very great, as the diſcovery of a treaſonable deſign may be of importance to the public.

Thus in the example given, you have △ (which muſt be ſuppoſed to ſhew that three letters are combined); extract the three firſt letters from the three firſt ſeeming words of the epiſtle, viz. *a*, *e*, *w*, here at firſt view you may perceive the order. Then taking out the next three letters, *e*, *b*, *r*, you have *a* for the firſt letter of the word from the firſt line, and *e* for the laſt letter; and then you are only to conſider whether *b* or *r* is the middle letter, which is eaſily determined; ſo *b* (being left out there), muſt be the firſt letter of the next word: thus you may proceed, for it is needleſs to enlarge in a caſe ſo plain.

2. If there be no key given, take the number of partitions of ſeeming words in the epiſtle, and find our their ſeveral diviſors; which may be performed by the following rules.

How to find out the equal Diviſors of any Number.

1. Divide the number given by ſome prime number, *i. e.* ſuch a number that cannot be divided but by itſelf, or unity, and the quotient by ſome or other prime number, and the laſt quotient again by a prime number, and ſo go on until the laſt quotient of all be one; and thus you ſhall find a certain number of prime diviſors.

2. Make a rectangular table that ſhall conſiſt of as many columns as you have prime diviſors, which you muſt place one after another at the tops of the columns; and by help of them you will find all the reſt of the diviſors, *viz.*

By multiplying the firſt prime diviſor, towards the left hand of the table, by the ſecond, and writing the product under the ſecond. Next, by the third prime diviſor, multiplying all the figures in the table towards the left hand, ſetting the ſeveral products in the third column; and ſo forth, throughout all the prime diviſors, but with this caution, that one product be not written twice: and in the end, the ſeveral numbers in your table will be all the aliquot parts, or juſt diviſors of the given number.

Example, to find out all the Diviſors in 450.

450	225	75	25	5	1
2	3	3	5	5	

The

The firſt line contains the firſt dividend, and the reſpective quotients; the loweſt line is the ſeveral prime diviſors.

Now 450, the number given, being divided by 2, a prime diviſor, the quotient is 225; which being divided by 3, you have 75 for a new quotient; and that again divided by 3, you have 25 for another quotient. This laſt divided by 5, gives 5, which being a prime number, you have 1, or unity in the laſt quotient of all; ſo that your prime diviſors are, 2, 3, 3, 55, all which ſet down in the tops of the columns, and multiplying them according to the rule given, the operation will ſtand thus:

2	3	3	5	5
	6	9	10	25
		18	15	50
			30	75
			45	150
			90	225
				450

All the diviſors of 450, are 2, 3, 5, 6, 9, 10, 15, 18, 25, 30, 45, 50, 75, 90, 150, 225; and one of them (ſuppoſing the epiſtle to have conſiſted of 450 ſeeming words) ſhould have been the number of letters combined for the key: for the number of ſeeming words in ſuch an epiſtle is equal to the rectangle made of the figure of the key, or number of lines; and conſequently the figure of the key, or number of letters combined, is ſome aliquot part, or equal diviſor of the number of ſeeming words.

But to ſave all trouble in ſearch of the key, you may take a certain number of letters out of the firſt places of the ſeeming words, and write them down in a line; next, take juſt as many letters out of the ſecond places of the ſame partitions, and then the letters out of the third, fourth, fifth places, &c. placing them directly one under another in order; or rather, for diſpatch, take out the ſeeming words, and write them down in rows, beginning at the firſt, and then proceed to the ſecond, third, fourth, fifth, &c. until you have gone through them; and if the number be too great, take as many as you think fit at a time, placing all the dots you find above the heads of the letters at their ſides. *e.g.*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	A	e.	w	e.	b	r	i	w	g.	h.	i	t	x	e	p
2.	t	c	e	t	i	a	o	t	n	n.	o.	k	w.	o	t
3.	ſ	e.	h	c	c	u	e	s.	s	u.	y	o	a	h	v
4.	a	h	e.	w	h	d.	e	h	t	t	e	r.	e.	h	a
5.	s.	m	r	o	u.	y	h	v	a	n	e.	u	e	d	r
6.	k	a	t	n.	f	e	o	w	r.	l.	i	l	e.	h	r
7.	d	a	e	u	p	y.	o	o	n.	a	c	c	i	s	o
8.	e	l	n.	y	o	t.	u	n	r.	t.	e	x	e.	b	w
9.	t.	i	r	y.	t	b	h	s	e.	a	q	u	e.	r	k
10.	—	y.	e	—	—	—	—	—	—	—	—	—	—	—	—

We have marked the lines and rows with figures for their more eaſy diſtinction.

Having brought the writing into this order,

1. Search in the ſeveral lines for ſome of the particles of that language you may ſuppoſe the epiſtle to have been written in; if in Engliſh, make ſuppoſitions, *e.g.* for ſuch little words as *the*, *that*, *for*, *of*, *to*, *and*, &c. and the like, without ſome of which no man can well expreſs buſineſs of any moment.

2. Having ſearched in any of the lines for ſome one of thoſe mentioned, or the like particles, you may prove the truth of your ſuppoſition, by taking out the oppoſite letters of all the other lines; and if they do not make up words, or ſyllables, or produce ſuch letters as can probably follow one another in that order, your firſt ſuppoſition is falſe, and you muſt gueſs again.

3. Having by freſh ſuppoſitions found ſome uſual word, and the letters of the other lines in the ſame order agreeing, the words or ſyllables ariſing from them will direct you to ſome new row that goes before or after in their true order; and thus you may proceed till you have found out the whole writing, which by this time will be no great difficulty.

Example.

In the ſixth line you have *f* once, *o* once, and *r* twice; ſo that probably amongſt theſe letters you may find the word *for*; and upon trial, the ſuppoſition is proved by the other lines: *e.g.* line 6 by lines 1, 2, 3, 4, 5, 7, 8, 9.

Rows	5	7	9
6.	*f*	*o*	*r.*
1.	b	i	g.
2.	i	o	n.
3.	c	e	s
4.	h	e	t
5.	u.	h	a
7.	p	o	n.
8.	o	u	r.
9.	t	h	e.

Here in the fifth line you find *u* a terminating letter; which muſt then have before it the vowel *o*, as in *you*, or *e*, as in *lieu*. And in this line you have *o*, once, and *e* twice; ſo that in three ſuppoſitions at moſt, you ſhall have the preceding row in its natural order; thus ſuppoſing it, *o*, in the fourth row that joins the vowel *u*, the writing will ſtand thus:

	4.	5.	7.	9.
1	e.	b	i	g.
2	t	i	o	n.
3	c	c	e	s
4	w	h	e	t
5	o	u.	h	a
6	n.	f	o	r
7	u	p	o	n.
8	y	o	u	r.
9	y	t	h	e.

Now, having *ou*, it is moſt probable that *y* is wanting to join with it; which, ſtanding in the ſixth row of the line, write down that row in order thus:

	6.	4.	5.	7.	9.
1	r	e.	b	i	g
2	a	t	i	o	n.
3	u	c	c	e	s
4	d.	w	h	e	t
5	y	o	u.	h	a
6	e	n.	f	o	r
7	y.	u	p	o	n
8	t.	y	o	u	r
9	b	y.	t	h	e.

And ſo you may go on until you get through the whole writing; which will in the end ſtand thus:

W	e.	a	r	e.	b	i	g.	w	i	t	h.	e	x	p
e	c	t	a	t	i	o	n.	t	o.	k	n	o	w.	t
h	e.	ſ	u	c	c	e	ſ	s.	y	o	u.	h	a	v
e.	h	a	d.	W	h	e	t	h	e	r.	t	h	e.	A
r	m	s.	y	o	u.	h	a	v	e.	u	n	d	e	r
t	a	k	e	n.	f	o	r.	w	i	l	l.	b	e.	r
e	a	d	y.	u	p	o	n.	o	c	c	a	s	i	o
n.	L	e	t.	y	o	u	r.	n	e	x	t.	b	e.	W
r	i	t.	b	y.	t	h	e.	s	q	u	a	r	e.	K
e	y.													

There

There are ſometimes other helps obvious, to diſcover the ſenſe of an epiſtle obſcured by this invention; *e. g.* you ſee only two letters falling in the laſt line of the example; whereby I not only conclude that the epiſtle ends with them, but may alſo infer from the ſuppoſition of a regular procedure in writing it, that the letter began at ſome of the ſeeming words that compoſed thoſe two rows, *viz. ecehmaaliy*, or *wehertenre*. The reaſon is evident, &c.

This method of ſecret-writing is, at firſt ſight, diſtinguiſhable from any other, only by obſerving the equality in the diviſion of its letters.

There are great varieties of inventions of this kind, more eaſy to the confederates; whereby they only write their ſecret intentions in a parallelogram, or other mathematical figure, and confound the ſenſe, by the method of extracting it. (See the "Account of Diſcoveries made in Scotland," p. 18, &c.)

Of ſecret-writing by means of a parallelogram, where the letters are extracted out of that figure diagonally.

To perform this, a man needs only form a parallelogram or table, and without any combination or other obſcurity in the writing, inſert his ſecret intentions therein; *e. g.* let the ſenſe of the epiſtle be,

"I ſuppoſe that things are ſo forward by your diligence, that we may adventure at all, once next week: meet me towards ten to-morrow's night at the old place."

It is firſt inſerted in the table thus:

I.	ſ	u	p	p	o	ſ	e.	t	h	a	t.	t	h	i	n
g	s.	a	r	e.	ſ	o.	f	o	r	w	a	r	d.	b	y.
y	o	u	r.	d	i	l	i	g	e	n	c	e.	t	h	a
t.	w	e.	m	a	y.	a	d	v	e	n	t	u	r	e.	a
t.	a	l	l.	o	n	c	e.	n	e	x	t.	w	e	e	k.
m	e	e	t.	m	e.	t	o	w	a	r	d	s.	t	e	n.
t	o-	m	o	r	r	o	w	s.	n	i	g	h	t.	a	t.
t	h	e.	o	l	d.	p	l	a	c	e.	*b*	*x*	*y*	*ſ*	*q*.

Here the laſt five letters *b, x, y, ſ, q*, are of no uſe but to fill up the void places in the table.

The firſt method of obſcuring the meaning of ſuch an epiſtle is, by copying it out of the table diagonally, upon a paper apart; *i. e.* by ſuppoſed lines extending from the ſecond letter in the firſt row towards the left hand, to the ſecond of thoſe in the uppermoſt line, and from the third letter in that row to the third in the upper line; next from the letters of the laſt line to thoſe in the upper line that remain, and then to the laſt row towards the right hand, &c. *Diagonal* is a mathematical term, from διὰ, and γωνία, an *angle* or *corner*.

Example.

They firſt write down *I*, beginning at the upper corner of the parallelogram; next they take the other two letters which lie in order to it, *viz. g, s*; then they extract the next three in order, *viz. y, s, u.* And ſo they go on until they come to the laſt corner, *viz. q.* The whole writing being extracted in this manner, will ſtand thus:

I. g s y s. u t. o a p t. w u r p m a e. r. e. o t e l m d ſ s t o- e l. a i o. e. h m t. o y. l f t e. o m n a i o h o r e. c d g r a l r t e. v e w t. d. o o n e n a t p w w e n c r h l s. a x t e. d. i a n r t. u t b n c i d w r h y. e. g s. e e. a *b* h t e a *x* t. e k. *y* a n *ſ* t. *q*.

For the ſolution of this and ſuch like manner of ſecret writing, the only difficulty is to find out the number of the lines and the number of rows. And here you may obſerve that the number of letters in the epiſtle is equal to the rectangle made of the number of lines and rows; ſo that if you take the diviſors or aliquot parts of the number of letters, you may find out the number of lines and rows by a few ſuppoſitions, and conſequently, the involved meaning.

Nay, you may ſoon diſcover any writing of this nature, by reducing the letters of the epiſtle into diagonal lines, as if you had found out its true figure; *e. g.*

Firſt, you may mark down *I*, the firſt letter in the writing, by itſelf, as in the margin. Next write the two following letters, *g, s*, by it thus; then to theſe join the three following letters *y, s, u,* thus; afterwards the following four letters *t, o, a, p*, thus; and ſo of the following five letters, &c. You will perceive when words or ſyllables appear; and withal if you obſerve the coheſion of words or letters, between the end of the firſt line, and the beginning of the ſecond, you will find out where theſe two lines join in the ſenſe, and, conſequently, where the firſt line ends: thus you ſhall have the number of rows, by which, if you divide the whole letters, the quotient gives you the number of lines, &c.

I

I. s.
g

I s u
g s
y

I. s u p
g s. a
y o
t.

This way of deciphering may ſeem to be eluded two ways:

1. By beginning (when they copy the epiſtle out of the table) at ſome of the other angles.

2. By inſerting nulls before the epiſtle.

As to the firſt, if they begin at the lower angle towards the left hand, the words will diſcover themſelves as before. Only the order of the lines will be reverſed in the operation, *viz.* The firſt line is laſt in the true order, &c. 2. If they begin at the upper angle of the parallelogram towards the right hand, the lines will be in their true order, but the writing muſt be read backwards. 3. If, at the lower angle towards the right hand, the order of lines will be reverſed, and the writing muſt alſo be read backwards. This holds true by the ordinary operation; but you may frame your figure for diſcovery, according to theſe three ſuppoſitions, *viz.* beginning it at any corner, &c. Yet, we think, the ordinary operation will give the ſpeedieſt reſolution.

Note. From beginning at the lower corner towards the right hand, you are not to expect words or ſyllables in the beginning of the firſt line by your operation, ſeeing it is laſt in the true order; and mutes, perhaps, may be inſerted to fill up the void places in the figure, ſo that you muſt obſerve the other lines.

As to the ſecond method, by inſerting nulls before the epiſtle, they may, in proceſs of time, be diſcovered thus:

When, upon trial, you find the writing in the epiſtle will make nothing of ſenſe, lay aſide the firſt letter, and make a new ſuppoſition with thoſe remaining; if nothing yet appear, lay aſide two letters, and proceed as before; then leave out three, four, &c. until you perceive words.

We next ſhall analyſe that kind of writing in which *more letters are uſed than are requiſite.* The firſt remarkable, and very ordinary, contrivance in ſecret writing, by more letters than uſually go to the framing of words, is that inſiſted on by Schottus, (in his "Scholia Steganographia,") *viz.*

1. The confidants at parting frame an alphabet of figures to write by; *e. g.*

A	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	v	w
4	22	10	9	1	11	13	18	3	19	12	8	20	2	21	23	7	6	5	15	14

x	y	z.
16	17	24.

2. Having written down their ſecret intentions on a paper apart, they contrive an epiſtle of ſome ordinary buſineſs in any language.

3. They ſearch for the numbers of the alphabet that expreſs

expreſs the letters of the ſecret writing; and counting the letters in the common miſſive from the beginning, they ſubjoin ſome private mark under every character where the reſpective numbers end; *e. g.* Let the ſecret intimation be this:

3	6	18	4	12	12	6	11	16	2	15	5	18	3	6	20	3	13	18	5	4	5
I	*ſ*	*h*	*a*	*l*	*l*	*ſ*	*ee*	*y*	*o*	*u*	*t*	*h*	*i*	*s*	*n*	*i*	*g*	*h*	*t*	*a*	*t*
16	2	15	7	12	2	9	13	3	20	13	6										
y	*o*	*u*	*r*	*L*	*o*	*d*	*g*	*i*	*n*	*g*	*s.*										

And the epiſtle may run thus:

"Having underſtood that I could not be ſafe any longer where you are, I have choſen rather a voluntary baniſhment to wander with my liberty abroad, than to lie under the daily hazard of loſing it at home: 'Tis in my opinion the leaſt of the two evils. 'Tis true, I am innocent; but innocence is not always a buckler; ſo that I hope you will not condemn, even though you cannot approve my choice, at leaſt till you have the particulars of my caſe; which expect *per* next."

You ſee the figure for the firſt letter, to be put in cipher, is 3; therefore a ſecret mark or point muſt be placed directly under, or above, the third letter of the epiſtle, *viz. v;* and number 6, expreſſing the ſecond letter in ſecret writing, a dot muſt ſtand under the 6th letter from *v*, *viz.* under *n;* and 18 letters from *n*, will ſtand another dot, &c.

Example.

Having underſtood that I could not be ſafe any longer

where you are, I have choſen rather a voluntary baniſhment,

to wander with my liberty abroad, than to lie under the

daily hazard of loſing it at home: 'Tis in my opinion the

leaſt of the two evils. 'Tis true I am innocent; but inno-

cence is not always a buckler; ſo that I hope you will not

condemn, even though you cannot approve my choice, at

leaſt, till you have the particulars of my caſe; which expect

per next.

Theſe points may be written with ſuch ink that they ſhall not be viſible, till held by the fire, or dipt in water, &c.

Solution.

For deciphering this, you have no more to do, but take the number of letters, from the beginning of the epiſtle to the firſt point, from that to the ſecond, and ſo from point to point until you come to the laſt; writing down the ſeveral numbers, diſtinctly one after another, and then you have it in a plain cipher reſolvable by the former rules.

Nich. Machiavel tells us, that in his own time a certain perſon deſigning to ſignify ſome ſecret intention to his friends, interlined private marks in letters of excommunication that were to be publickly affixed, by which the ſecret was afterwards communicated to the confederates; and this has in all probability been performed by the former or ſuch-like method of ſecret information.

We have already conſidered the obſcurity ariſing from the inſertion of nulls at random, as to ſeveral of the ways of ſecret writing mentioned: but here we ſhall inquire into them as inſerted by compact, either to prevent or divert ſuſpicion; and indeed the great deſign of perſons who uſe them, is generally one of theſe two.

When they would quite remove ſuſpicion, the epiſtle is ſo contrived, as to outward appearance, that it may appear to have nothing in it but ſome trivial buſineſs, as news, &c. or a private concern, as borrowing of money, paying of bills, &c.

But if the perſon to whom the epiſtle is written might render the paper ſuſpected, they endeavour to divert that ſuſpicion, by inſerting a falſe deſign to cloak a true one.

The nature of this ſecrecy will more fully appear in the ſubſequent examples:

Suppoſe two or more confederates had agreed to confine their ſecret intentions to one ſide of the paper in the writing, according to ſome private compact. Thus, upon diſcovery of a plot, if a ſpeedy flight were deſigned, and to be communicated by this contrivance, it might be written at firſt in the following manner:

This meaſure is not
ſecret; there is now no
ſafety but by flight
Do not fail to meet me
half an hour hence
Let the next meeting be
juſt without the gate
(if my ſenſes are ſound)
we may conclude to have
clear infallible evidence
the ſnare is prepared,
effectually to entrap
you and

Your, &c.

POST-SCRIPT.

Pray
expoſe not yourſelf to
imminent danger.

Now to obſcure the ſenſe and prevent ſuſpicion, the unfiniſhed parts of the lines may be ſupplied with ſomething foreign to the deſign; and afterwards the epiſtle is to be pointed according to the ſeeming ſenſe; *e. g.*

This meaſure is not in danger; to all it is as yet
ſecret; there is now no thing in view to threaten our
ſafety, but by flight we ſhould ruin all our deſigns.
Do not fail to meet me by ſix in the uſual manner:
half an hour hence, I intend to be at the council.
Let the next meeting be where they will, I'll have notice:
juſt without the gate was the governor this morning
(if my ſenſes are ſound) ſecure as we could wiſh him;
we may conclude to have hit right on the means, and more
clear infallible evidence is not on this ſide conjuration:
the ſnare is prepared, they are miſled, and ſee not 'tis
effectually to entrap them, and on their ruin to raiſe
you and

Your, &c.

POST-SCRIPT.

Pray throw off thoſe vain fears:
expoſe not yourſelf to ſcorn, when there is not any
imminent danger.

Here to divert ſuſpicion of what is deſigned for the confederates, the ſecret intelligence is divided from the reſt of the epiſtle, by a ſuppoſed perpendicular line; but however it be divided, the ſenſe cannot well eſcape a diſcerning eye: and to propoſe a ſolution would be ſuperfluous.

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We have already detailed Lord Bacon's mode of secret writing, and need not much enlarge on the means of deciphering it; for if you once find out whether two or three alphabets be used, (and the different kinds of letters in the epistle will inform you of that,) you may suppose one alphabet *a*, a second to stand for *b*, and if there be a third, let it be supposed *c*. Afterwards extract the writing out of the epistle, as if these letters *a*, *b*, or *c*, only, were inserted; and then it falls under the former considerations.

It is nothing to the purpose, whether your supposition and the writer's be the same, or not; for if you suppose always an *a* for his *b*, the operation will be alike easy.

This way of secret correspondence will therefore signify very little, unless to spend the time and paper of the writer: for if you put a mark of distinction between every two, three, or five, of the characters (as they make up a significant letter) they are liable to discovery the same way as an ordinary cipher.

And it is easily discernible when two, three, or five characters express one letter, either from the number of characters in a word, or in the whole writing;—

1. From the number in a word: for when two letters go to the composition of the alphabet, they must have five places; and the words will consist of 5, 10, 15, 20, or 25 letters, *&c.* If three letters are in three places, you will find 3, 6, 9, 15, or 18 characters, *&c.* in each word: if five letters in two places, the words shall have 2, 4, 6, 8, 10, or 12 characters, *&c.* a piece.

2. From the number of the letters in the whole; as if two be only used, in one rank, you shall have five differing characters in the whole at least: e. g. *a*, *b*, *c*, *d*, *e*. If three in a rank, then you may have 3 characters: e. g. *a*, *b*, *c*; and if 5 in a rank, you will possibly have but 2 characters in the writing, *&c.*

By these remarks it will be seen, that Lord Bacon's plan of writing *omnia per omnia*, as he calls this we allude to, is not deemed undecipherable, although it possesses the merit of ingenuity: and indeed all alphabets composed after that manner, in which each letter is represented by one uniform sign (whether composed of few or many characters does not matter) will be liable to exposure; because if you once find out the substitute of any single letter, you discover it in all other instances where that same letter is represented. Thus, suppose *aabaa* to signify *E*, this letter will be always found by detecting its substitute *aabaa*, and of course the recurrence of every other letter may be easily known; so that you are not embarrassed by this cipher with any extraordinary difficulty, as some inexperienced men have imagined.

And here we shall leave this kind of cryptography by *more letters*, *&c.*

The reader who duly attends to the foregoing directions, will be able to extend his knowledge to a variety of other methods, in which *fewer letters* or characters are used than are commonly required in forming words: but of this kind, the most difficult of all, which indeed we fear it is impossible to decipher, is the mode that consists in representing whole words, or even sentences, by single notes and figures. For by this method, we confess, there seems to be no ground whereon a decipherer can set his foot, no principle by which he may be guided in his operations; but all must be conjecture, and discouraging uncertainty! On many accounts, however, the alphabetical modes of writing are preferable for ordinary use; as the labour of putting an epistle into cipher and taking it out, by any other process, is insufferably tedious and operose.

One of the ingenious conceptions of a lady who intended to puzzle Mr. Thicknesse with a new cipher, was this. She composed an epistle in English by means of Etruscan characters, and rendered the whole, according to the French orthography, after the following manner:

"Sur, as yeux air il, doux comme & change the climat: here, yeux mai have game, fiche, duc, fat mutin, foule, porc, aile, port, fruit, & admirable menchette and butter; an mi sistre (a joli nymphe) tu chat tu yeux, & sing yeux an ode, tu the lute, or violin: yeux canne have a stéble for ure hors, & a place for ure chaise. Mi son met a physician néér the river, tisse fêtal signe! thé sai, the pour Docteur dos grive about the affaire, oing tu the rude Squire:—but pardon mi long lettre, pré doux comme tu us about mai, if yeux canne: mi service tu ure niece: hoüe dos Rasse doux?

Adieu mi friend

"P. S. [illegible]

"Pré doux comme; for ure pour Nenni seize but feu beaux."

This feminine production would create no difficulty to a decipherer who understands French, but might perhaps help a little to perplex any other person, on his first entering upon the task. We add a device of our own, with which some other lady may possibly amuse herself. The means of deciphering it will be obvious, we suppose, from what has been said in the preceding pages:

Take a sufficient number of ornamental beads of five colours, (though fewer will do); and string them upon a thread in pairs, according to the plan of combining two signs for one letter. Suppose them to be red, green, yellow, black, and white; an alphabet may then be formed many thousand ways, of which the following is one: Let A be red and green; B, red and yellow; C, red and black; D, red and white; E, green and red; F, green and yellow; G, green and black; H, green and white; and so on, with the other letters. Now, when a message has been composed after this manner, upon a long thread, it may serve for an ornament to some person's neck; or it might pass in a basket of pedlar's toys, without the slightest suspicion of its insidious contents. If only three colours were used, three beads must unite in representing each letter.

Among the incredible pretensions of men who have studied the art of cryptography in former times, we find this one of Trithemius, who certainly mistook his own talents in several particulars:—"Possum hominem idiotam, scientem tantum linguam maternam, qui nunquam novit verbum Latini sermonis, in duabus horis docere scribere, legere, et intelligere Latinum satis ornatè et disertè, quantumcunque voluerit; ita ut quicunque viderint ejus literas, laudent verba, intelligant Latinè composita."

The idea here held out, of teaching an ignorant person to write, read, and *understand* elegant Latin, in two hours, although he never before knew one word of it, is most absurd, and repugnant to all our experience of human ability! None but the Almighty himself could thus instantaneously confer the power of *understanding* a foreign language: although, without doubt, a man who can write, may be taught to copy any Latin words in less than two hours. And Trithemius seems to have attempted nothing more.

To explain this, suppose a great multitude of common alphabets written in order; and to each of the letters in those alphabets synonymous Latin words are annexed, as denoting the respective letters. If all the words expressing A, in the different alphabets, make up an oration, and all the words in each rank be of like signification; and if A, in writing by this method, begins the first alphabet: let one word be taken from thence, another from the second, and another from the third alphabet, as they are required, until the intention of

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the writer ſhall be fulfilled : it is eaſy to perceive how a man, unacquainted with Latin, ſhall thus write it " ſatis ornatè et diſertè ;" but he would nevertheleſs remain totally ignorant of the meaning of thoſe Latin words, any otherwiſe than as they expreſſed the various letters for which they were ſubſtituted, and whereby he has compoſed ſome ſecret meſſage conceived in his mother-tongue. We here remark,

1ſt. That there muſt be a new alphabet conſtructed for every letter in the ſecret writing.

2. Theſe alphabets require a more than ordinary degree of ingenuity in their contrivance.

3. When the alphabets are exactly framed, the leaſt miſtake in the writer turns the ſecret intimation into a chaos.

4. But ſuppoſe there were nothing amiſs in the whole deſign, (which is enough in all conſcience freely to grant,) yet there is much more time required in writing and reading, by this artifice, than a man in buſineſs can diſpenſe with : for, (as we have before ſaid) according to Trithemius the key muſt contain as many alphabets as the ſecret epiſtle has letters in it. Now in Argyle's long letter inſerted in the diſcoveries made in Scotland, there are upwards of a thouſand words ; and if he had taken Trithemius's way of concealing it, there would have been five or ſix thouſand alphabets uſed in the key : we leave it to arithmetic to reſolve, how much time a particular ſearch into each of thoſe alphabets will amount to ; and to ſtoiciſm, (for none but men of that ſect will try) how much patience.

Athanaſius Kircher, in his " Steganography," endeavours to improve Trithemius's method. The alterations we obſerve are theſe,

1. Kircher contrives his key in the form of any ordinary epiſtle ; whereas Trithemius conceives his in forms of prayer, which are more liable to ſuſpicion, eſpecially in an age, when the greateſt villainies are committed under a mere form of godlineſs.

2. Kircher has alphabets of ſeveral languages, whereby a man may chooſe what ſpeech he pleaſes for his exterior letter, though he underſtand not the genuine meaning of one word. But this was propoſed by Trithemius.

3. Kircher's key conſiſts not of many words ; ſo that, if the ſecret or interior epiſtle be not conceived in a few, it gives ground of ſuſpicion and of reſolution too,—

For the words that expreſs every particular alphabet, as before, being of like ſignification, (that the outward writing may have a ſeeming ſenſe,) at every few lines you ſhall have the ſame ſenſe, though not in the ſame words; which gives ground to ſuſpect it, and if the writing be long to attempt a ſolution.

Again, ſuppoſe that ſeveral letters, written by the ſame key, were ſeized, (which is no great improbability) the ſenſe of all will be to the ſame purpoſe ; and that gives cauſe enough of jealouſy, and facilitates the diſcovery.

The compiler has now laid before his readers a conciſe hiſtory of the origin and progreſs of cryptography, and has pointed out ſome of the beſt means hitherto ſuggeſted for deciphering ; but he has not aimed at giving many new ciphers, nor has he endeavoured to ſhew how many ways a ſkilful writer might prevent the diſcovery of even an intention to deceive. He is confident, however, that ciphers may be conſtructed, of a much ſuperior kind to any he has met with : more ready in execution ; more ſimple in their principle ; more intricate to diſcloſe ; and (in ſome examples) not liable to ſuſpicion.

It only remains at preſent to explain the nature of *Plate* III. and the lower part of *Plate* II.

The muſical writing, on *Plate* II. *fig.* 5, containing the words, " Let me know you are ſafe," &c. was compoſed and publiſhed by an author of no ability in muſic ; and the ſpecimen is here added, only to ſhew how puerile any common endeavour of that kind muſt appear to a judge of harmony : ſo that this propoſal, which has been much vaunted and recommended by Mr. Thickneſſe, is never likely to prove of extenſive practical utility.

Fig. 6, *Plate* II. repreſents one of the various modes of cryptography invented by the writer of this article. In its preſent form, it is not difficult to decipher, but is more ſimple and regular in its ſtructure than any of the Iriſh Oghams ; and, by an artifice exemplified in the next plate, which conſiſts of dots inſtead of ſtrokes, it may be rendered abſolutely inſcrutable.

Plate III. exhibits a perfectly new plan of ſecret writing, where there are only three dots (over the line, upon it, and under it,) repreſenting eighty-one letters or figures, conformably to the alphabet engraved upon the ſame plate. This method is capable of a ſurpriſing variety, but, in every variety, ſhall ſeem to be the ſame writing ; it is alſo practiſed by letters and figures, or words, or by all mingled together, without any apparent difference in its form. The reader will never diſcover any thing here beſides a ſimple dot in three poſitions, and cannot tell whether one, two, three, or more of them, compoſe each character. The inventor preſumes to think, that this contrivance is deſerving the attention of ingenious men, and might be a very advantageous acquiſition in the foreign ſecretary of ſtate's office : but, it would be incompatible with his feelings, to ſubmit any ſuch propoſal to the judgment of inferior clerks, who perhaps know nothing beyond the mechanical uſe of ciphers, and are totally unqualified to appreciate the merits of a ſcientific invention. At preſent he has, therefore, not choſen to divulge the principle of this cipher to any perſon living.

The following paragraph gives the explanation of the dot-writing on *Plate* III. with the interpretation of the two ſucceeding examples ; and alſo, in Italic letters, it expreſſes the author's name, profeſſion, place of reſidence, and the date of the year : theſe four different ſpecimens are all deciphered by ONE KEY, which is engraven at the top of *Plate* III. and it would have been eaſy to have given ſeveral hundred more varieties, to be likewiſe deciphered by the ſame key.

The art *of* writing in *c*ipher h*as* *been* ſt*udie*d by me*n* of *t*he gre*a*t*est* t*ale*nts an*d* r*a*nk in *every* civil*ized* country ; bu*t* am*o*ng the vari*ous* *c*ip*hers* whi*c*h have b*ee*n *made* public, we *h*ave neve*r* ſee*n* any tha*t* ar*e* exempt *from* *cons*iderable *objections*. So*me* o*f* them ar*e* t*oo* labor*iou*s fo*r* di*p*l*o*matic uſe*s*, *or* diſpa*t*ch *o*f buſ*in*eſ*s* ; *o*th*ers* are not ſuf*fici*ently *f*aithful to *e*lu*d*e a diſco*v*ery, *w*hen *e*xam*ine*d with *ſ*crupulo*us* a*t*ten*t*ion ; *a*nd *o*ther*s* *are* *o*f ſuch a n*a*tu*r*e as to be in*ad*miſſi*ble* *f*or prac*t*ice, excep*t* un*d*er very p*e*cu*lia*r circumſta*nces* : beſides *w*hi*c*h, the gen*e*ral*it*y of cip*hers* ar*e* comple*x* *a*nd diffi*cu*lt *t*o write, in proportion to their intricacy.

152618035466693599507192735855362202836931217327
245920645394011183947056667685736342011439314394
706595077377993219296977788565806653544536151393
29478504635641935574079616302430375806198162891
963401283797466464393112515532259472106664630615
34649596670125532261892940717273752693373561630
111839470223534399324251116177507163064696146047
396019084939478038207582430663727590354679939681 8
814241575284652207565474849424546691116180271131
181215172736480949922450654401526391403546450585
938016351127572159680409599920342824626514355849
750765645670655704298943235151226059520112556686
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7494718139408323261857130354645074831505668954 45
512171836151643044352858374468160666509554768588
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93493717377269394758487242516277656938677664 5475
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77572935036291525573993869407799931111801736 3514
1449486789115463939599920324653121517757904 58112
1824589368473445460616347439332391225161735 46975
7384128722485878747596949300011184849424556 93717
2987564006672639322183639463554557743938394 00748
9242618465693354645000756514325445819386748508 58
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Great care has been taken, in a former part of this article, to exhibit the peculiarities of the English language, and to point out the most approved means of deciphering any secret writing composed alphabetically: and, "such is the craft of man," says a modern author, "that it is scarcely possible for a letter in cipher to be written so as not to be deciphered, without any clue but a close application to the letter itself; and that too, though it were written in a language the decipherer does not understand." This author has only re-echoed the words of Mr. Falconer, and seems to believe he had even arrived at the ne plus ultra of his art; but, to shew that the writer of this article entertains a very different opinion, and that he challenges all the scrutinizing powers of man, these few specimens are here adduced. The two former, as has been already stated, contain the same internal sense as the dot-writing, and are explained by the same key. Although the key and explanation may serve to develope the principle on which this cipher is constructed, the writer has nevertheless hazarded making a discovery, by adding this one example more; wherein the involved sentiment is expressed by points, and which is also decipherable by the same key as the other specimens.

The present mode of corresponding, as well as the preceding, may be conducted with a triformed alphabet without any suspicion of a cipher being employed. The words represented by the points, in this example, may be found in the paragraph itself; so that the student will not have to look far for an interpretation of its contents. If, after such an unprecedented challenge, and so many helps towards an explanation, the reader still cannot develope this cipher; he ought to concede, that "the craft of man" is inadequate to the task of deciphering it "without any clue."

Before the student attempts to decipher the above specimens, or the dot-writing on *Plate* III. it may be proper to inform him, that the alphabet by which these paragraphs were composed, is wholly unlike any other. The alphabet consists of letters arranged in eighty-one places, forming a square of nine letters deep; and it will be observed, that the letters which are most wanted in ordinary writing, are there repeated most frequently: so that it is possible to produce an immense variety in the appearance of the specimens, while that great variety shall make no real difference in their sense or internal meaning. In consequence of such a construction of this alphabet, all the rules for deciphering with which the author is acquainted, are easily and effectually frustrated. The ingenious reader must, therefore, hit upon some new mode of analysing and explaining what is written in the paragraphs alluded to.

A similar method of corresponding admits of such an arrangement of the letters, as to seem like a foreign language: this mode has not any peculiar advantage in practice, but is somewhat remarkable in the appearance of the writing. As an example—*Relieve us speedily, or we perish; for the enemy has been reinforced, and our provisions are nearly expended,* is thus written:

Sika jygam a fuva quaxo Rolofak adunabi ye, Rasc quema Lovazig arodi; Moxati Ho hyka Fagiva myne quipaxo Aukava in Onfa yani moxarico, Pangdo Spulzi Jorixa mugaro ya zangor Alsiva yival ponbine Kazeb re linthvath.

CIPHERING, or CYPHERING, is popularly used for the art of accompting; properly called *arithmetic;* which see.

CIPIERES, in *Geography*, a town of France, in the department of the Var; 10 miles N. of Grasse.

CIPOLI, a considerable town of Asia, in the kingdom of Nepal, containing about 8000 houses, and very populous. This, and other towns of the same country, both great and small, are well-built; the houses are constructed of brick, and are three or four stories high; but their apartments are not lofty; they have doors and windows of wood, well worked and very regularly arranged. The streets of all these towns are paved with brick or stone, so laid as to afford a regular declivity for carrying off the water. In almost every street of the capital towns there are

 good

good wells made of stone, from which the water passes through several stone canals for the public benefit. In every town there are large square varandas, well built, for the accommodation of travellers and the public; and on the outside of the great towns are small square reservoirs of water, faced with brick, having a good road to walk upon, and a large flight of steps for the convenience of those who choose to bathe. Asiatic Researches, vol. ii. p. 308, 8vo.

CIPONIMA, in *Botany*, Aubl. Juss. See SYMPLOCOS *ciponima*.

CIPPUS, in *Antiquity*, a little low column sometimes without base or capital, but generally bearing an inscription. The cippi served for various uses among the ancients: placed in roads with distances engraved upon them they became milliary columns, or served the purpose of indicatory hermas. They were used for land-marks, and when the circuit of a new city was traced with the plough, cippi were placed at equal distances, on which sacrifices were offered, and which marked the situation of the towers.

The cippi found in sepulchres have been often taken for altars, on account of their form and ornaments, especially when the inscription has not contained an epitaph, properly speaking. The distinction is, however, very slight, as these cippi were consecrated to the infernal deities, and to the manes in particular; and they are even sometimes excavated in the upper part, in the form of a bason or crater. Fabretti mentions a number of cippi perforated from top to bottom, to receive libations in the manner of some altars. Hottinger has an express treatise of the cippi of the Jews, "De Cippis Hebræorum;" wherein he takes cippus for the tombstone of a defunct.

CIPPUS was also used in antiquity for a wooden instrument wherewith criminals and slaves were punished; being a kind of clog, or stocks for the feet.

CIPPUS, in *Entomology*, a species of PHALÆNA-*Bombyx*, with brown wings and three green spots, found in Surinam.

CIPRANDI *of Milan*, in *Biography*, a serious tenor singer, with much taste and feeling, arrived here in 1755, during the high favour and opera regency of Mingotti. He remained here a considerable time, for we find his name in the dramatis personæ of our lyric theatre in 1764 and 1765, with Manzoli, when, in the opera of Ezio, he was deservedly very much applauded in Bach's charming air, "Non so dondi viene," originally composed for the celebrated tenor, Raaf. And at Milan, in 1770, it has been recorded by travellers, that he sung in the churches on great festivals, in a manner far superior to the rest of the choral performers. Indeed, his cast of parts has seldom been better filled by subsequent tenor singers.

CIPRIAN RORE, or, as the Italians call him, *Cipriano di Rore*, one of the most voluminous and renowned composers of the sixteenth century, was born at Mechlin, in Flanders, 1516. In the title-page of a book, published at Venice, 1549, he is called the scholar of Adrian Willaert. In the preface to the Canti Carnascialeschi, published at Florence, 1559, he is called *Cantore;* as if he had been merely a *singer* in the service of the house of Medicis. However, he seems to have spent the greatest part of his life in Italy, as a composer; in which character he is mentioned with great respect by Zarlino, Vincenzo Galilei, Pietro Pontio, and almost every Italian musical writer of his time. And, after having been successively maestro di capella to the duke of Ferrara, the republic of Venice, where he was the immediate predecessor of Zarlino, and the duke of Parma, he died at the court of that prince, 1565, aged forty-nine. His motets and madrigals were first published at Venice, 1544, and again, together with his masses, and many other works, after his decease, in 1562 and 1565. His "Cantiones Sacras," or motets, were likewise published at Lovain, 1573.

CIPRIANI, GIOVANNI BATISTA, was of a Pistoiese family, but born in Florence, according to Heinecken, in 1732. At a very early period of life he evinced great facility and taste in his drawings, many of which, in the manner of Gabbiani, are still to be met with at Florence. Lanzi mentions two juvenile performances of Cipriani in oil, in the abbey church of St. Michele near Pistoia; one representing St. Tesauro, the other St. Gregory the 7th, observing at the same time, that though he drew much he painted but little.

In 1750, he went to Rome to complete his studies, and soon afterwards came to England, where he was chosen a member of the Royal Academy, and lived much respected during the remainder of his life. Amongst the first works which Cipriani painted after his arrival in this country, was a room decorated with poetical subjects, in the house of the late sir William Young, at Standlynch in Wiltshire. The intimacy, however, which subsisted between our artist and Bartolozzi, the celebrated engraver, contributed not a little to encourage him in his fondness for sketching, and to deter him from the more laborious task of oil painting; what the one drew the other etched, and thus the elegant designs of Cipriani were rapidly disseminated over Europe. It might, perhaps, be said, that throughout his works there was too evident a similarity, as the same forms, the same characters, the same expressions, so frequently pervade them, but his drawing is at all times correct and graceful. Some of the few pictures which he left, are at the seat of Mr. Coke, at Holkham, in Norfolk. He died, much regretted, in the year 1790. Lanzi Storia Pittorica. Fuseli.

CIPSOLA, in *Geography*, a town of European Turkey, in the province of Romania: 24 miles N.N.W. of Gallipoli.

CIPURA, in *Botany*, Juss. p. 58. a genus formed by Aublet for a plant found in Guiana, of which he gives the following description. *Cal.* tubular at the base, superior; border six-cleft; three inner ones alternating with the others, and only one third as large. *Stam.* three, inserted into the tube. *Pist.* Style thick, trigonous; stigma three-lobed. *Root* tuberous, tunicated. *Root-leaves* sword-shaped, nerved, sheathing. *Flowers* on a scapus, in a kind of terminal spike, spathaceous; lower spathes longest. Aub. Guian. tab. 13. La Marck has adopted this genus, and copied Aublet's figure, Illust. Pl. 30. with the following generic and essential characters expressed in the language of the Linnæan system. Class and order, *triandria monogynia*.

Gen. Ch. *Cal.* none, spathe oblong, membranous, concave, involving the flower. *Cor.* six-petalled; three outer petals larger, egg-shaped; three inner ones alternate, three times less. *Stam.* Filaments three, very short, inserted into base of the corolla; anthers oblong, erect. *Pist.* Germ inferior, oblong, trigonous; style thick, triangular; stigmas three, petal-shaped, acute. *Peric.* Capsule oblong, angular, three-celled. *Seeds* many, angular.

Ess. Ch. Corolla six-petalled; three inner ones smaller, capsule inferior, three-celled. Illust. p. 107.

Sp. C. *paludosa*. *Root*, a round fleshy bulb. *Stem* six inches high or more, slender, firm, furnished near the top with two leaves, and sometimes with other short ones. *Leaves* more than a foot long, surrounding the bulb at their base, narrow, acute, thin, striated. *Flowers* white, or blue. Encyc.

Obs. Linnæus would have called the three interior petals, or rather segments of the border, a nectary.

CIRCADA, a tribute anciently paid to the bishop or archdeacon, for visiting the churches.

CIRCÆA,

CIRCÆA, in *Botany*, (Κιρκαια, Diosc.; *Circea*, Plin.; so called from the enchantress, Circe); Tourn. Cl. 6. §. 9. gen. 2. Linn. gen. 24. Schreb. 31. Gært. 134. Juss. 319. Vent. vol. iii. 310. Enchanters nightshade. Class and order, *diandria monogynia*. Nat. ord. *aggregatæ*, Linn. *onagræ*, Juss.

Gen. Ch. *Cal.* Perianth two-leaved; leaves egg-shaped, concave, reflexed, coloured, deciduous. *Cor.* Petals two, spreading, equal. *Stam.* Filaments two, capillary, erect; anthers roundish. *Pist.* Germ top-shaped, beset with little hooked bristles, two-celled, two-valved, opening from the base towards the top. *Seeds* solitary, oblong, narrow at the bottom.

Eff. Ch. Corolla two-petalled. Calyx two-leaved, superior. Capsule two-celled. Seeds solitary.

Sp. 1. C. *lutetiana*, With. Sp. Pl. Mart. Lam. Willd. Flor. Dan. tab. 210. Lam. pl. 16. fig. 1. Gært. tab. 24. Eng. Bot. 10156. Common enchanters nightshade. "Stem erect; leaves egg-shaped, finely toothed, opaque, pubescent." Dr. Smith. *Root* perennial, creeping so much as not to be easily extirpated. *Stem* erect, or procumbent, according to its situation, a foot and a half high, not much branched. *Leaves* opposite, dark green. *Flowers* white or reddish, in terminal racemes; peduncles, spreading, at length reflexed; calyx-leaves scarcely membranous, egg-shaped, reflexed, coloured. *Capsule* roundish, beset with little hooked bristles, by which, separating entirely from the stalk, it sticks to the coats of animals. One of the seeds frequently abortive. A native of England and other parts of Europe, in shady lanes under moist hedges. In gardens it is often a common weed, flowering in June and July. 2. C. *alpina*, Linn. Sp. Pl. Mart. Lam. Willd. Lam. pl. 16. fig. 2. Eng. Bot. 1057. (Solanifolia circæa alpina, Bauh. Pin. 168. Moris. tab. 34. fig. ult.) Mountain enchantress nightshade. "Stem ascending; leaves heart-shaped, shining; calyx membranous." Dr. Smith. β. C. alpina, Flor. Dan. 256. Curtis Flor. Lond. Fasc. 3. tab. 3. (C. intermedia, Ehr. 101.) *Root* creeping. Whole plant less pubescent than the preceding species. *Stems* low, diffuse at the base, with red joints. *Leaves* tender, of a pleasant yellowish green colour, toothed-serrated; petioles membranous-angular. *Flowers* of a vivid red colour; racemes often numerous, short, terminal and axillary; calyx membranous, white, with a red tip. Dr. Smith. A native of Sweden and other northern parts of Europe; of Scotland and Cumberland, &c. in the north, but not in the south of England. The variety β is erect, about the size of C. lutetiana, in other respects resembling the present species. A native of shady, but open woods, by the river side of Matlock in Derbyshire. We have found it, but sparingly, in similar situations in the neighbourhood of Leeds.

CIRCÆUM, in *Ancient Geography*, *Irké*, a town of Asia in the Colchide, seated on the left bank of the Phasis, W.S.W. of the Tyndaris.

CIRCÆUM *Promontorium*. See CIRCEII.

CIRCAR, in *Geography*, a name given in Hindoostan to a tract of country, which, according to the statement of major Rennell, is not very dissimilar to that of a county in England; few of the circars being of less extent than the largest English counties. The famous Acbar, in the 16th century, began by dividing Hindoostan Proper into 11 soubahs or provinces, some of which were in extent equal to large European kingdoms; and the soubahs were again divided into circars, and these subdivided into purgunnahs, corresponding, as major Rennell suggests, to kingdoms, or viceroyalties, counties, and hundreds, in English terms. See SOUBAH.

CIRCARS, *Northern*, denote five circars or provinces, so denominated originally from their position in respect to Madras, on which they depend. These Circars are Cicacole, Rajamundry, Ellore, Condapilly, which are in the possession of the English; and Guntoor, which is in the hands of the Nizam. The first four occupy the sea-coast from the Chilka lake on the confines of Cattack, to the northern bank of the Kistnah river; forming, comparatively, a long, narrow slip of country, 350 miles long, and from 20 to 75 wide. The nature of the country is such, as to be easily defensible against an Indian enemy; as it has a barrier of mountains and extensive forests on one side, and the sea on the other: the extremities only being open. Its greatest defect is in point of relative situation to Bengal and Madras; it being 350 British miles from the first, and 250 from the latter: so that the troops destined to protect it cannot be reckoned on, for any pressing service that may arise at either presidency. The Circars, in point of strictness, appertain partly to Golconda (or the Deccan) and partly to Orissa; and are held of the Nizam, on condition of paying him a stipulated quit-rent. In consequence of the wars which terminated, after much bloodshed and assassination, in 1754, by fixing Mahomed Ally in the government of Arcot, and Sa abidjung, son of the late Nizam-al-Muluch, in the soubahship of the Deccan, the English gained the point of establishing their security, and their influence, in the Carnatic; and the French, in addition to the solid advantage of getting possession of the northern circars, gained the splendid but uncertain privilege of influencing the councils of the Nizam, by attending his person with their army. This latter privilege was of short duration; for while M. Bussy, at the head of the French army, was at Sanore, in the western quarter of the peninsula (in 1756) a quarrel with the minister of the soubah of the Deccan occasioned the dismission of the French. They were then compelled to retreat through an enemy's country for near 300 miles, till they reached Hydrabad, where they fortified themselves, and waited for reinforcements. At Hydrabad the quarrel was compromised; and the following year (1757) and part of the next were spent by M. Bussy in reducing the refractory Rajahs, or Zemindars, in the northern circars, and in assisting the soubah to execute his own plans. In the midst of these transactions, M. Bussy was suddenly recalled into the Carnatic; and the soubah was left at full liberty to accede to the proposals of the English. The Circars, the fruits of M. Bussy's wars and negotiations in the Deccan, and which had been obtained in 1753, yet remained with the French; but colonel Clive, at this time governor of Bengal, with that promptitude and decision which so strongly marked his character, seized on them with a force from Bengal, in 1759; although they were defended by a much superior force; and the French were deprived of resources to carry on the war in the Carnatic. Thus the French not only lost all their possessions in the Carnatic, but in every other part of India: so that their political existence may be said to have begun in 1749, and to have ended in 1761, by the capture of their principal settlement, Pondicherry. When the French took possession of the five Circars in 1753, they were valued at about 43 lacks of rupees per annum. The English never possessed Guntoor, which was estimated at near 7 lacks of the above sum; so that 36 lacks (about 360.000*l.*) should be taken for the true value of the English possessions in the Circars. In 1784, they were reckoned to produce about that sum. It would appear, that the Nizam, by retaining Guntoor, had more than an equivalent for the peihcush or tribute, which is 5 lacks per annum. However, Guntoor has since been ceded to the East India company;

company; and it is justly reckoned an important accession. See GUNTOOR.

CIRCASSIA, a country of Asia, bounded on the north by the river Don; on the east by the Caspian sea, and the mouths of the Volga; on the south by mount Caucasus and the Black Sea; and on the west by part of the Black Sea and the lake of Azof. It was formerly governed by several independent princes: but since the convention of 1783, it is now almost wholly subject to Russia, and included in the government of Caucasus. See CAUCASUS and *province* of CAUCASUS. The Circassians, or, as they are called by the Russians, Tcherkessians, are formed of the relics of the mingled swarm, usually comprehended under the appellation of Alanians, who settled on the northern side of Caucasus soon after the Yazamates. The Circassians, or races collaterally related to them, as for example, the Zichians, and Auchasians, gradually took possession of the southern regions adjacent to the Cuban. During the empire of the Chazares, the Byzantine emperors appear to have exercised, or at least to have claimed, a sort of paramount supremacy over this nation, because the Zichians were reckoned among their provinces. When the Russians erected a state upon the island and in the city of *Taman* (which see), the Zichians were tributary to them; but, after the Komanes or Polootzes had conquered the north-eastern part of the Cuban, they put the Circassian stems in possession of the southern and western, and extended themselves afterward continually farther and farther to the north. In 1277, the Zichians were compelled to yield to the victorious arms of Mangu-Timur and Nogay. However, both they and the Circassians remained truly independent in the upper regions of the mountains. They were even, at that period, still in possession of the whole eastern coast of the sea of Azof as far as the Don. They rendered themselves masters of the city of Kertsch in the Crimea, made frequent incursions into that peninsula, and into other European countries, formed the basis of the then rising Caucasian tribes, and founded in Egypt a famous dynasty. At the close of the 14th century, when the Zichians suffered much by the famous victories of the great Timur, and afterwards asserted their liberty with energy and effect against the Ottomans, the Circassians remained unsubdued. Although in the middle of the 16th century the czar Ivan II. reduced the Circassians under his dominion, it was only for a short period; and the Circassians of Cuban maintained themselves as well on the Don as on the Cuban. There they formed, in conjunction with the Russians, the state of the Don-Cossacks; where they retained possession of all the islands of the Lower Cuban, the whole of its southern banks, and the regions contiguous to the Euxine. These southern people, however, were compelled, in the 17th century, to acknowledge the paramount lordship of the khan of the Crimea, although they were governed by beys of their own nation. The tribute which they paid to the khan consisted chiefly in beautiful youths and virgins for the supply of his Harem. At the commencement of the 18th century, the Circassians revolted against this humiliating tribute, and put themselves under the protection of the Porte, without becoming subject or tributary to it. About the middle of this century, 29 Circassian stems, according to Peyssonel's account, were under the khan of the Crimea, who could easily bring into the field 100,000 men. But few of these stems were really his subjects: the south-eastern lived almost in an entire independence, or acknowledged only with reservation the sovereignty of the Crim. At the peace of 1774, some other districts of the Circassians were ceded to the khan; but on the seizure of the Cuban in 1783, the stems of this people in subjection to the khan of the Crimea, fell to the Russian empire. The separation of the Asiatic districts, usually comprehended under the general appellation of Circassia, was, on that occasion, recognised to be made by the river of Cuban. Concerning the present state and the population of the Russian Circassians, little can be authentically ascertained, as no enumeration has been hitherto instituted in those parts. All the districts and stems in the Cuban are properly Russian subjects, inhabiting the islands of the Lower Cuban, the whole southern shore of that river up to its source, and the regions bordering on the Euxine as far as Auchasia. The Circassians in both the Great and Little Kabarda are reckoned only among the vassals of Russia. The sovereigns of that empire style themselves, since the conquest of the Upper Kabarda by Ivan II. lords of the Kabardinian countries of the Circassians and mountain-princes. This seems not to have been a mere title, for though this conquest was afterwards lost, yet the princes of the Great and Little Kabarda, several times between the years 1740 and 1750, took the oaths of fealty to Russia.

The Circassians who inhabit the parts of mount Caucasus more advanced than the Abassinians that occupy Great Abassa, and who have spread into the contiguous beautiful plain, whence they have expelled or subjugated the former natives, are represented by Pallas, in his "Journey into the Southern Departments of Russia," as a warlike nation. They are, he says, a species of knights, observing a complete feudal system among one another, and towards their subjects; and in this view of them, supposing that the chiefs and nobility alone constitute the nation, that their subjects are almost all slaves of conquered nations, who have adopted the language of their masters, and as such are mildly treated, and that a free courageous knighthood cannot endure a foreign yoke, without the greatest repugnance; we may judge with greater indulgence concerning their aristocratical constitution, their constant wars, and their resistance formerly against the khan of the Crimea, and now against Russia. It is fortunate that their internal feuds, and the division of the power of this heroic race among a number of petty chiefs, render them less formidable; and it were to be wished, that, without impairing their bravery, they could be brought to be good vassals, and somewhat accustomed to order; in which case, they would turn out as resolute light cavalry as ever took the field. The part of this nation which concerns Russia, is that which is settled in and near the Caucasian line, inhabiting, as we have already observed, the larger and smaller Kabarda. The Kabardinians hold themselves to be of Arab origin; perhaps they are the remains of the armies formerly sent by the khalifs against Caucasus. Others deduce them from the Mamelukes. General tradition, confirmed by still subsisting names, shews that they formerly inhabited the Crimea. The nobles are divided into ancient noble knights and nobles of nobles.

The Circassians in general, and particularly the Kabardinians, live in villages, which they quit from time to time on account of the accumulation of filth, their insecurity, or other inconveniencies. They carry with them their best wood for spars and wheel-wright's work, and burn the rest. They then seek some other commodious spot. When they build at any distance from water, they conduct a canal by embankments from the nearest brook, in which business they are as expert as the Crim Tartars. They build their habitations near together, in one or more circles or parallelograms; so that the area within constitutes the common spacious yard for cattle; this has only a single gate, and is surrounded, and in some sort defended, by the houses. The men usually dwell in a separate apartment, and do not willingly

ingly appear with their wives in the prefence of ftrangers. The Circaffians are, generally fpeaking, a handfome people. The men, particularly the chiefs, are commonly tall, flim, very flender above the hips, fmall in their feet, and ftout in their arms. They have for the moft part a Roman and martial air, but in fome a mixture of Nogai blood is vifible. The women are not all Circaffian beauties, but they are generally well made, fair-complexioned, dark-haired, regular in their features, and among them are to be obferved more beauties than frequently occur among an uncivilized people.

They are very cleanly in their villages and houfes, as alfo in their clothes and diet. It is a known fact, that a corfet, or broad belt of undreffed leather, is fewed (among more diftinguifhed perfons, it is fixed with filver clafps), from below the breafts to the hips. This girdle muft not be laid afide till the wedding night, when the bridegroom himfelf removes it with a fharp fword, often at confiderable hazard to the bride. For the fake of their fhape alfo, the girls are kept low, being fupported only with a little milk and cake. According to the Circaffian, and alfo to the Turkifh ideas of beauty, a woman fhould be drawn very fmall over the hips, and have the belly projecting downwards.

The men alfo endeavour to render the waift exceffively flender, by the belt to which the fabre is appended. They have all very fmall feet, from inclofing them as tight as poffible in focks of morocco leather, which give them the air of dancers, and with which they fit on horfeback.

The chiefs and knights have no bufinefs but war, pillage, and the chafe. They live like gentlemen, ramble about, frequent caroufals, or concert freebooting fchemes. The knights keep the people in order, and are in nothing bound to the chiefs or princes, except in military fervice. The peafants or fubjects, who yield blind obedience to the princes and knights, and hold life and property at the will of the former, are tranfmitted by inheritance; but no inftance has occurred of their being fold. Thefe people, and the flaves taken in war, who afterward fall into the clafs of the commonalty, plough the land with large ploughs, feed the herds, carry wood, build the habitations, reap, and make hay, which in winter is commonly eaten on the fpot. In harveft they are affifted by the women and grown-up girls, who are not kept fo clofe as among the Crim Tartars.

Among the peafants, every man muft mow and carry hay for three days, for the nobleman or prince; cut and carry wood three days; and deliver feven facks of millet for every ox that he poffeffes. A bridegroom of this clafs muft alfo give two cows and two oxen to his lord. The inhabitants of the mountains, whom the Circaffian princes have rendered tributary, give for each family a fheep, or its value. Every one who has a flock, be it great or fmall, muft give a fheep in fummer, at the time of encampment, to the prince; for which the latter keeps open table.

In general, the prince, although he is bound by no laws, muft endeavour to deferve the love of his fubjects, and their attachment in war by liberality, hofpitality, and kindnefs. He may ennoble a deferving fubject. On occafion of great undertakings, he affembles the nobles, and by them the decifions of the affembly are notified to the people. The number of Circaffians it is difficult to determine. Reckoning the tribes beyond the Cuban, they amount to a confiderable power; which, confidering their bravery and military fpirit, would be dangerous, were it not divided among fo many difagreeing princes.

The two oppofite cuftoms of hofpitality and the *lex talionis*, are held facred among the Circaffian knighthood, and moft other people of Caucafus. The former is reduced to fixed principles; and every one who finds himfelf under their protection is perfectly fecure againft all moleftation. The hoft guards him with his own and his people's life, furnifhes him with an efcort, is anfwerable for him to his kinfmen; and the murder of, or infult towards the gueft, is punifhed as feverely as in the cafe of a relative. A ftranger who puts himfelf under the protection of a woman, or can touch the breaft of a woman with his mouth, were he an enemy, or even the murderer of a kinfman, is fpared, and protected as if he were a member of the family.

The *lex talionis* is juft as confcientioufly practifed among the Circaffians. The next heir, or neareft in blood, even though at the time he be a child, muft take vengeance either openly or by guile, for the murder of a kinfman, if he will not be expelled from fociety. The price of blood is called *Thlil-Uefa*. Princes, however, and nobles, accept no price, but require blood for blood.

The education of the children of the princes is calculated, from the earlieft infancy, to ftifle every feeling of affection. Sons and daughters are delivered on their birth to fome nobleman, often not one of the richeft. The parents, particularly the father, never fee the boy till he is capable of bearing arms, nor the girl till after fhe is married.

The origin of this cuftom of committing the education of all male children to ftrangers, in preference to parents, whilft (as fome fay) females are brought up by the mothers; and alfo that which prohibits hufbands, under pain of infamy, from publicly converfing with their wives, fo that the two fexes are divided into two diftinct communities, cannot be traced to any diftant nation. But if we fuppofe them to exift at an early period in mount Caucafus, they may, perhaps, in fome meafure, account for the fabulous defcription of the Amazons and Gargarenfes, who are placed by ancient geographers in the country now occupied by the Circaffians. See AMAZONS.

The Circaffians practife agriculture, and particularly pafturage. They principally fow millet, of which they not only make various preparations for food, but alfo a liquor which they call *bauthups*. They likewife cultivate maize, which, on journeys and expeditions, ferves for aliment in cafe of need. They plant feveral garden vegetables. The women make a very ftout yarn out of the wild hemp, but they have not the art of weaving linen cloth.

The care of horfes conftitutes, as one may expect among roaming horfemen, the moft important department of their rural economy. To this they attend with as much care and zeal as the Arabs. They aim not merely at beauty, but alfo at ftrength, ability to endure hunger and fatigue, and fpeed; fince the fuccefs of their expeditions depends on the quality of their horfes. Almoft every princely and knightly family boafts of a particular breed of horfes, and burns their mark upon the hips of the true bred foals. In this refpect they are fo confcientious, that he who fhould fix the mark of a noble race on an ordinary foal, muft pay for the fraud with his life.

The language of the Circaffians is common to them with the other neighbouring Tartars, although the chief people among them are not ignorant of the Ruffian.

It appears from a vocabulary prefented to us of the languages or dialects of the Caucafian nations, by Mr. G. Ellis in his "Memoir of a Map of the Countries comprehended between the Black Sea and the Cafpian" (1788), that many of the Circaffian and Caucafian words are nearly the fame as thofe of the uncivilized inhabitants of America. Hence thofe who incline to the opinion of Hornius, and others,

others, who have maintained, that America was originally peopled by colonies from Asia, particularly from Scythia or Tartary, deduce an argument in favour of their opinion.

Their reli[illegible]n is Paganism: for though some of them were formerly Christians, and others Mahometans, and they practise circumcision, they have neither priest, alcoran, nor mosque, like other Mahometans. Every body here offers his own sacrifice at pleasure, for which, however, they have certain laws, established rather by custom than by any positive com[illegible]: their most solemn sa[illegible] their nearest friends, upon which occasi[illegible]men meet in the field, to be present at the offering, which is an he-goat; and having killed, they flay it, and stretch the skin with the head and horns on it, upon a cross at the top of a long pole, placed commonly in a quickset hedge (in order to keep the cattle from it), and near the place the sacrifice is offered, by boiling and roasting the flesh, which they afterwards eat. When the feast is over, the men rise, and having paid their adoration to the skin, and muttered over certain prayers, the women withdraw, and the men conclude the ceremony with drinking a great quantity of aqua-vitæ, and this generally ends in a quarrel before they part.

The Circassians have few manufactures. The points of their arrows are the only articles of iron, which they work up themselves. They make, indeed, some very fine cloths, and felt for cloaks, which is singularly light and durable; and to these we may add a few articles of leather, embroidered housings for horses, &c. Their beautiful coats of mail are brought from Persia, and their fire-arms from Kubescha. The principal traffic of the Circassians consists in slaves, honey, wax, skins of cattle, deer, and tigers. They have no money, and their whole commerce is carried on by exchange.

CIRCE'. See the next article.

CIRCELLI, or Circello, Monte, a cape and promontory of Italy, near Naples, sometimes erroneously described as an island, but connected with the continent by a neck of land. It is a high mountain, at the southern extremity of the Pomptine marshes in the Ecclesiastical state, renowned in fable for having been the residence of the enchantress Circé, who transformed men into brutes, and whose connections with Ulysses are described by Homer in the 10th and 12th books of his Odyssey.

The ancient *Circeii* included both a town and promontory situated in that part of Latium, which had belonged to the Volsci, and which lay nearly at an equal distance from Rome to the N.W. and Naples to the S.E. on the western side of the mountain. The coast was subject to the lashing of furious waves, and presented a variety of steep rocks, on the most elevated of these was placed the temple of Circé, the daughter of the Sun. The port was surrounded by a long wall, and it had been formed into a lake situated on the west. Circeii, about 24 years before the expulsion of Tarquin, became a Roman colony. In the time of Cicero, the temple of Circé subsisted. The outline of the fable is as follows: Ulysses, landing upon this promontory, sends a party to explore the country. They arrive at the palace of Circé, who courteously invites them to enter; and all but Eurylochus comply. She sets before them a mixture of meal, cheese, honey, and Pramnian wine; the same composition as Nestor prepares for the wounded chiefs in the Iliad. With this she mixes poisonous drugs, and after they have all partaken of the refection, she strikes them with a rod, and they are instantly transformed into swine. In this part of the fable nothing has the appearance of intemperance or gross sensuality. On the return of Eurylochus, however, who, not knowing the fate of his companions, concluded that they were all murdered, Ulysses bravely resolves to set out alone, in order to explore the event. In the way, he is met by Hermes in the shape of a youth, who informs him of the nature and mode of Circé's enchantments; and presenting him with a root, called "Moly," as a preservative, directs him, on being touched with the rod, to draw his sword and threaten Circé with death. "Then (says he) she will invite you to her bed, and do not you on [illegible] offer, since it will conciliate her kind[illegible] with an oath not to plan any farther mischief against you." Ulysses acts in all points as he was commanded. Ulysses stays a whole year with Circé, sharing her bed, and making merry with her good cheer, without ever thinking of Ithaca, till his men remonstrate with him, and urge his return. An ingenious writer suggests, that Homer, in the story of Circé, had no other end in view, than in that of the Cyclops, the Læstigons, and various others; namely, to gratify the passion for novelty and love of wonder belonging to all ages and all readers, by introducing into the travels of his hero, all those extraordinary narrations, which he had learned from tradition, or the reports of mariners. This purpose, so natural in a poet of a rude age, will account, not only for the strange matter intermixed with many of his fables, but for their being introduced at all. He who looks for any better reason for many things that he will find in the early writers, will only sacrifice his own judgment to their reputation. Aikin's Letters to his Son, p. 62.

CIRCELLIONES. See Agonistici.

CIRCENSES *Ludi*, Circensian *games*, or *games of the* Circus, a general term under which were comprehended all combats exhibited in the Roman circus of what kind soever; whether on foot or horseback, or in a car; wrestling, or boxing; with swords, pikes, darts, or arrows; against men, or against beasts; on the ground, or aboard vessels.

There were few, except slaves, that gave the people this cruel pleasure: it was an exercise that would have disgraced people of any account. See the article Gladiators.

Some say the Circensian games were so called from the Latin *circumenses*; because they were held in a place encompassed round with naked swords, that the combatants might not have an opportunity of escaping.

At first they are said to have been exhibited on the brink of the river Tyber, and the ground encompassed toward the land with naked swords.

Most of the feasts of the Romans were accompanied with Circensian games; and the magistrates, or other officers of the republic, frequently presented the people with them on other occasions. The grand ones were held for five days, commencing on the 15th of September. See Circus.

CIRCERELLUS, in *Ichthyology*, a name used by some authors for a fish usually called *ammodytes*, or the *sand-eel*.

CIRCESIUM, Circessus, or Cercusium, *Kerkisieh*, in *Geography*, a town of Asia, in Mesopotamia, at the confluence of the Aboras, or, as Xenophon calls it, the Araxes, with the Euphrates. In the time of Dioclesian this town was strongly fortified.

CIRCIA, in *Ornithology*. See Anas.

CIRCIDIUS, in *Ancient Geography*, a river of Corsica, the mouth of which is placed by Ptolemy on the western coast of the island.

CIRCIGNANO, Niccolo, called *Pomarancio*, in *Biography*, an historical painter of considerable eminence, who was born at Pomarance, a small town in the vicinity of Volterra

terra in Tuſcany, about the year 1516. Vaſari ſpeaks of him as a young man of ability, but without informing us who was his maſter. He is conſidered one of the beſt of the artiſts employed by Gregory XIII. and Sixtus V. upon the extenſive but hurried performances in the Vatican. In his freſcoes in the cupola of the church of S. Pudenziana at Rome, he appears ſuperior to the manneriſts of his time. Many of his other works at Rome are mentioned by Baglione: amongſt the moſt eſteemed is a coloſſal figure of Chriſt giving the benediction, ſurrounded by angels; a freſco in the church of S. Giovanni e Paolo. His native city and Loretto poſſeſs other of his performances. He died in Rome at the age of 72, about 1588. Baglione. Lanzi, Storia Pittorica.

Circignano, Antonio, called *Pomerancio*, was the ſon of the preceding artiſt; but, beſides the inſtructions of his father, he received great benefit from the leſſons of Chriſtoforo Roncalli his countryman, one of the beſt artiſts of his time. Antonio Circignano is little known by his works at Rome; but Città di Caſtello, where he ſpent ſome of the beſt years of his life, poſſeſſes ſeveral of his pictures; one of which a conception, (*concezione*,) at the church of the Conventuali, ſeems an union of the ſtyle of Roncalli with that of Baroccio. He died, aged 60, in the pontificate of Urban VIII. Pilkington ſays he was born in 1560. Baglione. Lanzi, Storia Pittorica.

CIRCINALEA *Folia*. See Leaf.

CIRCINIUM, in *Ancient Geography*, a city of Aſia, in Magneſia, ſituated at the foot of mount Oſſa, near the lake Bœbis, between Sothuſſa and the Macedonian ſea.

CIRCITOR, in the *Ancient Military Diſcipline*, an officer among the Romans, who went the rounds, after having received his orders from a tribune to viſit the ſeveral poſts, and ſatisfy himſelf that the ſentinels had not quitted them nor fallen aſleep.

Circitor is alſo uſed to ſignify a hawker, or pedlar, who goes about from place to place to vend his goods.

CIRCIUM, in *Botany*. See Cirsium.

CIRCLE, the name of various *aſtronomical inſtruments*. It will probably appear a paradox to ſome of our readers, to be told, that aſtronomical *obſervations* were made, in various parts of the world, many centuries before aſtronomical *inſtruments* were invented. The obſervations, to which we allude, were ſuch as related to the riſings and ſettings of the ſtars in different latitudes and in different ſeaſons of the year; to the claſſing of cluſters of ſtars into imaginary figures, called in the Engliſh language conſtellations; to the reſpective aſcenſions and deſcenſions of the circumpolar ſtars; and to eclipſes of the ſun and moon, as well as to occultations of the ſtars and planets, or *wandering* ſtars, by the moon. Hence aroſe the terms *heliacal*, *coſmical*, and *achronical* riſings and ſettings of the ancient authors, and various other terms in aſtronomy, which are retained to this day. Theſe obſervations, made at firſt by ſhepherds and herdſmen, ſimple as they were, were not only ſerviceable in determining the ſeaſons ſuitable for the different operations in huſbandry, but afforded data for aſcertaining the lengths of the ſolar and lunar periods, with a degree of accuracy which aſtoniſhes the modern aſtronomer. Before we proceed to deſcribe the circular inſtruments uſed in aſtronomy and navigation at the preſent day, it may not be unintereſting to give a brief hiſtory of the inſtruments that preceded them.

The firſt inſtrument, probably, which was uſed as a meaſure of altitude, was the gnomon, many centuries after the Babylonians, the Egyptians, and the Chineſe had been accuſtomed to make celeſtial obſervations, ſuch as we have ſpoken of. The firſt mention, we believe, that is made of the term *hour*, as a portion of the day, occurs in our Bible, in the book of Daniel, chap. iii. verſe 6, under the reign of Nebuchadnezzar, about the year before Chriſt 600; and the Grecian hiſtorian Herodotus expreſsly ſays, that the Greeks learned the uſe of the pole, the gnomon, and the diviſion of the day into twelve parts from the Babylonians. Accordingly, Diogenes Laertius informs us, that Pherecydes ſet up a pole or dial in the iſland of Syra, one of the Cyclades, about the year before Chriſt 540, which, indeed, Anaximander had done previouſly, about the year before Chriſt 547, at Lacedæmon; and the Jews, in the reign of Ahaz, had known the uſe of a dial nearly 200 years before. The Roman dials, of courſe, were poſterior to theſe; the firſt that was ſet up at Rome, which was by Papirius Curſor, being, according to Pliny, (N. H. l. vii. c. 60.) about the year 461 of the building of the city, or 293 before Chriſt. The uſe of a gnomon, or ſtyle of a large dial, as an inſtrument for meaſuring altitudes of the ſun, aroſe from the circumſtance of an obſerved increaſe in the length of the ſolar ſhadow as the ſun's altitude decreaſed. Geometry by this time had begun to be greatly improved by Thales, Pythagoras, Hippocrates, Eudoxus, Euclid, Apollonius, Archimedes, and others; and aſtronomy was now cultivated in the ſchools, particularly by Eudoxus and Aratus. Plato alſo had learned in Egypt, that the ſolar year is $365\frac{1}{4}$ days; and Philolaus aſſerted the annual motion of the earth round the ſun, as did Hicetas the diurnal motion of the ſame; ſo that the obſervations which had been made ſome centuries before the Chriſtian æra, and the ſyſtems ſuggeſted by different philoſophers to explain the obſerved phenomena, muſt have diſpoſed the minds of all the early cultivators of ſcience, to avail themſelves of the uſe of an inſtrument, which afforded data for calculations, beyond what mere ocular obſervation could furniſh. The compariſon of the perpendicular height of a gnomon with the length of its meridian ſhadow, projected on a horizontal plane, ſimple as the obſervation was, afforded the means of aſcertaining the ſun's apparent meridian altitude on any day by means of the Pythagorean Theorem on the properties of the right-angled triangle. This obſervation, made on the days of the ſummer and winter ſolſtices ſucceſſively, determined the difference of the ſun's meridian altitudes on thoſe days, and conſequently the ſpace contained within the two tropics, which is juſt double the greateſt declination; hence the complement of the latitude of the place, or, which is the ſame thing, the complement of the pole's elevation, was determined with conſiderable accuracy. Thales, whoſe diſciple Pythagoras was, and who, Laertius ſays, was the real author of Euclid's 47th propoſition, uſually called the Pythagorean propoſition, was accuſtomed to meaſure the heights of the pyramids of Egypt by their ſhadow, and could foretel eclipſes; he was alſo the firſt who divided the celeſtial ſphere into zones by the introduction of five circles, *viz.* the arctic, the ſummer tropic, the equator, the winter tropic, and the antarctic circle. This diviſion of the heavenly regions into zones, divided by parallel circles, at a time when geometry was cultivated, naturally led to the taking of the latitudes and longitudes of the heavenly bodies; and it may be worthy of remark here, that the pyramids themſelves had their planes facing the eaſt, weſt, north, and ſouth points, which, therefore, might be uſed as inſtruments of obſervation. Anaximander, another diſciple of Thales, who, we have ſaid, invented the gnomon, wrote a treatiſe on the ſphere, and explained the obliquity of the zodiac; and, about 100 years after him, Anaxagoras, who ſtudied philoſophy for 30 years at Athens, wrote a book on the "Quadrature nature of the Circle." Thus, these philosophers of what was called the Ionic sect, may be said not only to have laid the foundation of astronomy as a regular science, but also, by referring the places of the heavenly bodies to certain supposed circles in the heavenly regions, to have suggested to future astronomers the most natural shape of an instrument that should be best calculated to measure their relative angular distances: we do not, however, meet with any account of circular or other instruments used by any of the philosophers of the Ionic or the Academic schools, until we arrive at the time of Hipparchus, who lived about 160 years before Christ. This astronomer collected the different observations that had been previously made; and made new ones by means of an instrument, called an *astrolabe*, which was a kind of armillary sphere, calculated at once for being used in taking observations, and for illustrating the heavenly motions when ascertained. This astronomer is said to have been the first who attempted to count the stars, and to make a catalogue of them: and was also the first who made *ephemerides*, or calculations of the relative places of the heavenly bodies, which he did to include a space of 600 years. Soon after Hipparchus, Eratosthenes, the Alexandrian librarian, measured the length of the earth's radius by a comparison of a gnomon at Syene in Upper Egypt with another at Alexandria, it having been observed that the former used to cast no shadow on the day of the summer solstice; this Eratosthenes had also an astronomical instrument constructed similar to that of Hipparchus, with which he made observations on the heavenly bodies.

We do not find any other mention of astronomical instruments until we come down to the reign of the Roman emperor Antoninus, when Claudius Ptolemæus, commonly called Ptolemy, wrote his "Almagest," or famous book on astronomy, about the year of Christ 147, which science he had learned in Egypt, though a native of Pelusium. In this work, which has also been called the "Great Syntax," and which is well known to astronomers, we find an account of another circular astronomical instrument for making celestial observations, described also by the name of *αστρολαβικον οργανον*, which, we understand, had only one large ring or plane graduated, and most likely was similar to the astrolabe described in Bion's book on the "Construction and principal Uses of mathematical Instruments;" this instrument, according to Bion's description, (see *Plate* I. *fig.* 1. of *Astronomical Instruments*,) like a common ring-dial, was made heavy, and arranged itself in such a vertical plane when suspended by a small ring, that the points *o* and *o* of the graduated circle stood at opposite ends of a true horizontal line; and a diametrical bar, turning on a pin in the centre, carried two vanes, one at each end, through which the altitude of a heavenly body might be readily taken, in degrees and parts of a degree, as indicated by the fiducial edge of the diametrical bar. Sir George Shuckburgh, however, thinks that Ptolemy's astrolabe had two graduated circles placed at right angles. The ages of ignorance which succeeded Ptolemy produced no improvement on the astrolabe for more than fourteen centuries, and it is not easy to fix the exact date of the next succeeding instruments that owed their existence to the revival of letters. The most obvious, and therefore probably the first, improvement in the astrolabe, was an enlargement of its radius, for the purpose of making the divisions to be on a larger scale than the portable instrument at first had; this enlargement of the radius, of course, led to a reduction of the circle to a quadrant, which would naturally be supposed to be sufficiently extensive in its use, particularly for the purpose of taking altitudes, as they never exceed 90°. It does not appear, however, certain, when or by whom the plumb-line was introduced in the quadrant.

The introduction of the Indian, or Arabic numerals through Spain into England, must have contributed to a facility in reading the graduated divisions of a circular, or quadrantal instrument. According to Dr. Wallis, the first figures of this shape, which were noticed in England, were on a chimney-piece at Helmdon in Northamptonshire, in conjunction with the Roman characters, thus, M° 133, meaning 1133, which numerals fix their own date. Another step, towards the improvement of instruments of observation, was the introduction of optical glasses, and of optical instruments, which were made by the famous Franciscan friar, Roger Bacon, who was born in 1214. He talks of making small things appear large, and of bringing distant things near him by his instruments, so that he must at least have made Microscopes, if not, as some suppose, Telescopes also. It will not be deemed foreign to our present purpose to notice here that Paul the Venetian (see Costard's history of Astronomy, p. 65.) introduced the use of the mariner's compass, borrowed, as it is said, from the Chinese, in the year 1260; though it was not till 1300 that John Goia, a Neapolitan, the reputed inventor, introduced its use in navigating the Mediterranean. We are not assured, indeed, that the directive power of the magnet had any circular or other graduated instrumental appendage, as its variation from the true pole was not discovered till Christopher Columbus, the illustrious adventurer of Genoa, made this discovery in his voyage to the West Indies, on the 3d of August, 1492. The magnet's attractive power, however, had been previously known to the ancient Greeks. The next maker of astronomical instruments that we find spoken of in history, was John Muller, who, being born at Mons Regius in France, in 1436, was therefore called Regiomontanus; this illustrious scholar and astronomer, after having learned the doctrine of the sphere at Leipsic and Vienna, set about learning the Greek language, on purpose that he might make an epitome of Ptolemy's Almagest, or Great Syntax, which was written in that language; in which labour he was assisted by Purbach; and when, during the war between Matthias king of Hungary and the Bohemians, he retired to Nurembergh, he met with Bernard Walther, and other men of a mechanical turn, who assisted him in constructing astronomical instruments. The first attempt was to make rules of tin for observing the altitudes of the sun, moon, and planets, but particularly of the sun; whether these rules were made in the form of a sector, or in the form of a sliding cross, we are not informed. The second instrument made by Regiomontanus and his assistants was a rectangular, or astronomical radius, for measuring the angular distances of the planets; the third, by the same mechanician, was an astrolabe, either armillary, like that of Hipparchus, or planispheric, like Ptolemy's; and lastly, some minor instruments were constructed by him, such as the *torquet*, the *meteoroscope* of Ptolemy, and others of mere curiosity. This author established a printing-office at Nurembergh, and as he was the inventor of decimal arithmetic, we must suppose that his method of graduating his instruments, whatever it was, was adapted for decimal calculations.

A posthumous treatise by Regiomontanus on the subject of astronomical instruments is preserved in the British Museum, which is, perhaps, the only copy in the kingdom; its title is, "Scripta clarissimi Mathematici M. Joannis Regiomontani de Torqueto, Astrolabio armillari, Regulâ magnâ Ptolemaicâ, Baculoque Astronomico," &c. This treatise, which is in folio, was printed at Nurembergh in 1544. The torquet, which was a kind of portable equatorial,

rial, is also described in Bailly's "Astronomie Moderne," tome i. p. 687, and before either of the others by Apian in a scarce folio book, which has for its title "Introductio Geographica Petri Apiani in doctissimas Verneri Annotationes, &c. cui recens jam Operâ P. Apiani accessit Torcuetum Instrumentum pulcherrimum sane et utilissimum. Ingolstadii anno 1533."

Regiomontanus's description of Ptolemy's armillary astrolabe may be seen in Weidler's "Historia Astronomiæ," 4to. 1741.

About two centuries and a half after Regiomontanus, we find the celebrated Copernicus still using an astrolabe, his knowledge of which first gave him a taste for the study of astronomy, and consequently was the primary incident to which we are indebted for the introduction of our Copernican system, in which the systems of Philolaus and Hicetas are united. This celebrated astronomer of Thorn, in Prussia, wishing for tables preferable to those previously made by Ptolemy and Alphonsus, had a quadrant erected and fixed in the meridian line above the plane of the horizon about the year 1507, from which we may date the origin of regular observatories. This quadrant, of which we know not what were the exact dimensions, took altitudes of the sun by means of a cylindrical gnomon, or pin stuck in the central hole, the shadow of which, falling on the limb of the instrument, measured the greatest and least meridian altitudes of this luminary at the two solstices, and thereby ascertained the distance between the tropics and the height of the pole with considerable accuracy. But the instrument with which the altitudes of the heavenly bodies in general were taken by Copernicus, was a parallactical instrument made of fir, the limb of which, we are told, was subdivided into 1414 equal parts, just included in the quadrantal arc, that was contained between two legs of each four cubits long, which legs were respectively divided into 1000 parts, similar in magnitude to the subdivisions of the arc, according to Benj. Martin's account, in his "Biographia Philosophica;" but if the subdivisions were of similar dimensions on the arc and legs of the instrument, as is said, there must have been 7854 on the former, with 1000 on the latter, to form an exact quadrantal arc. The angle subtended by each space in the 1414 subdivisions of the limb must have been $\frac{90^\circ}{1414} = 3' \, 49''.137$, &c. which quantity might induce one to suppose, that the circle had not been hitherto divided into exact degrees and minutes on an astronomical instrument.

Tycho Brahe, who was born about 73 years after Copernicus, and who is well known as the inventor of the Tychonic, a kind of Ptolemai-copernic system of the planetary motions, had a more expensive collection of astronomical instruments than any one who preceded him. His observatory in the isle of Huen in the Sound, founded by Frederic II. of Denmark, was called "Uranibourg" (heavenly habitation), and had the first stone laid on the 8th of August, 1576. In his "Astronomiæ Instauratæ Mechanica," this author has described four instruments by the names of *armillæ, zodiacales,* and *equatoriæ,* varying from $4\frac{1}{2}$ to 10 feet in diameter, which were divided into degrees and minutes, and some of them even to 15 and 10 seconds. The towers in which these instruments were placed, had moveable roofs; and, what is worthy of remark, the axis of the ten-feet instrument was tapering and hollow, in order to have strength without increased weight, which construction our modern instrument-makers have adopted. The graduations of his instruments were into equal spaces of 10' each, and the intermediate minutes were ascertained by triangular diagonals formed of straight lines of ten equidistant dotted spaces, instead of parallel continued lines.

As Tycho Brahe cultivated also chemistry and metallurgy occasionally, it is very probable that his instruments were of better metal than the instruments of Copernicus, particularly when we take into consideration the circumstance of his having devoted nearly his whole life to astronomy, and pursuits subservient to this noble science, and also that he had several pupils or assistants learning to make celestial observations in Uranibourg; indeed, it is said in the original account, that the *constans axis* was made *e chalybe.*

About the beginning of the 16th century, when nautical astronomy had begun to be cultivated, a spirit for making discoveries, beyond what Columbus had made, spread itself over the different kingdoms of Europe; among these adventurers we find the names of Americus Vespucius, John and Sebastian Cabot, John Ponce de Leon, Cortez, Saavedra Guznam, Mendoza, Solo, Gonsalvo, Pizarro, &c. on the continent; and in England, sir Martin Frobisher, sir Francis Drake, Mr. John Davis, &c.; the last of whom we shall shortly have occasion to mention again. During the sixteenth century, quadrants, sectors, fore-staffs, and back-staffs, began to be made of various dimensions, and on various constructions, both for astronomical and nautical purposes, but when, or by whom, the plumb-line was first made a part of the astronomical quadrant, is a matter not easily ascertained at this distance of time: the graduations at first were pointed out by contact of a fiducial edge of the index, or were cut by a fine thread used as the line of the plumb, as seen in *Plate* I. *fig.* 4.; but this mode of reading an observation left much to conjecture, however small the subdivisions might be on the limb of the instrument. The first important improvement in the method of reading an observed angle, was that of Peter Nonius, or Nunez, a native of Portugal, born in 1497, which he described in his "Treatise on the Twilight," published in 1542. The contrivance was this; 45 concentric circles were described on a broad limb of the quadrant, and divided into spaces differing from one another by unity only in regular succession, beginning with 90, and ending with 46; so that the edge of the plumb-line, when resting on any particular point on the limb of the instrument, was certain to be contiguous to some one dividing mark in one of the 45 circles; which was an ingenious thought, but more plausible in theory than useful in practice; for the dividing of 45 circles into equal spaces of different numbers, out of which nine are prime numbers, was a laborious task to be performed with the requisite accuracy; and again, when the observation was read off, an arithmetical operation was necessary to reduce the observation to degrees, or parts of the largest circle; which operation was necessarily proportioned differently for each separate circle. But perfection is not usually attained at the first attempt in the construction of any new instrument, or new method of performing instrumental operations; the concentric circles of Nonius led the mechanician to the diagonal scale, which was formed successively by curved and straight lines. In the year 1573, the "Scalæ Mathematicæ" of Thomas Digges, esq. was published in London, in which is contained the method of making diagonal scales: the transition from Nonius's scale to the diagonal scale, with equidistant parallel curves, was easy; and it is said, was first effected by an ingenious workman of the name of Richard Chanseler. The diagonal scale, however, of either the curvilinear or rectilinear kind, was not well calculated for affording a very accurate reading of any observation, by reason of the difficulty of ascertaining the exact intersecting point of the scale, which a thread or edge of the index exactly covered, where the slope of the

diagonal

diagonal line did not deviate much from a radial line. Jacobus Curtis had a method of making scales for astronomical instruments, which was published by Clavius in 1586, at Rome. This method, like that of Nonius, consisted of concentric arcs, each differing in size by 1′ from the next contiguous: there were 39 of these concentric arcs, each divided by bisection into 128 equal parts, beginning with an arc of 90°, and ending with one of 128°. But, like Nonius's, this scale required an arithmetical reduction to degrees, though it had the advantage of being free from prime numbers. In or about the year 1590, captain John Davis, whom we have already named, contrived an instrument for taking altitudes, which consisted of two concentric contiguous arcs, one larger than the other, and three vanes; (see *Plate* I. *fig.* 2.). One vane was placed at the centre, and was called the horizon vane; another to slide on the arc of 60° of the small radius, and to receive the rays of the sun, which was therefore called the shade vane; and the third was made to slide on the arc of 30° of the long radius, for the eye to look through towards the horizon vane, and was thence called the sight vane. In using this instrument, the back was turned towards the sun; which circumstance gave the name of back staff also to the instrument, which far exceeded any nautical instrument that had preceded, both in accuracy and convenience. (See the article QUADRANT).

About the same time that Davis's quadrant was brought into use, we find another very similar instrument, called "Elton's Quadrant," made use of both at sea and on shore. This differs from the former principally, as it has its index levelled by a spirit level, which renders it useful where there is no good horizon to be seen. Its description may be seen in No. 423. of the "Philosophical Transactions," and in "Bion's Book," p. 274. See QUADRANT, and *Plate* I. *fig.* 8.

It is not quite certain at what exact period the instrument called the *fore-staff* or *cross staff*, (*Plate* I. *fig.* 3.), was used first in nautical astronomy, but as Bion calls the back-staff an English instrument, we may conclude it was contrived on the continent; the divisions are laid down on a long arm in the form of a tangent line, and three cross pieces of unequal lengths slide on this arm separately to the distance that allows the eye, placed at the extreme end of the arm, to see the horizon below and the heavenly object above the cross-piece used; the smallest sliding cross-piece will measure as far as 30°, the next in size 60°, and the largest 90°, when placed at the interior end of the divided scale. This instrument, when well made, was very convenient at sea, but was incapable of having the diagonal scale applied, as the divisions were unequal: it was capable of measuring angular distances as well as altitudes.

Another instrument used in navigation and astronomy was the nocturnal, (*Plate* I. *fig.* 6.) which consisted of a handle, an index with sights, and two circular plates revolving on the same central pin, so divided as to be capable of adjustment for the right ascension of some given circumpolar star, as compared with the pole-star on any day of the year; its use was, to find the hour, and to take the altitude and depression of the pole-star at any place, and consequently to determine thereby the latitude. Its exact date is not, perhaps, well known.

About the end of the 16th century, Edward Wright, of Caius college, Cambridge, in whose time the fore-staff or cross-staff was used, introduced the sea-rings for determining the variation of the magnetic needle, which instrument, no doubt, was the origin of our azimuth compass, as it is said that the altitude of the sun and hour of the day could be determined by it. The same ingenious mathematician made a six-foot astronomical quadrant better than any that had been made in England, and rectified with it the declinations of the stars, as given in the former catalogues; which labour was performed in the years 1594, 95, 96, and 97; he also made a sea-quadrant that would take altitudes by either a forward or backward observation, and that would determine the latitude by the observed height of the pole-star, even out of the meridian, which must have been an ingenious contrivance.

After the invention of logarithms by baron Napier in 1614, calculations began to be abridged, and numerical proportions began to be performed by logarithmic scales. The first of these was by professor Gunter, of Oxford, who, in the year 1618, contrived also a quadrant, bearing his name, which having a stereographic projection of the sphere on its plane considered as the equinoctial, ascertained the hour as well as azimuth, altitude, declination, and place of the sun, by an observation without subsequent calculation, and these with some degree of accuracy.

Contemporary with professor Gunter, was the celebrated Galileo of Italy, who, having heard of a certain glass in Holland, that would shew objects at a distance distinctly, set about contriving the dioptric telescope, in which he succeeded; and we find Christopher Scheiner using one moveable on a polar axis in the year 1620 *(vide Rosa Ursina)*; this discovery led ultimately to considerable improvements in astronomical instruments, though the unequal refrangibility of the different coloured rays of light prevented its being constructed with much power, and at the same time of a convenient length, for many years afterwards.

The invention of the micrometer, or mechanism in the eye-piece of a telescope, for measuring very minute angles, soon followed the invention of the telescope itself, and contributed greatly to the accuracy of observations, taken by the help of that instrument. It has been generally supposed that Monf. Auzout, a Frenchman, was the author of this invention, in the year 1666, but according to Costard, an English gentleman of the name of Gascoigne was the real inventor, as appears by a letter written by himself, in 1641, which is still extant in the library of the Earl of Macclesfield. Gascoigne was slain near York in the civil wars in the year 1644.

In 1658, John Collins, an eminent mathematician of the county of Oxford, published a pamphlet, entitled "The Sector of a Quadrant," in which are described four different quadrantal instruments, but that which is called Collins's or Sutton's quadrant, contains a stereographic projection of one quarter of the sphere, between the tropics on the plane of the ecliptic, agreeably to the latitude of London, the eye being supposed to be placed in its north pole: the use of this quadrant is very similar to that of Gunter, from which the idea was no doubt borrowed.

Another very important improvement in astronomical and nautical instruments, was the divided scale at the end of the index, contrived by Peter Vernier, a gentleman of Franche Comté, and described in a small tract, called "La construction, l'usage, & les proprietes du Quadrant Noveau de Mathematique, &c." which was published at Brussels in 1631. As this contrivance will be particularly described in its proper place, it may suffice to say here, that when the limb of the instrument is very equally divided by nice strokes into halves, thirds, or fourths of a degree, an arc containing a given number of those divisions is laid on a circle described on the end of the index contiguous to the divided limb, which equal arc is divided into the same number of spaces, as its like arc on the limb, with the difference of *one*; so that

that if the limb contains 19 or 21 thirds, the index or rather that portion of it which subtends precisely the same sectoral arc, must contain 20 spaces, then when No. 0 on the index is put to any line on the limb, so as exactly to coincide, No. 1 of the former will not exactly coincide with the next succeeding line of the latter by $\frac{1}{20}$ of a space, and No. 2 on the index will be $\frac{2}{20}$ from an exact coincidence, and so on till the end of the scale on the index, where there will be a second coincidence; but whenever No. 1 does not coincide, there is only one coincidence, which may fall at any number of lines from 1 to 20 on the Vernier; but we have said the limb is divided into thirds of a degree, when the scale has 20 divisions, therefore $\frac{1}{20}$ of $\frac{1}{3} = \frac{1}{60}$ of a degree $= 1'$. When the divisions of the limb are halves of degrees, the scale has 30 divisions covering exactly 29 or 31 on the limb; and when they are quarters, 15 on the scale must just cover 14 or 16 on the limb. This scale is called a *Vernier* from the inventor's name, but is frequently, though very improperly, even by instrument-makers themselves, called a *Nonius*, from which it is quite a different thing: by means of a Vernier a very small circle may be graduated so as to shew *minutes* of altitude or of angular distance.

According to Joannes Baptista Morinus, Joannes Ferrerius, an ingenious workman, contrived a kind of circular diagonals, which, if continued, would pass from the limb to the centre of an instrument, but to avoid trouble, he laid 60 of these on the index, which intersected straight lines drawn from the centre in such a way that these straight degree lines marked the minutes by their intersections with the curves of the index. The account was published in 1634, but this method was not found so good as that of Vernier, and therefore was discontinued.

Notwithstanding telescopes, as we have said, were necessarily very long, to obtain much power, in order to be free from a discolouration in the eye-piece, yet we learn that so early as the time of Dr. Robert Hooke, certainly one of the greatest mechanicians of his own, or perhaps of any other age, telescopic sights were applied to the astronomical quadrant, as his well known dispute with Hevelius of Dantzic will testify. Hevelius's Cometographia, which induced the dispute, was published in 1668, which will fix the date pretty nearly of the telescopic sights. It is somewhat extraordinary, that the dispute alluded to terminated with the public opinion in favour of plain sights, in preference to telescopic ones, as to the accuracy of observations made respectively with each; though Dr. Hooke contended that Hevelius could not measure a smaller space in the heavens than *a minute* by plain sights, whereas he could measure to the accuracy of *a second*, with a radius of a span long. This degree of accuracy in Dr. Hooke's observations, if really effected, one might suppose, left his successors little more to do, but to copy his method of constructing instruments, and of observing by them; and our reflection upon his assertion would have led us to infer that he must have measured his *span* with very long fingers, had we not previously known that his person was of very short stature: his unwillingness to allow a competitor in mechanical inventions may in some measure account for the greatness of his pretensions. Doctor Hooke had moreover a zenith sector with a telescope of 36 feet focal length, fitted up with plumb lines in his apartments at Gresham college, which had a micrometer in its eye-piece, and we suspect that this was the instrument with which he measured to the accuracy of *seconds*.

We have now arrived at a period in the history of astronomical instruments which is truly important. The introduction of pendulum clocks, of the vernier, and of the telescope, with a micrometrical eye-piece, together with a fine plumb-line, had become valuable additions to the simple sector or quadrant; and in the year 1660, Huygens brought into England the art of grinding and polishing glasses suitable for telescopes: in the same year the Royal Society of London was founded by Charles II.; in 1670 the Royal Observatory at Paris was begun, to which Cassini was appointed in the following year; and on the 10th of August of the year 1675 the first stone was laid of the Royal Observatory at Greenwich, to which fortunately the celebrated Flamstead or Flamsteed was appointed the following year. These institutions of course produced a demand for good instruments, and, what is somewhat remarkable, the first man of eminence in this way, Geo. Graham, was born in a village in Cumberland, (which county has since given birth to many of the most eminent mechanicians), in 1675, the very year in which the observatory itself was founded. The new astronomer royal observed, as might be expected, with instruments of a large radius nicely divided, and furnished with telescopic sights. One of those instruments was a large sector or sextant, constructed, as has been said, by a Mr. Abraham Sharp, the assistant to the astronomer royal, whose skill as a mathematician rendered him worthy of his situation, and we are told in Dr. R. Smith's Optics, that a quadrant, similar to those of Tycho Brahe and Hevelius, was fixed in the meridian by a solid wall, whence it was called a *mural arch*, and was, we understand, made by Flamsteed himself and his assistant.

Doctor Edward Halley, who had been fixed upon to go over to Dantzic in the year 1679, to settle the dispute between Doctor Hooke and Hevelius, which we have before mentioned, and who in the year 1713, succeeded Sir Hans Sloane as Secretary to the Royal Society, was appointed to the situation of astronomer royal, at the death of Flamsteed, in the year 1719, when he was nearly 65 years old, in which situation he continued 18 years. Doctor Smith says that Halley made use of a meridian telescope, and a pendulum clock for determining the right ascensions of the stars before the great mural arch by George Graham was made for the observatory; the telescope in question is particularly described (Smith's Optics, p. 321. and seq.) as having a transverse axis of an ell in length, and a tube of $5\frac{1}{2}$ feet, which had cross hairs in the eye-piece with proper adjustments, a frame with the Y supports, and a spirit level for levelling the axis; in short it was what is now denominated a transit instrument, and probably was the same which Evans mentions in his Tour as being still at Flamsteed house, with the telescope fixed near one end of the axis. Graham's great mural arch is also particularly described by the same author, which consists of iron bars firmly joined together, and a brass arc of 90°, divided by a beam compass, with a degree of accuracy that far exceeded any thing that had been before attempted. Besides the arc of 90°, there is another quadrantal arc divided into 96 equal parts, as a check on any inequality that might be supposed to exist in the graduated arc of 90°. The particulars of the construction of this instrument, of which the radius of one qudrantal arc was 96.85, and of the other 95.8 inches, together with the method of dividing the limb, and of making the centre work, &c. are treated of from page 332 to page 341 of Smith's Optics, in the latter part of which account it is said, that Sisson of the Strand made a similar mural arch for Colin Campbell, esq. to be used in Jamaica.

The micrometers at this time used, began to be differently constructed: Romer or Roëmer at Paris, who was contemporary with Flamsteed and Huygens, and who had a transit instrument in 1700, contrived a piece with ten squares, called a retia reticulum put in the body of a microscope, as we understand, where the focus of the eye-glass meets the magnified image, which squares were placed opposite the graduations of the divided limb of an instrument, and acted probably as a kind of Vernier. Huygens proposed parallel straight-edged brass plates to slide and to include the measured object between them; the distance of which plates was afterwards measured by a scale and compasses:—Cassini observed by four parallel hairs placed in the focus of the eye-piece, and made adjustable for collimation.—Before we part with Dr. Smith, whose book will long be admired, we beg leave to observe that he mistakes the name of the Vernier, which Graham's quadrant had, and mis-names it a Nonius, as various authors have done since, no doubt, on the strength of his authority. It was during the life of Dr. Halley that Mr. Roger Cotes contrived an equal altitude instrument to adjust the pendulum clock by, which sir Isaac Newton presented to Trinity college, Cambridge; this instrument consists of a telescope leaning on an inclined gibbet-piece, that revolves on an upright axis placed in pivot holes above and below, and kept perpendicular by a suspended fine plumb-line, which, revolving with the upright axis, detects its want of perpendicularity in any point of its revolution. This instrument, which does not seem to have come into general use, is likewise described by Dr. Smith (p. 327 to p. 331).

It was also during the presidency of Dr. Halley at Greenwich, that the first achromatic or colourless telescope was invented, though not generally used, nor even known by that name, till Mr. John Dollond afterwards took out a patent for the invention, and brought the execution of it to great perfection. So along ago as the year 1729, Chester More Hall esq. of More Hall, in Essex, considering the different humours of the eye, was led to infer, that they were so arranged as to correct the variable refrangibility of the different rays of light, which idea probably was suggested by sir Isaac Newton's experiments on optical glasses. He then conceived that if he could meet with transparent substances possessing the same peculiar properties as he supposed the humours of the eye to possess, he could make an object-glass that would unite all the colours in its focus. After several experiments with different kinds of glass, he succeeded, in the year 1733, in completing object-glasses of the desired construction, which bore an aperture of 2½ inches, with only a 20 inch tube; and we are informed that one of these original object-glasses is still in the possession of a clergyman of the name of Smith, who lives in Charlotte-street, Rathbone-place, which object-glass, on examination by several scientific gentlemen, has been found to possess the achromatic property; and in 1754, Mr. Ascough, optician on Ludgate-hill, was in possession of one of Mr. Hall's telescopes of the achromatic kind. Indeed, when it was allowed at the trial at Westminster Hall, respecting the patent for making achromatic telescopes, that Mr. Hall was the original inventor, lord Mansfield, who did not deny the proof of the fact, observed, that "it was not the person that locked up his invention in his scrutoire that ought to profit by a patent for such an invention, but he who brought it forth for the benefit of the public."

The same ideas respecting an object-glass had, it appears, occurred to the celebrated Euler and other foreigners, but no one is so clearly entitled to the honour of the invention as Mr. Hall, nor did any one succeed in practice so well as Dollond, who therefore was entitled to his portion of the honour of an improvement in optical instruments, which, together with the compound or achromatic eye-glass, has contributed very much to the nicety with which observations are made and read off by modern instruments of the different constructions.

Dr. Halley was succeeded by Dr. Bradley in the year 1741, for whom Graham made a sector of 10°, bearing a Vernier with a screw of adjustment, and a telescope with another Vernier separately moveable, (see *Plate* I. *fig.* 5.); the use of this instrument was to take the *difference* of the right ascension and declination of a planet or comet, and of a known star, and consequently the right ascension and declination of the wandering body itself, by a cheap and simple contrivance. The instrument turned on a long axis, and was so contrived, that both the bodies that were compared together, might be seen passing the micrometer of the telescope without altering the elevation more than 10°. Dr. Bradley, we find, was the inventor of the screw-micrometer, and also of a kind of triangular micrometer, adjustable by a circular motion given to it by a sectoral rack and endless screw, the use of which was to take declinations; but this second mechanism is not adopted in subsequent instruments. When the Royal Society made their annual visit to Dr. Bradley to inspect his instruments in 1748, he complained of wanting new ones; in consequence of which complaint, his majesty ordered 1000*l.* to be expended in furnishing a proper supply, which enabled the astronomer-royal to procure not only the sector we have just mentioned, but also a large mural arch of brass of eight feet radius made by Bird, which is now in use, and which is too well known to astronomers to need further notice till we come to the proper place for describing it particularly.

While these improvements were going on in the English instruments of observation, Peter Horrebow published a pamphlet, in 4to. called "Basis Astronomiæ, sive Astronomiæ Pars Mechanica," Hauniæ 1735, in which a *meridian circle* is described, to which was attached an optical tube with Romer's *reticulum* of ten squares for reading off the divisions on the limb, and which had been intended by the inventor for a quadrant. We find, notwithstanding this early notice of a circle, that La Caille made his catalogue of southern stars from observations made with a *sector* at the Cape of Good Hope between the years 1750 and 1754.

The English transit-instrument was by and bye made portable, and the improved modern manner of grinding the tube, that contains the spirits, on the interior surface, has rendered the bubble capable of indicating not only minutes of a degree by its run, but in many instances seconds; the manner also in which the cross and parallel hairs are enlightened by the reflection of light entering the end of the axis from a diagonal mirror placed in the body of the tube, renders the use very convenient at all elevations; and, lastly, the diagonal eye-piece for high altitudes, and a graduated circle with a spirit level at the end of the axis, to ascertain the elevations proper for given stars, together with the various other adjustments, leave little more to be expected, or even wished for, as an improvement of this instrument, notwithstanding the Society of Arts at the Adelphi have repeatedly advertised a reward, among their proposed annual premiums, for an *improvement* in the *portable transit-instrument.*

The invention of catoptric or reflecting telescopes may here also be mentioned among the improvements made in astronomical instruments. Mr. Short was probably the first who brought these to any degree of perfection, and his description of various circles united with a catoptric telescope, as described in the Philosophical Transactions of London in 1789, laid the foundation of the *equatorial instrument,* as afterwards improved by Ramsden, Nairne, and the Dollonds, about the year 1770 or soon after, (vide the Phil. Trans.

Tranf. 1771); fince which time the achromatic telefcope, being lighter, has had the preference, except for the purpofe of ftar-gazing, where the comparative brightnefs and magnitudes of the ftars are the principal objects of obfervation. Of this kind of inftruments Dr. Herfchel's far exceed in power any others that have been made.

With refpect to the comparative accuracy of the inftruments hitherto made for obfervatories, we beg leave to tranfcribe fir George Shuckburgh's words from his account of the equatorial inftrument, publifhed in the Philofophical Tranfactions of London in the year 1793, who fays "that from the time of Hipparchus and Ptolemy, before and at the commencement of the Chriftian æra, to the age of Walther and Copernicus, in the beginning of the 16th century, few obfervations can be depended on, to within lefs than 5, 8, or perhaps even 10 minutes; thofe of Tycho Brahe, indeed, that princely promoter of aftronomy, to within 1 minute. The errors of Hevelius's large fextant of fix feet radius, towards the middle of the laft (17th) century, might amount to 15 or 20 feconds; Flamftead's fextant, to 10 or 12 feconds; and laftly, thofe of Mr. Graham's mural quadrant of eight feet radius, with which Dr. Bradley made fo many obfervations from 1742, might amount to 7 or 8 feconds.

The *nautical* inftruments of obfervation hitherto made were, however, by no means well calculated for taking altitudes or angular diftances during the different motions of a fhip under way: the great difcovery that has proved moft permanently ufeful in a voyage, was that which pointed out the ufe of a *mirror* as attached to the limb of an inftrument. A metallic mirror was known to the ancient Greeks and Romans, and was made fometimes of filver, fometimes of a compofition of copper and tin ("ftanno & ære miftis," Plin. lib. xxxiii. cap. 9.) and fometimes of a polifhed opaque ftone, or of coloured glafs; and the knowledge of the reflecting property of glafs with a metal in contact with the back furface, if it was not known to the Sidonian mirror-makers mentioned by Pliny, when he fpeaks of glafs mirrors, was known to Alexander, the reputed author of the "Problemata;" for he exprefsly fays, "Διατι τα ὑελινα κα- [illegible] δ'αυτου η φυσις διαυγης, και τῃ ὑελῳ αναμιγνυμενη, λαμπρα ουτη, πλεον διαυγαζεται," &c. which may be tranflated thus: "Why do the glafs-mirrors fhine fo much? Becaufe they anoint them with tin, the nature of which partakes of a pellucid property, and being joined to, or mixed with, the glafs that is tranfparent, becomes more fhining," &c. We do not introduce this quotation for the fake of its reafoning, but to fhew that glafs mirrors coated with tin, were known when Alexander wrote the "Problemata," but whether it was Alexander Aphrodifias of the third century, or Alexander Trallianus of the fixth century according to others, we pretend not to determine; and that the art was preferved is clear from the writings of John Peckham, or Peccam, an Englifh Francifcan monk, who wrote his "Johannis Pifani Perfpectiva communis" in 1279, in which are mentioned various kinds of mirrors, and among others, fteel mirrors and mirrors of glafs, covered on the back with lead, which lead Vincentius Bellovacenfis fays (Specul. Natur. ii. 78. p. 129.) was poured over the glafs-plate while hot; fo that our amalgam of tin-foil and mercury is an improvement on the ancient method of making the mirror. The firft idea of ufing a mirror in a nautical inftrument, it fhould feem from Dr. Sprat's "Hiftory of the Royal Society," originated with Dr. Hooke, and, according to the doctor's pofthumous works, an inftrument of this kind was actually made for obfervations at fea, in which the eye faw at once two objects fituated at a diftance from each other, but brought together by reflection of one of them; in this inftrument, however, there was but one reflection, and it was not till fir Ifaac Newton took up the fubject, that an inftrument, fuch as is reprefented in *Plate* I. *fig.* 7, with two reflections was contrived, which conftruction this prince of mathematicians communicated to his friend Dr. Halley, in a paper that was found after the doctor's death by Mr. Jones, and given to the Royal Society of London, in whofe Philofophical Tranfactions it was publifhed in the year 1742. In the mean time John Hadley efquire, a friend of fir Ifaac Newton, had fomehow become acquainted with the fame principle of a double reflection, as had alfo Mr. Godfrey of Pennfylvania, both of which latter gentlemen have been honoured with the reputation of being the inventors of the reflecting octant, which bears the name of Hadley's quadrant, becaufe, though actually only the eighth part of a circle, it meafures 90° by reafon of the reflected ray having double the velocity of the incident ray, as coming from the obferved object. The peculiar advantage of Hadley's octant over all the preceding inftruments ufed at fea, confifts in its being capable of ufe during the toffing of a fhip under way; and the appendages of telefcopic fights, dark-glaffes to take off the glare of the fun, and a Vernier's fcale, have rendered it fo complete, that, when well made and perfectly divided, no better inftrument for taking altitudes at fea can reafonably be defired, particularly when a tangent-fcrew of adjuftment for quick and flow motions and a reading lens are fuperadded.

But excellent as Hadley's quadrant is for taking altitudes when divided in the beft manner, it is not competent to one very effential purpofe of nautical aftronomy: it will not meafure an angle of any kind of more than 90°. When the tables of the folar and lunar motions were prefented to the lords of the admiralty in the year 1755 by Tobias Mayer, of Gottingen, and when a reward of 3000*l.* was afterwards given by the Britifh parliament, to the celebrated author, the method of finding the longitude of a fhip or place by meafuring the moon's diftance from the fun or from a ftar, at firft fuggefted by Gemma Frifius, was now propofed to be put in practice; but this method required that angular diftances fhould be accurately meafured; we fay *accurately*, becaufe an error of *one minute* of fpace in taking an obfervation of the moon's diftance, which would not materially affect the determination of a latitude from an obferved altitude, will, at a mean rate of the moon's motion, produce an error of about 25′ in longitude, as afcertained by the lunar method, the moon and ftar being fuppofed to be both in or near the equator. Mayer, whofe anxiety to promote the lunar method muft have been equal to that of any other man, not excepting doctor Mafkelyne himfelf, who undertook the calculations of the Nautical Almanac for this purpofe, was well aware of the celebrity of the Englifh inftrument-makers, fuch as Bird, Ramfden, Sifion, Troughton, &c. and therefore contrived a new inftrument, which was made from his directions by Bird, to take angles of any magnitude within 160°, and with fuperior accuracy; this author very properly judged that there might be three principal caufes of inaccuracy in the ordinary octant, of whatever radius, notwithftanding they were divided by very fuperior workmen; one of which errors might be an inequality among the fubdivifions; a fecond, the want of exactitude in the total magnitude of the divided arc; and the third, an error in the meafure arifing out of the eccentricity of the point round which the index turned, as it regarded the graduated fector of the limb. Thefe three fources of error were to be guarded againft, but particularly the firft, in the conftruction of a new inftrument; our author's thor's idea was a happy one; he availed himſelf of all the ingenious contrivances that Hadley's octant poſſeſſed, extended its limb to a circle, agreeably to the original conſtruction of the aſtrolabe, and meaſured his angle many times over on different portions of the circumference; after which he divided the whole amount by the number of obſervations for the mean quantity of the obſerved angle, which method included the corrections for all the ſources of error to which he could conceive the octant liable. As we ſhall give a perſpective drawing of the original inſtrument made by Bird, and uſed by admiral Campbell, we ſhall defer our further remarks on it till we come to our particular deſcription.

Admiral Campbell, however, having found the repetition of his obſervations with a large and heavy inſtrument troubleſome, diſpenſed with the original principle, and having found, as he ſuppoſed, one-third part of the circle better divided than either of the other two, made uſe of that only for ſingle obſervations, and reported ſo favourably of his method of uſing the third part of a circle only, that ſextants on Hadley's principle came immediately into uſe inſtead of reflecting circles, from this peculiar circumſtance, which we here mention, becauſe it has been generally aſſerted, upon ſuppoſition only, that circles did not precede, but followed reflecting ſextants; even Dr. Mackay has fallen into this error, when he ſays that the circular inſtrument "was propoſed, with a view to correct the errors to which a ſextant is liable." (Theory and Practice of finding the Longitude, vol. i. p. 65.)

Chevalier de Borda, of Paris, ſoon noticed, among others, that the two indices of profeſſor Mayer's circle, which carried, one the central mirror, and the other the teleſcope and horizon-glaſs, required to be both moved in ſucceſſion at each obſervation, ſo as to render two operations indiſpenſable for aſcertaining one ſimple meaſure of an angle; after ſome conſideration, he hit upon an improvement, by means of which the double of any angle could be as readily meaſured as Mayer's ſingle angle, while yet the principle of the repetition with one reading off at laſt was retained, and the mean angle was aſcertained by dividing the whole amount by double the number of obſervations, ſuppoſing them to have been all double angles. This invention ſhortened the proceſs of repeating the obſervations, and will be alſo deſcribed at full length hereafter.

But Mayer's and Borda's reflecting and repeating circles were both ſubject to great inconvenience in uſe, partly from the tedioufneſs of aſcertaining the exact time, which the mean of all the obſervations was to be put down for, and partly from the unſteadineſs and other objections, occaſioned by two indices ſeparately moveable, and the frequent eſtimations by the eye of the coincidence of the direct and reflected objects at each obſervation; their principal property being to diminiſh the errors of diviſion of a bad inſtrument, and to render it capable of uſe, when it could not be depended on for taking a ſimple obſervation. It has fallen to the lot of Mr. Ed. Troughton, whoſe nautical and aſtronomical inſtruments are known, and highly valued all over the world on account of their accuracy, to make a very eſſential improvement on the foregoing reflecting circles, in 1796, without being ſubject to theſe and ſimilar objections, which will hereafter be mentioned; he has retained the principle of meaſuring an angle to the right and left of Zero, when the inſtrument is properly ſet, and inſtead of repeating the obſervation round the different portions of the limb, to do away the errors of eccentricity and of imperfect diviſions, he uſes three Verniers at 120° diſtance from each other, which ſeparately meaſure each a double angle; ſo that at one obſervation taken backward and forward, the average of ſix different ſextants is obtained without the leaſt trouble or liability to miſtake the inſtant of obſervation; for fixing one of the Verniers fixes them all till their meaſures are ſucceſſively read off, which may be an hour, or even many hours after the inſtant of the obſervation has been noted. The conſtruction and uſe of this very perfect inſtrument will be deſcribed more particularly in its place, which will be the more intereſting, as its powers and peculiarities have never been heretofore laid before the public in a regular deſcription.

About the year 1800, Joſeph de Mendoza Rios Eſq. F.R.S. the author of the collection of Nautical Tables, which we had occaſion to mention in reſpectful terms under our article CHRONOMETER, and who has for ſome time ſhewn a great deſire to promote the intereſts of navigation, (being himſelf a captain in the ſervice), invented an ingenious method of transferring the motions of both the indices of Borda's reflecting circle, into one reading by what he terms a *flying nonius*, or more properly ſpeaking, a *flying Vernier*, by means of which the velocity of repeating an angle with Borda's circle is doubled. This inſtrument is deſcribed in the Philoſophical Tranſactions of London for the year 1801. The conſtruction of Borda's circle, however, being unfit to receive the propoſed improvement, the thing was found not to anſwer in practice, but ſhews well enough the *principle*, which was at that time the chief deſign of the author. Subſequently to the above period, an union of the conceived principle with Troughton's conſtruction was found to anſwer a much better purpoſe; for by this union, not only is the repeating or multiplying property reſumed, but the alternate motion of the index is transformed into a continued motion, ſo that the whole amount of the croſſed obſervations is read off at laſt by two ſeparate Verniers. This being a great improvement of Mendoza's original reflecting circle, and not having been any where publiſhed, ſhall be deſcribed in its turn after Troughton's, to which it is a relative.

While theſe improvements have been going on in the fabrication of nautical inſtruments, correſponding improvements have alſo been made in inſtruments appropriated to obſervatories; the original circle, which had long ago been commuted for the aſtronomical quadrant, ſextant, or ſector, was again brought into uſe, and for the ſame reaſons that the nautical circle was revived after the aſtrolabe had been laid aſide. As it is our intention particularly to deſcribe in ſeparate ſections the principal circular inſtruments uſed in practical aſtronomy, as well as the principal nautical circles, it would be ſuperfluous to give here more than a brief hiſtorical notice of each.

We may go back to the year 1768, when Le Duc de Chaulnes publiſhed a work, which we ſuppoſe may have ſuggeſted to the Engliſh inſtrument-makers, ſome notion of the uſe of a microſcope and micrometer uſed in conjunction to read off the ſubdiviſions of the circular limb of a large inſtrument; the work is entitled, "Deſcription d'un Microſcope et de differens Micrometres deſtinés à meſurer des parties circulaires ou droites avec la plus grande preciſion, 1768, à Paris." We have not the work before us, and therefore are unable to ſtate, in what particulars the propoſed apparatus differed from that previouſly propoſed by Romer by the name of a *reticulum* or *reticule*. When the late Jeſſe Ramſden, whoſe eminence as an inſtrument-maker will never be forgotten, was applied to, about the year 1785, to make an inſtrument for meaſuring horizontal angles with more preciſion than the ordinary theodolite is capable of, he

adopted

adopted the plan of reading off by microſcopes the ſubdiviſions of his large circular inſtrument, which was uſed in the trigonometrical ſurvey, made for the purpoſe of meaſuring the linear diſtance from the two obſervatories of Greenwich and Paris, under the direction of general Roy.

Profeſſor Vince has deſcribed this inſtrument in his practical aſtronomy, (p. 170.) The line on the French ſide was meaſured by the help of a repeating inſtrument without reflection, contrived by the Chevalier de Borda, which we propoſe to deſcribe more fully preſently.

But Ramſden was not ſatisfied with applying the new method of reading off by microſcopes, which he could do repeatedly within the accuracy of *one ſecond* of ſpace, to horizontal angles only, but in a large circular inſtrument, which he finiſhed for Piazzi of Palermo in 1789, to be placed in his obſervatory, the ſame mode of meaſuring this very minute portion of a degree, was adopted with complete ſucceſs in a vertical circle, as will be ſeen in our ſubjoined account of this expenſive inſtrument.

Nor was Mr. Ramſden the only Engliſh maker of aſtronomical inſtruments, who has conſtructed aſtronomical *circles* or circular inſtruments, on the plan propoſed by the Duc de Chaulnes; Mr. Ed. Troughton, and Mr. Wm. Cary have ſucceded in ſimilar attempts, and we can venture to affirm, that their inſtruments have not been equalled in excellence, by thoſe of any foreign maker whatever; of the veracity of which aſſertion it will be conſidered as a ſufficient proof, that all the beſt obſervatories on the continent are furniſhed with Engliſh inſtruments, and chiefly if not entirely by thoſe three makers, including Berge, Mr. Ramſden's ſucceſſor, under his name.

Thus have we given ſuch a ſketch of the riſe and progreſs of aſtronomical and nautical inſtruments, particularly circles, as will enable the reader, we preſume, to appreciate the value of each improvement, and to underſtand the uſes and originality of the different parts of the inſtruments of which we have thought it right to ſubjoin appropriate deſcriptions.

The German reflecting and repeating Circle, *by Tobias Mayer of Gottingen.*

After having peruſed the Latin deſcription of the circle of Tobias Mayer, as publiſhed by him in his "Tabulæ Motuum Solis et Lunæ," Londini, 1770, and compared it with the inſtrument itſelf, (No. 9.) as originally made by Bird for the uſe of admiral Campbell, we found that the Author's plate and deſcription are defective, inaſmuch as ſome of the appendages found neceſſary by the maker are omitted; we therefore cauſed an original drawing to be taken in perſpective, which we now come to deſcribe, and to which we have put Mayer's original large letters of reference, and ſome of the ſmall ones as far as they would go; we propoſe alſo to deſcribe the parts of the inſtrument, and their uſes nearly in the ſame order in which their author has deſcribed them, that his ideas may be the better preſerved. *Fig.* 1. *of Plate* II. of *Aſtronomical inſtruments*, is a repreſentation of the inſtrument in an entire ſtate; in conſiſts principally of three parts with their appendages; namely, the graduated circle A, the radial bar C, and the teleſcope on the radial bar G; the inventor propoſed the circle to be of 8 inches radius, which we find is juſt 8.7 from the divided circle, and 9 to the circumference; this meaſure of 8 inches was fixed upon, becauſe it was ſuppoſed by Mayer that a larger would make the inſtrument too heavy, and that a ſmaller could not be divided accurately enough to guard againſt an error, in the meaſurement of a lunar diſtance of 3′, correſponding to about 1° 14′½ of determined longitude, notwithſtanding the addition of a vernier; a ſuppoſition which, our pocket box ſextants ſhew, was widely erroneous; as the inſtrument was intended to meaſure angles by reflection, like Hadley's octant, uſually called quadrant, it was at firſt propoſed that the whole limb of the circle ſhould be graduated into 720 parts inſtead of 360°, becauſe the reflecting inſtruments meaſure a whole degree by *halves* marked on their limbs, and figured as *wholes*, but Bird thought proper to put on only 360°, each of which is ſubdivided into *three*, and reads with a vernier of 20 ſpaces, covering 19 on the limb, ſo that the quantity read off requires to be doubled to bring it into exact degrees and minutes of reflected meaſurement. The centre work is ſimilar to that of Hadley's quadrant, except that the radial bars C and G, to each of which a vernier is put at *h* and *k* reſpectively, move ſeparately. The bar G grows wide enough before it comes to *g* to admit a large circular hole, the centre of which is properly its centre of motion; which is alſo the caſe with the bar C: the bar G prolonged beyond the centre a little way carries a ſquare piece of ground and poliſhed glaſs *b*, of which the lower half is ſilvered and kept faſt in a little braſs frame, adjuſtable for perpendicularity by ſcrews below; on the ſame bar is alſo carried the teleſcope B, in two pair of jointed little ſupports *f* and *f* ſcrewed to the bar G, ſo moveable like an ordinary parallel ruler, in a longitudinal direction, that when the ſaid jointed ſupports are perpendicular to the plane of the bar G, no part of the glaſs *b* can be ſeen, but the part which is not ſilvered; but when the teleſcope is puſhed nearer to or drawn further from the ſaid glaſs, the line of collimation of the teleſcope approaches the bar G, and its field of view takes in alſo the ſilvered portion of the ſmall-glaſs; and thus any portion or nearly the whole of this glaſs may be readily taken in by the eye at the end of the teleſcope. This contrivance was not in the original ſketch, but was no doubt added by the maker, and has another convenience beſides its uſe in the adjuſtment juſt mentioned, which is, that by the teleſcope's approaching the bar G when puſhed forwards, a more ſhallow box will ſuffice for packing the inſtrument than muſt neceſſarily have been uſed if no ſuch motion of the ſupports *f* and *f* had been there. In the focus of the eye-piece there are three fine wires, two parallel at ſome diſtance on each ſide of the centre of the field of view, and one at right angles to the other two cutting the exact centre; the tube is 10 inches long, and the magnifying power juſt *four*, with a field of view of 2° 15′; the object glaſs is of the achromatic kind, and the eye-glaſs being a ſingle lens inverts the object, which is of no conſequence in celeſtial obſervations.

The radial bar C which carries the index *k* has the large central mirror attached to it, and has adjuſtable ſcrews for perpendicularity like thoſe of glaſs *b*, and is in every reſpect like the index bar of a Hadley's quadrant; it is placed above the plane of the bar G, and, as has been ſaid, moves ſeparately from the teleſcope. The piece *d* near K is a holding piece of metal claſping the limb in ſuch a way, that, when its fixing ſcrew, the head of which is a milled nut at *d*, is faſt, it fixes the bar C immoveably, by means of the tangent ſcrew *i i* which is tapped into a little ball at the outer end of this bar. The tangent ſcrew has two milled nuts as heads at its oppoſite end, by either of which it may be turned, as convenience may require, and, when the piece *d* is ſcrewed faſt to the limb, the tangent-ſcrew is moreover uſed to adjuſt the bar C and its mirror, till the real object, and object by reflection exactly coincide: at the end of the bar G, under the eye piece of the teleſcope, is a ſimilar tangent ſcrew and fixing apparatus, the whole of which cannot be ſeen in the figure; but when the reader is told

told that the milled nut at *e*, is exactly similar to the one which has been described at *d*, the portion out of sight will easily be apprehended; there is however a second fixing screw below, as well as the one *e* above, which may sometimes be more convenient to use, or which for the sake of greater security may be used along with the other. *Fig.* 2. is a dark glass in a frame which may be placed, when the sun is one of the observed objects, parallel and near to the mirror *c* by its cross *n*, the edges of which are sloped, sliding into a corresponding groove behind the mirror *c* among the screws of adjustment; this coloured glass is for the reflected sun, and turns on a horizontal joint at *o*, and therefore may at any time be turned aside, without being removed from the groove, and lest the deepness of the colour of one glass should not suit under all circumstances, a second and a third, each of a shade lighter colour, and in frames exactly similar to *fig.* 2. may be put on instead, one of which has moreover a vertical joint near the horizontal one, by which it may be turned back entirely out of sight of the telescope. Besides these dark glasses, there is one in a small tube which slips over the eye-piece of the telescope, and guards the eye from the sun's rays when seen by direct vision. *Fig.* 3. is a microscope borne by a clamp of ivory with a spring below at P, which slips upon the limb at any point of it, and assists in reading the coincidence of the vernier with some dividing line on the limb; there is one to each vernier; these microscopes would have been better placed on the bar C, that carries the vernier, if the reading had been wanted at every observation, but as the reading is only required to be made once, after half a dozen observations successively made, it was thought better to have them detached. The circle is made firm by six radial arms braced below by long bars screwed edgewise to their inferior planes, by screws going from above, some of the heads of which are seen. As a support for this instrument, a long tube of brass of great strength is screwed into a thick plate, borne by a heavy ring, attached to the interior ends of the cross arms; this long support has a ball E and socket, which allow the plane of the instrument to be elevated to any angle with the horizontal line, and which fix the position by being tightened with a vertical screw within the tube carrying a cup of pressure that is raised as the screw is turned; the screw has also a small wheel attached to it which is actuated by an horizontal endless screw, bearing the ring F by which it is turned, so that one turn of the ring F moves the wheel within the tube the space of one tooth, and as the thick arbour of the wheel is that which has the vertical screw on its circumference, and carries the cup of pressure, it is not difficult to conceive that the ball may be loosened or fixed in the socket, accordingly as the ring F is turned forwards or backwards by hand.—The inventor intended a staff to bear on the ground, but Bird preferred a belt for the end to rest on like a standard belt, and the tube contains a stick that will draw out and fix at any convenient length to go into a hole in the belt.

In Hadley's quadrant there is an adjustment to be made for the parallelism of the two mirrors, when the point *o* of the vernier is at *o* on the limb; this adjustment is here not necessarily on any particular degree on the limb; but, what seems to be a condition in this instrument, the two mirrors are required to be put parallel, when the two verniers are so far removed from each other, as to include between them the greatest angle that is ever intended to be measured by them, a degree or two over or under does not at all affect the operations; on examining the instrument at present under our eye, we find 73° 38′ contained between the points of commencement in each vernier, so that the actual measure of this angle, when the object has suffered two reflections, will be 147° 16′, which is the greatest angle that the instrument will measure in its present state, as the points *o* and *o* of the two verniers coincide when the bars C and G are in contact, one of the verniers being an interior, and the other an exterior one. In our figure the distance between the verniers is 60 full divisions, or 120°, which our draftsman thought was a good position for exhibiting all the different parts of the instrument, consequently the mirrors are not parallel in their present position, but will become so when the telescope is carried forwards, in the order of the figures, till its vernier indicates 73° 38′ on the limb, which quantity we have said measures 147° 16′.

The mode of using this instrument may be explained thus:—Let the mirrors be placed parallel in the first place, while the vernier *k* of the arm C rests fixed at *o*, or 360° on the limb, which may be done most accurately by moving the telescope and its vernier first to 73° 38′ nearly, and fixing it, and then by making the sun, moon or star, the last of which is best, as seen by reflection, exactly to coincide with the same as seen through the unsilvered part of the glass by direct vision, and there fix it by the screw *e*; and if the two mirrors are so adjusted, as to be perpendicular to the plane of the instrument, the real body and its image will not be at one side of one another, either perpendicularly or horizontally; but if they should be so, the mirrors must be set right by the adjusting screws, and then the instrument will be fit for taking an observation; we will suppose that the angular distance between some known star and the moon be required to be ascertained; in this case the lower end of the support D is made to rest in one of the holes of the belt, and the ball is so adjusted in the socket, that the plane of the instrument may pass through both the objects; in this situation the right hand body is viewed through the telescope, and the vernier *k* being set at liberty, the bar C is brought by an uniformly slow motion towards the telescope so far, that the object seen by reflection, when followed by a proper motion of the body, and of the entire instrument, comes very nearly in contact with the second body seen by direct vision, there the screw *d* must fix the bar C and its vernier, which are now moved, the remaining quantity backward or forward by the tangent-screw *i i*, till one of the moon's limbs and the star are in exact contact; these two operations of fixing the mirrors parallel, and of effecting the contact of the two bodies afterwards, constitute what is called a *single observation*, and if the vernier *k* were now examined, the angle indicated, which we will suppose to be 30° 0′, would be half of the true distance, as the instrument is graduated, if the graduation were perfect; but if Mayer's supposition be allowed, that there is a possibility of an error of 3′ plus or minus in this single observation from imperfect graduation, then such single observation ought not to be depended upon; the same process is consequently repeated, that is, the vernier *l* remaining fixed as at first, and the time being noted of the instant of the first contact, the telescope is again made to advance, till the mirrors are parallel, as examined by a star's coincidence with its reflected image, and is then fixed by the screw *e*, the tangent-screw being again used if necessary for the exactitude of the coincidence, which is the first operation of the second observation; in the next place, the bar C, with its large mirror and vernier *k*, is again carried slowly and uniformly, as before described, till a second contact of the star with the same limb of the moon is effected, and then this bar is again fixed as before, and the tangent-screw completes the exactness of the contact, which is called the second operation of the *second observation*, which observation is here completed, as soon as the

instant

inftant of the contact is noted down; now fhould the angle be read off by the vernier *k*, it will indicate 60°, or a meafure of 120°; but fuppofe a pofitive error of 3′ to exift, the amount of two obferved angular diftances will on this fuppofition be 120° 3′, which, divided by 2, the number of obfervations, will make the angle 60° 1′ 30″, inftead of 60° 3′, which it would have been with the fame error in one obfervation; hence two obfervations diminifh the error of graduation one half; but fix repetitions of the two operations, *i. e.* fix obfervations will diminifh the faid original error fix times, and reduce it to 30″, which is the advantage peculiar to the inftrument: whenever it is found beft to view the left hand body, and to carry its image to the left hand body, the vernier *k* muft be fixed at Zero, and the telefcope muft be moved, and vernier *h* ufed in reading the angle, which is juft the reverfe of the motion defcribed. When any number of obfervations is fixed upon to be taken, the times of contact muft as often be noted down, and then the mean time is taken as the inftant of contact correfponding to the mean angular diftance, which is obtained by dividing the total arc paffed through, as read off at laft, by the number of obfervations or contacts; the readings of all the intermediate obfervations being of no importance, otherwife than as we have ufed them to explain the effect of the repeating procefs. It may be neceffary to obferve, that all the obfervations of a ftar's angular diftance from the moon, fhould be completed within half an hour, or at moft an hour, otherwife the inequality of the moon's hourly motion muft neceffarily be taken into the account, which would be a troublefome correction. By this method of diminifhing the errors of graduation, by a repetition of the obfervations taken all round the circular limb, it is eafy to fee that an error of one whole degree may be reduced to a minute at fixty repetitions, whatever may be the magnitude of the obferved angle.

Hitherto we have fuppofed angular diftances only neceffary to be meafured by this inftrument, for doing which indeed it was originally invented, but altitudes may be taken quite as well, and with the fame advantage, for the ball will turn in the focket, fo as to give a vertical pofition to the plane of the circle, or it may be held without the fupport like a quadrant, and the contact of a heavenly body with the horizon is made, as well as with the moon's limb, after the firft operation of placing the mirrors parallel has been performed; likewife a repetition of the obfervations may be carried to any number; but as the variation in the altitude of any body is not fo regular as the variation in the angular diftance between two bodies, a repetition of the altitudes with the correfponding times, unlefs made in rapid fucceffion, will not give a mean altitude with its correfponding time, and as the meridian or greateft altitude is that which is moft frequently wanted in navigation, for the fake of the fimplicity of the fubfequent calculation of the latitude thereby, the mean of a number of altitudes before and after apparent noon, will give the greateft or true meridian altitude too little. In the defcription which we have fo far given of Mayer's circle, and of its ufe, we have confined ourfelves to the reading of the vernier *k*, which indeed was all that admiral Campbell ufed, but it is evident that the vernier *h* may alfo be ufed with advantage, for the diftance between the verniers is a conftant angle, in this inftrument, of 73° 38′, or rather of its double, 147° 16′, and the reading may as well be made by this vernier as the other, if this conftant angle be fubtracted from the angle indicated; for the fake of greater accuracy therefore, it is advifable to read the whole amount of the repeated angles, from both verniers, as the author intended, and then having deducted the conftant angle from the latter reading, they ought to agree in quantity, but if there is any difference, the mean between the two muft be taken, as the true amount to be divided by the number of obfervations, and the mean angle thus obtained will be afcertained as it were by two feparate inftruments, both ufed on the repeating principle. Befides the inftrument before us, there were others made, particularly one for captain, afterwards lord Howe, but we have not been informed whether, like admiral Campbell, he compromifed the repeating principle for the beft fextant of the circular limb, to be ufed as a Hadley's fextant, or whether he perfevered in ufing it according to the original intention, notwithftanding the inconvenience of the operations during the repetitions.

The inftrument at prefent before us, we obferve, has been divided by bifections, and not by an engine, as is now the cuftom in dividing inftruments of fmall radius, for the occult dividing dots and bifections are ftill vifible by a magnifying glafs in the original circle within the graduations transferred therefrom, that are intended to be permanent: on examining the limb all round with a microfcope, by the two verniers, and alfo by examining the included conftant angle on different portions of the circle, we have not detected more than a minute of error in the graduations, fo that had Mayer been aware of fuch accuracy in the divifions inferted by a beam compafs, he probably would never have fet about his contrivance, which was invented on a fuppofition that there muft exift an error of at leaft 3′, which he propofed to diminifh to 30″ by fix repetitions of an obfervation of the moon's angular diftance from the fun, or a known ftar. The errors which we detected lie chiefly in the femicircle numbered from 180 to 360; in the firft third part of the degree 181, there is about 1′ too much, which is the cafe with one of the third parts of both 264 and 277; but as the contiguous fubdivifions are proportionably too fmall, the errors are corrected within the degree fpace, alfo the degree 279 has a third part too fmall by 1′, which is given to its contiguous fubdivifions. The dividing lines on the limb are thicker than neceffary, we think, and meafure more than a minute each, fo that the greateft error does not exceed the thicknefs of the dividing ftroke on any part of the whole limb.

The verniers too have each of them one fpace larger than the reft by about half of a minute, and what is fomewhat remarkable, it is one of the end ones in both that is too large; but in both the whole length of the fcale of 20 is exactly proportioned to the 19 thirds of a double degree, when compared all round the limb, except in the particular degree fpaces which we have above noticed, and fome few others where the error is within a minute.

It may be proper to mention, before we difmifs this account, that there is a contrivance in the inftrument we are defcribing, introduced by Bird, for giving the large central mirror a circular motion on the arm C, by means of a fide fcrew *o o* actuating the circular piece of metal *p* which bears the mirror, and which has very fine concave indentations, like thofe of a milled head, on its circumference; but as this motion, which was originally intended to adjuft for the exact quantity of the conftant angle contained between the verniers when the mirrors are parallel, is calculated to render the large mirror unfteady, we confider the addition as being of no real fervice, but on the contrary rather detrimental, provided the central mirror be placed in fuch an angle at firft, with refpect to the radial line of bar C as will allow the inftrument to meafure an angle fufficiently large for the purpofe required. We have adjufted the conftant angle to exactly 75 large divifions, or 150°, in which ftate it is now fixed and fuffered to remain, as being more convenient than an angle confifting of degrees and minutes.

 The

The inventor propofed a kind of metallic gage by which to fix the conftant angle, when once afcertained, without an operation for determining by a heavenly body the exact parallelifm of the two mirrors, but the inftrument-maker knowing that no gage could be depended upon in all degrees of temperature, did not make it a part of the appendages.

The French reflecting and repeating CIRCLE, *by the Chevalier de Borda of Paris.*

In the year 1787, the Chevalier de Borda, publifhed at Paris a pamphlet entitled "Defcription et Ufage du Cercle de Reflexion," in which is contained a particular account of his improvement on Mayer's circle, together with the ufes of a circle of his improved conftruction, and the dimenfions of its different parts, which had occupied him twelve years in perfecting. The objections which he ftated to the ufe of Mayer's circle were; that one obfervation required two operations; that the adjuftment for the parallelifm of the two mirrors was ufually made by viewing the horizon at fea, and was very often productive of error, on account of the direct and reflected line being difficult to bring into exact coincidence; that a repetition of this kind of verification is very tedious in practice; that it is difficult to make a circle fo exact, but that the parallelifm of the central mirror, in refpect of perpendicularity to the plane of the circle, fhall have a deviation in different parts of the limb, when the parallelifm with refpect to the horizontal pofitions of the two mirrors is well adjufted; and laftly, that a great number of fingle angles thus meafured by double operations, is very embarraffing to feamen. For thefe reafons, which were all real objections, the Chevalier contrived his reflecting circle, that, in the firft place, entirely difpenfed with the adjuftment for the parallelifm of the mirrors; that in the next place meafured two angles at two operations, after the inftrument was previoufly fet for parallelifm and to zero; and laftly, that was capable of being ufed on the repeating principle as well as Mayer's inftrument.

We have been fo fortunate as to gain a temporary poffeffion of one of Borda's reflecting circles made by Lenoir of Paris, of which we have had an original perfpective drawing taken, fuch as we flatter ourfelves will be readily apprehended by thofe readers, who have perufed our account of Mayer's with attention.—*Fig.* 4. *of Plate* II. *of Aftronomical Inftruments*, reprefents Borda's improved reflecting circle, No. 56, nearly in the fame pofition as Mayer's which is placed over it, and confifts of the fame parts fomewhat differently made and placed with refpect to each other; we have therefore put the fame letters of reference to both, which will enable us to fhorten our defcription of the prefent inftrument, as well as affift the reader where to find the parts referred to.

The circle A in this inftrument is much fmaller than in the preceding one, being only 5.3 inches radius from the graduated circle of the limb, and is therefore fufficiently portable by the fhort handle D, without a ball and focket or belt; it is divided into 720 larger divifions, which by reafon of the reflection of the mirror at the centre are read off as fo many degrees; and each of thefe divifions, which in future we fhall confider as degrees, are fubdived into three fmaller fpaces of 20′ each; two verniers *k* and *h*, of 20 fpaces each, on the ends of the bars C and G, refpectively, cover juft 19 of the faid fubdivifions of the limb, as is the cafe with Mayer's, from which it differs no otherwife, than as the degrees are here fingle degrees juft as they are meafured by reflection. The limb appears to be engine-divided; for we cannot difcover any original dots or bifections of a beam-compafs. The telefcope carried by the bar G is fhorter than Mayer's, and the fmall glafs *b*, half filvered and half plain, is removed from the centre to as near the circumference of the circle as can be with convenience, which pofition requires the bar G to be prolonged quite acrofs the circle, to the plane of which it is held clofe by an attached piece behind the fmall glafs, which goes under the extreme edge of the circle. This fituation of the fmall glafs conftitutes the principal improvement in this inftrument, fimple as the caufe may appear at firft fight; for an incident ray of light may now be received by the large central mirror, from either the right or the left hand fide of the fmall glafs, which glafs together with its frame, according to Mayer's conftruction intercepted the light coming from the left, and allowed only the light coming from the right to fall on the central mirror; and it is owing to this circumftance that Mayer's circle is capable of meafuring only a fingle angle at two operations, as we have defcribed, whereas Borda's circle will meafure a double one with equal eafe and expedition, as will be explained prefently. The telefcope B in this inftrument is borne by two cocks *f f* fcrewed to the bar G out of fight; thefe cocks have each an oblong aperture contiguous to the 24 dividing lines figured from *o* in the middle to 12 both up and down, which divifions are indicated by a line, marked on the folid piece of brafs which flides in the aperture of each cock, and is tapped to receive the thread of the fcrew *l f*, the head *l* of which is a milled nut over each cock, the fliding pieces bearing the lines of indication are faft to the tube of the telefcope, which therefore they fupport; the line of fight may be adjufted by thefe fcrews, not only to be parallel to the plane of the circle, but to a point at any height in the glafs *b*, borne by the bar G, either in the plane or filvered part of its furface. This mechanifm therefore is inftead of the jointed frames *f f* in Mayer's circle.—There are three pairs of dark glaffes *m*, fuch as are feen at *m* in *fig.* 5. varying in their fhades of colour; any pair of which may be ufed as circumftances may require; one of each pair is fixed in a focket by a thumb fcrew at *m*, and the other at *n*, when the angle to be meafured is pretty large; but as the frame of the glafs at *n* will intercept the incident ray, when a fmall angle between 5° 20′ and 34° to the left is meafured; another fet of dark glaffes *o*, *fig.* 5, may be fubftituted for thofe at *n*, to be fixed clofe to the mirror of the bar C, by the two thumb-fcrews, which appear contiguous to this central mirror at *o* in *fig.* 4. When a pair of the dark glaffes *m* are ufed, they muft both be of fimilar fhades of colour, that the coloured rays of reflection, and thofe of direct vifion may require the fame focal adjuftment of the eye glafs of the telefcope; but as the rays incident on the central mirror, have to pafs twice through the dark glaffes *o*, when any one of them is ufed, thefe glaffes are only of half as deep a fhade of colour as their refpective correfponding ones *m* are; the double paffage producing the effect of doubling the fhade of colour. If the glaffes *m* were placed exactly parallel to the glafs *b*, there would be a fecond reflection of the image of any object, viewed through the telefcope, and feen through the unfilvered or upper part of this glafs; to prevent which effect, the dark glaffes ftand inclined in a fmall angle from true parallelifm, with refpect to the glafs *b*, which pofition deflects the fuperfluous faint image we have juft mentioned, and prevents its entering the object end of the telefcope.

The telefcope itfelf is fix inches long and magnifies three times, with a field of view of 5° 40′, of which the quantity contained between the parallel hairs or wires of the eyepiece, is exactly 2°; it is not of the achromatic kind, and inverts the object: the glaffes are a fingle object glafs, an amplifier,

amplifier, and a single plano-convex lens as an eye-glass; the two last are put in the opposite ends of an interior tube, which contains the two parallel wires; so that the wires may be placed either horizontally or vertically by turning this interior tube a quarter round.

The clamps for the verniers of this instrument appear to be each consisting of one piece, as seen in *fig.* 4, but as they are more steady than those of Mayer's instrument, we have thought it might be acceptable to the reader to have a view of the parts of the mechanism shown separately, which, therefore, we have done in *fig.* 6. The piece *a f*, which has the vernier scale on it, is screwed by four small screws, the heads of which are seen upon the forked end of the bar C, and has an oblong slit through it at *a*; *b c i* is the tangent-screw, with the milled head *i*, tapped with a detached piece *b*, which carries an oblong spring under and parallel to the axis of the screw, to cover the oblong hole *a*, and to create some friction so as to produce steadiness of motion in the piece *b*, when the screw turns; at *e* is another piece attached to the axis of the screw, in such a way that it will not slide along it by either a backward or a forward motion, but yet will allow the axis of the screw to revolve; this piece *e* is inserted into a hole *f* in the vernier piece, and kept fast by a screw underneath, not seen; and *b* has also its projecting part inserted into the oblong aperture *a*, and is attached at its lower extremity to the piece *c c*, by a screw entering below this piece *c c*, so that the tangent-screw will move the piece *c c* along with the piece *b*, as far as the aperture *a* will allow the projecting piece of *b* to move, the screw itself in the mean time keeping its position on the vernier piece *a f*; the piece *c c* has a square sided oblong groove on its inferior surface, a section of which may be seen near the right hand *c*; into this groove the cross piece *g h* is bedded, which carries the transverse spring *h* on its end, and the fixing screw *d* entering into the left-hand hole of *c c*, which is tapped, fixes the pieces *c c* and *g h* close together, when the screw is turned one way about, but allows them to separate when turned the other way; the piece *b*, therefore, the piece *c c*, and the piece *g h*, together with the screw *d*, are all moveable as one piece along the aperture *a* by the tangent-screw *i*, while the piece *a f* of the vernier remains fixed to the bar C; but if the compound piece *b*, *c c*, and *g h*, be made fast to the limb, which is interposed between the end *h* of the piece *g h* below C, and the vernier piece *a f*, then the tangent-screw *i* will be obliged to move, and will carry the vernier with it, which is actually the case in taking an observation, when the fixing screw *d* has fixed the said compound piece, which altogether may be called the clamping piece, while the exactitude of a coincidence is finally effected by the slow motion of the tangent-screw. The other vernier on the arm G differs from this in its mechanism for clamping, no otherwise than as the bar G has only one prong of the fork to attach the vernier to.

Fig. 7 is a piece of thin brass, made black on both surfaces, called a *ventelle*, which has a small triangular hole through it, and which fits the socket *m* behind the glass *b* in *fig.* 4, to limit the quantity of light admitted directly through the unsilvered part of the glass, which it will regulate by sliding up and down the socket; it is chiefly used for terrestrial objects, to make the image as distinct as the object itself, which is an advantage not possessed by Mayer's circle. *Fig.* 8 is a bent piece of brass equal in height to the centre of the central mirror from the plane of the circle; there are two of those pieces which are called *viseurs*, and which are placed at diametrically opposite sides of the plane of the limb for examining the perpendicularity of the index mirror, the height of one viseur, seen by reflection, being compared to the height of the other seen directly. These pieces may be considered as superfluous, because the extreme edge of the limb itself, seen both by reflection and direct vision, will do as well, and with less trouble in the usual way. *Fig.* 9 is a key with a milled nut at one end, and a square hole at the other for receiving the square ends of the screws which verify the mirrors.

We have said that Borda's circle will measure the double of an angular distance, contained between two terrestrial or celestial bodies; it now remains for us to explain the manner in which this is done. On examination, we find that the constant angle contained between the verniers, when the mirrors are exactly parallel, is $167° 35'$ in the instrument before us; instead of looking at the right hand object, and of bringing the index *k* of bar C towards vernier *h* of bar G, or telescope, in taking an observation, (which would be the mode if a single angle only were wanted to be ascertained,) when the vernier *k* is at zero, the telescope, according to Borda's method, must be directed in the first place to the left hand object, which must have its image brought to coincide with the right hand object seen directly, by carrying the telescope outward from the vernier *k*, which operation will enlarge the constant angle of $167° 35'$, by the quantity of the simple angle to be ascertained; suppose this to be $30°$, then $197° 35'$ will be the distance of the verniers when the image of the left hand body is in contact with the real body to the right; this we call the first operation, by which the simple angle might be obtained by subtracting the constant angle from the angle now indicated by the vernier of the telescope, but such notice is disregarded as not being necessary; the telescope, being now clamped to the limb by the fixing screw, while the contact remains perfect, the bar C of vernier *k* is next moved by the second operation toward the telescope, which carries the image back again to the original situation, where, if the motion of the vernier *k* were stopped, the glasses would be again parallel, and the index of bar C would show $30°$, on our former supposition; but instead of stopping here the vernier *k* crosses the point of parallelism, and diminishes the constant angle by approaching the telescope, till the image of the right hand object is found in contact in its turn with the left hand body; in this situation the vernier *k* has measured the observed angle twice over, and will be found to stand at $60°$; for, first, the former contact effected by moving the telescope, in the first instance, is undone, by placing the objects in their original situation, as the vernier *k* passes the point of parallelism in moving from the right of that point, and, secondly, a new contact is made, by taking the image of the other object, and carrying it to the left hand side of the point of parallelism, hence the whole of the two operations is called the *crossed observation*, and takes in the angle twice over; once to the right and once to the left of the parallelism of the two mirrors. From this account of the crossed observation, it is easy to conceive, that it is of no importance to fix the mirrors parallel in the middle of it, because if there were an error of a minute, or even of a degree, in adjusting for parallelism at the middle of this double angle, plus or minus, the second half of the said double angle would be just as much wrong in the opposite extreme, that is, would afford an exact correction; hence there is no need of waiting for adjustment of parallelism at all; but the index may be made to pass the point of parallelism in a crossed observation without the least notice taken of it, which is the peculiar advantage of this instrument. During this explanation of the principle of Borda's circle for measuring double angles, we have said nothing of the repeating principle; but the process we have described may be repeated any number of times,

times, and the amount, as in Mayer's circle, may be read off at once on vernier k, or on vernier h, diminished by the constant included angle, which, in the present instrument, we have said is 167° 35′; or what is still better, a mean of both may be taken, to be divided by double the number of crossed observations, and the quotient will be the true corrected angle resulting from the different observations.

This method is, however, adapted more particularly to terrestrial objects, where it is generally a matter of indifference which of the two objects has its reflected image carried to the other object, so far as relates to the distinctness of the image; but in celestial observations, for which the instrument was more particularly intended, it is well known to practical astronomers, that it is preferable to bring the reflected image of the more luminous body into contact with the less luminous body seen directly, whether the former be situated to the right or left of the other; it is also equally well known, that to effect this purpose, even with a Hadley's sextant or octant, the plane of the instrument must frequently be turned towards the ground, in order to catch that body to the left which would be caught to the right, if the same plane were towards the sky; hence, the reflecting circle must have its position also inverted, by being turned over on the telescope as an axis half round, in one of the alternate operations; for, to have the advantage of a luminous reflected image, it is necessary that either the leading or following operation of a crossed observation should place the instrument in the inverted position, as the case may require; the result, however, is the same, whether the inversion be used or not, when both the image of the first, and the real body of the second object are both sufficiently distinct in the field of view of the telescope. It may appear at first sight, that, because inversion makes a motion of either vernier from the right become a motion from the left, that the reading of the limb will thereby be affected; but when it is considered that the figures of the limb itself are reversed by inversion, no difference will be found to take place; for provided, for instance, the vernier k at Zero be brought towards the telescope at the point of parallelism by a motion from the right, when the divisions are above, and from the left, when the divisions are below, facing the ground, when a horizontal angle is measured, in both cases the effect is a lessening of the angle included between the two verniers, the quantity of which is read by that vernier which has been moved. If, therefore, the object to the left be the brighter object of the two, the first or preparatory operation, in which the vernier of the telescope moves, and in which the image comes from the left hand object, must be performed with the graduated face upward, and must be the second operation, where vernier k moves after inversion, or with the same face down; but if the right hand object be the more luminous, the inversion must take place in the first instance, and the subsequent portion of the crossed observation must be performed with the divisions and scales upwards; a little practice is all that is necessary to render this process familiar, whenever both the objects are sufficiently distinct. The adjustments for perpendicularity of the mirrors are the same as in Mayer's, and the principal objections to the present construction will be stated in our account of the English reflecting circle, that owes its origin to those objections; which, therefore, we shall describe the next, though out of its order of time.

There is, however, an adjustment of the index-mirror mentioned by Borda, which, we think, is worthy of observation here, as it is an adjustment probably too much neglected by many makers of octants and sextants, to which instruments it is equally applicable, and as it is of importance in directing the maker's choice of a proper mirror. The adjustment is that which detects the want of uniformity in the thickness of the silvered glass that composes the mirror at the centre, which is essential to be noticed, for if the slip of glass is thicker at one end than at the other, it will form a kind of prism, and a deflection of the rays of light will take place, more or less, in their second passage from the back or reflecting surface of the glass, which deflection may be plus or minus with respect to the true reflected angle, accordingly as the thick end of the mirror is contiguous to or remote from the end of the telescope. Let us call the end of the silvered slip of glass next the telescope a, and its opposite end b, then the uniformity of the glass composing the mirror, in regard to its thickness at the respective ends, is thus proposed to be ascertained.

When the two mirrors are made both parallel to the plane of the limb, measure a large horizontal angle of about 120°, as contained between two remote and distinct terrestrial objects by a series of crossed observations, and mark down an accurate mean for the true angle, when the end a of the mirror is towards the telescope; then take the mirror carefully out of its frame, (we are here addressing ourselves to the maker) and place it again with the end b towards the telescope, and examine that both the mirrors be again perpendicular to the plane of the limb as before, which they must be before a second series of crossed observations, similar both in kind and number to the former series, be taken; take now the mean of the second series, and note it down also, and the difference between those two means, if nicely obtained, will be double the error of undue refrangibility of the glass of which the index-mirror is composed, half of which must be allowed for in every observation taken with the instrument with the said mirror; but as the error is proportionable to the angle observed, the quantity of it to be applied depends on the said angle, and is a variable quantity; for ascertaining which, under different circumstances, Borda has given a table in his pamphlet, which may be used with advantage, where great accuracy is required, and when the error in question is considerable; but we should recommend in preference that a more perfect mirror be substituted in this case, such as may be found on trial to require no correction, which the best instrument-makers will always take care to do. In the same pamphlet are contained various other useful tables, one of which, in particular, must be necessary, when meridian altitudes are taken by a series of crossed observations, inasmuch as it gives the variations of altitudes a little before and after the meridian passages of the heavenly bodies, and, consequently, assists in ascertaining the greatest altitudes, which a mean of the observations taken before and after the meridian passage would not of itself give truly. There is also another table of corrections for a deviation of the plane, in which the contact is observed, which may sometimes be necessary, but it is better that the due rectification of the two mirrors should supersede the use of this table also.

The English reflecting Circle, *by Troughton of London.*

We come now to treat of the reflecting circle as an English instrument, for as Bird, in constructing the first, gave it no distinguishing feature, it must hitherto be considered as a foreign production. Our countryman Troughton had formerly much experience in making the circle of Borda, and had marked with attention the inaccuracy and inconvenience of that construction; nay, had long turned his mind towards

towards its improvement before in the year 1796 he produced his first specimen.

The scientific men, and instrument makers of France, have long gone hand in hand in improving and recommending the circle of Borda; almost indeed to the total exclusion of the octant and sextant in the maritime service of that country; but the success of the English construction has hitherto been left wholly to the exertions of the individual who proposed it.

The circle of Borda, as before described, is objectionable chiefly in the following respects.

First. The two indices revolve round the centre upon bearings only equal to their own thickness, and want consequently that steadiness which is derived from a long axis, to assure the glasses and telescope to reverse in the same plane through every portion of the circle:

Secondly. The telescope being raised and lowered by two screws, the motions of which are necessarily shewn by dividing lines, cannot be acted on without much loss of time in looking at those divisions: for if one of them be screwed up or down the least quantity more than the other, the observations will be rendered inaccurate; the telescope thereby being drawn from its parallel position. In a well-contrived instrument, this adjustment, the use of which is to render the brightness of the objects apparently equal, should be performed with the greatest facility, in order to keep pace with the fleeting variations of brightness in those objects:

Thirdly. The darkening glasses are awkwardly applied; indeed the constitution of the instrument scarcely admits of a better application; they take up too much time to exchange them as the brightness of objects varies, and are therefore liable to the objection stated just above. Those dark glasses which are used in the small angles are moreover objectionable, because their position is such as in a great measure diminishes the distinctness of the objects:

Fourthly. Above all, the want of a handle on the upper side renders the observation in the inverted position of the instrument almost impracticable. Every observer, who has much used the former constructions, must have felt this want; but it fell to the lot of the author of the English construction to contrive and apply the remedy. Good observers, for want of this handle, have seldom availed themselves of the properties of either Mayer's or Borda's inventions, and of course have degraded the circle to a rank below the common octant:

Fifthly. A most embarrassing thing in the use of Borda's circle, which renders it almost useless in the night, is, the necessity of making a previous observation, from which to compute nearly the points of the limb where the indices will rest at every stage during the continued operation of repeating the angle. Some years ago the inventor of the English circle found a remedy for this inconvenience, by attaching a divided arc to one of the indices, having two stops sliding thereon; these stops being set to the apparent angle, the progress of the two indices will be alternately arrested thereby at the two relative positions of the indices, where the objects will appear near each other in the field of view. By this simple contrivance a set of observations may be managed in the dark.

Sixthly. The correction of the error of eccentricity is not certain in all cases; if the index which gives the angle has only traversed one third round the limb, whatever has been the number of observations, the mean observation may have nearly the whole of the error belonging to the measured angles charged upon it. On this index's getting quite round the limb the correction will be perfect; but proceeding further than a complete circle regenerates the error. It is true this kind of error diminishes at any given point of the limb, as the number of repetitions are increased; but is never perfectly corrected but at complete revolutions.

These are the imperfections of Borda's circle, which being built upon the fabric of Mayer's, a form ill suited to receive his invention, subjected it to error and inconvenience, and reserved it for the honour of an English artist to give full effect to one of the happiest thoughts that ever led to the improvement of any instrument.

Plate III. of *Astronomical Instruments* exhibits perspective drawings of Troughton's circle. *Fig.* 1 shews the face or divided side of the circle, and fig. 2 the back, or side of the glasses and telescope. In both of these views of the Instrument the form of the cross-bar frame, and its connection with the strong circular border, is too plainly exhibited to require a particular reference. This form of the body of the instrument was found by experiment to resist the pressure of the weight in every position, and to assure a coincidence of the image and body of the two objects to be observed at all angles when held by the different handles, and from trial of many other figures was the only one that did so.

In the middle of the frame is fixed a hollow centre, A, upwards of two inches long, having its flaunch or broad base contiguous to the back of the frame; in this the axis revolves freely: at one end of the axis is fixed the index, and at the other end the index-glass, both firmly united thereto; this is the only central motion in this instrument, and being the axis from which the circular plane is generated, the first objection to the former construction of the reflecting circle is thereby obviated.

On the back, or side of the glasses, is erected a kind of secondary frame, BB, removed from the principal frame a distance equal to the lower end of the hollow centre: these frames are united by five equi-distant pillars. Below the secondary frame all the glasses appear; and the distance below the frames affords a relief for the darkening glasses to be turned down round a joint as in the sextants and octants. This contrivance corrects the third mentioned defect. The same secondary frame allows a length of barrel, C, in which is effected a contrivance for raising or lowering the telescope, even while the observer is looking at his objects, and without the least danger of deranging the parallelism of the line of collimation with respect to this plane of the circle. Thus the second evil is prevented.

D is a handle on the divided side, but fixed to the instrument on the side of the glasses; it is attached to a brass tube, which, being bent over the edge of the circle, allows the index to revolve freely: but as in some positions of the index the bent tube would cover the limb at the point where the observation must be read off, it is readily removed by taking out the finger-screw, *d*. E shews another handle on the back, or side of the glasses, one end of which enters the centre pillar, A, as a steady pin, and is screwed fast to the frame at one of the principal crossing places of the bars. Moreover, a cock, *c c c*, on the side of the glasses and above them, receives another handle, F, the position of which is vertical with respect to the plane of the circle; it also applies to the handle, D, and in both situations occupies the line of the axis. This handle is very convenient when the line of position of the objects to be observed is horizontal, or nearly so; and when applied on the lower side affords the best hold of the instrument while an observation is read off. Thus this instrument presents to the observer in every possible position a convenient hold for either hand, and therefore removes the fourth, or chief inconvenience of Borda's circle.

The fifth objection cannot here occur, as the index does not proceed along the limb as in Borda's; it only steps forward and backward nearly to the same parts of the arc,

 during

during a feries of obfervations; therefore there is no need to calculate or make a preliminary obfervation. The index G has three branches at equal diftances, each having a vernier: by thefe verniers, if they are all read, the eccentricity or error of the centre will in every fight be perfectly corrected, which in former conftructions is uncertain, as has been fhewn in the fixth objection. By reading the three branches of the index, the fimple errors of divifion are meant to be reduced to a quantity not worth notice; for as every obfervation fhould be taken both backwards and forwards, every angle will be meafured on fix different and diftant parts of the limb, and the greateft error of the divifions, by taking a mean, will be reduced to a fixth part of its fimple value. The contrivance of the three verniers was intended as a fubftitute for repeating; but it muft be obferved, that as there is a bare poffibility that the fix readings may be all + or all —, this method of reducing the errors refts only upon probability, whereas that of repeating is a certain one.

Other parts, common to all circles of this clafs, are *a*, the index-glafs; *b* the horizon-glafs; *c* one of the glaffes for darkening the reflected object; *e* one of thofe for darkening the object feen directly; of both thefe there is a frame of three; *f* is the ufual apparatus for faft and flow motion; and *g* one of the telefcopes; *h* is the microfcope, with its illuminating reflector for reading off the parts of the divided limb, for which purpofe it fhifts from one branch of the index to another. The limb is divided all round into 720 parts, which may be called degrees, which they meafure, but are numbered only from the point of parallelifm of the glaffes, or the place where the index ftands in the annexed figures, each way to 160°, that being the largeft angle that can be meafured by this inftrument. The verniers fubdivide down to 20″, which on a diameter of 10 inches is judged fully fufficient for the feaman's ufe; but fome of larger dimenfions for obfervatories have been divided as low as 10″.

The telefcope is here fixed near one edge of the circle, and the horizon-glafs near the oppofite edge, which, admitting the rays of light to fall upon the index-glafs, both to the right and left of the horizon-glafs, conftitutes the peculiar invention of Borda, and affords the means in the Englifh conftruction alfo of obferving angles on both fides of Zero. But as this has been explained in the foregoing inftrument, it would be fuperfluous to fay more about it in this place.

A journalift, who is one of the ableft aftronomers of the continent of Europe, has ridiculed the Englifh conftruction under the appellation of *eunuch* (what we call *repeating* they call *multiplying*); but as it has really multiplied in kind to a family little fhort of 200, the baron's pun feems but indifferently pointed. That aftronomer, however, in a more ferious mood, has thought proper to fay that Troughton's conftruction has deprived the reflecting circle of every improvement; but this being no place for controverfy, we leave the charge to the fagacity and candour of the Englifh reader.

In a comparifon of the Englifh circle with the former ones, the want of repeating is the only ground that a critic can ftand on: and it would be weaknefs to endeavour to depreciate the value of that invention; but if to acquire it, a facrifice were made, either of accuracy or convenience, to a greater extent than the gain, it would be more than weaknefs; it would be folly to perfevere in it. When Mayer propofed the repeating circle, the ftate of the art of dividing was fo rude, that all muft have confidered the repeatiug property as a moft valuable difcovery; nay, it may perhaps yet be valuable in every other nation except England; but here the dividing-engine has been fo well applied, that the fmalleft inftruments, with refpect to the graduation, may be confidered as nearly perfect.

We fhall defcribe the adjuftments of this inftrument beft by copying the practical inftructions ufually diftributed with it, which are as follow, *viz.*

Prepare the inftrument for obfervation by fcrewing the telefcope into its place, adjufting the drawer to focus, and making the wires parallel to the plane, exactly as you do with a fextant; alfo, fet the index forwards to the rough diftance of the fun and moon, or moon and ftar; and, holding the circle by the fhort handle, direct the telefcope to the fainter object, and make the contact in the ufual way. Now read off the degree, minute, and fecond, by that branch of the index to which the tangent fcrew is attached; alfo, the minute and fecond fhewn by the other two branches; thefe give the diftance taken on the three different fextants; but as yet it is only to be confidered as half an obfervation; what remains to be done, is to complete the whole circle by meafuring that angle on the other three fextants. Therefore, fet the index backward nearly to the fame diftance, and reverfe the plane of the inftrument by holding it by the oppofite handle, and make the contact as above, and read off as before what is fhewn on the three feveral branches of the index. The mean of all fix is the true apparent diftance, correfponding to the mean of the two times at which the obfervations were made.

When the objects are feen very diftinctly, fo that no doubt whatever remains about the contact in both fights being perfect, the above may fafely be relied on as a complete fet; but if, from the hazinefs of the air, too much motion, or any other caufe, the obfervations have been rendered doubtful, it will be advifable to make more; and if at fuch times fo many readings fhould be deemed troublefome, fix obfervations and fix readings may be conducted in the manner following. Take three fucceffive fights forwards, exactly as is done with a fextant, only take care to read them off on different branches of the index; alfo make three obfervations backward, ufing the fame caution; a mean of thefe will be the diftance required. When the number of fights taken forward and backward are unequal, a mean between the means of thefe taken backward and thofe taken forward will be the true angle.

It need hardly be mentioned, that the fhades, or dark glaffes apply, like thofe of a fextant, for making the objects nearly of the fame brightnefs; but it muft be infifted on, that the telefcope fhould on every occafion be raifed or lowered by its proper fcrew for making them perfectly fo.

The foregoing inftructions for taking diftances apply equally for taking altitudes by the fea, or artificial horizon, they being no more than diftances taken in a vertical plane. Meridian altitudes cannot however be taken both backward and forward the fame day, becaufe there is not time; all therefore that can be done, is to obferve the altitude one way, and ufe the index-error; but even here you have a mean of that altitude, and this error, taken on three different fextants. Both at fea and land, where the obferver is ftationary, the meridian altitude fhould be obferved forward one day and backward the next, and fo on alternately from day to day; the mean of the latitudes, deduced feverally from fuch obfervations, will be the true latitude; but in thefe there fhould be no application of index-error, for that being conftant, the refult would in fome meafure be vitiated thereby.

When both the reflected image and direct object require to be darkened, as is the cafe when the fun's diameter is meafured, and when his altitude is taken with an artificial horizon, the attached dark-glaffes ought not to be ufed; inftead

inftead of them, thofe which apply to the eye-end of the telefcope will anfwer much better, the former having their errors magnified by the power of the telefcope, will, in proportion to this power, and thofe errors, be lefs diftinct than the latter.

In taking diftances, when the pofition does not vary from the vertical above thirty or forty degrees, the handles which are attached to the circle are generally moft conveniently ufed; but in thofe which incline more to the horizontal, that handle which fcrews into a cock on one fide, and into the crooked handle on the other, will be found more applicable.

When the crooked handle happens to be in the way of reading one of the branches of the index, it muft be removed for the time, by taking out the finger-fcrew which faftens it to the body of the circle.

If it fhould happen that two of the readings agree with each other very well, and that the third differs from them, the difcordant one muft not on any account be omitted, but a fair mean muft always be taken.

It fhould be ftated, that when the angle is about thirty degrees, neither a diftance of the fun and moon, nor an altitude of the fun with the fea-horizon, can be taken backward, becaufe the dark-glaffes at that angle prevent the reflected rays of light from falling on the index-glafs; whence it becomes neceffary, when the angle to be taken is quite unknown, to obferve forward firft, where the whole range is without interruption; whereas, in the backward obfervation, you will lofe fight of the reflected image about that angle. But in fuch diftances where the fun is out of the queftion, and when his altitude is taken with an artificial horizon, the fhade being applied to the end of the telefcope, that angle may be meafured nearly as well as any other; for the rays incident on the index-glafs will pafs through the tranfparent half of the horizon-glafs, without much diminution of their brightnefs.

The advantages of this inftrument when compared with the fextant, are chiefly thefe; the obfervations for finding the index error are rendered ufelefs, all knowledge of that being put out of the queftion, by obferving both forwards and backwards. By the fame means the errors of the dark glaffes are alfo corrected; for, if they increafe the angle one way, they muft diminifh it the other way by the fame quantity. This method alfo perfectly corrects the errors of the horizon glafs, and thofe of the index-glafs very nearly. But what is ftill of more confequence, the error of the centre is perfectly corrected, by reading the three branches of the index; while this property combined with that of obferving both ways, probably reduces the errors of dividing to one-fixth part of their fimple value. Moreover, angles may be meafured as far as one hundred and fifty degrees, confequently the fun's double altitude may be obferved when his diftance from the zenith is not lefs than fifteen degrees; at which altitude, the head of the obferver begins to intercept the rays of the light incident on the artificial horizon; and, of courfe, if a greater angle could be meafured it would be of no ufe in this refpect.

This inftrument in common with the fextant, requires three adjuftments; firft, the index-glafs muft be made perpendicular to the plane of the circle; this being done by the maker, and not liable to alter, has no direct means applied to the purpofe; it is known to be right when by looking into the index-glafs, you fee that part of the limb which is next you reflected in contact with the oppofite fide of the limb, as one continued arc of a circle; on the contrary, when the arc appears broken, where the reflected and direct parts of the limb meet, it is a proof that it wants to be rectified. The fecond adjuftment is, to make the horizon-glafs perpendicular: this is performed by a capftan-fcrew at the lower end of the frame of that glafs; and is known to be right, when, by a fweep with the index, the reflected image of any object will pafs exactly over, or cover the image of that object feen directly. The third adjuftment is for making the line of collimation parallel to the plane of the circle: this is performed by two fmall fcrews, which alfo faften the collar into which the telefcope fcrews, to the upright ftem on which it is mounted; this is known to be right, when the fun and moon having a diftance of one hundred and thirty degrees or more, with their limbs brought in contact juft at the outfide of that wire which is next to the circle; remain the fame juft at the outfide of the other wire; their being fo in both fituations is the proof of adjuftment.

The inftrument by the prefent maker which we obtained a temporary poffeffion of for examination, has been fome time in ufe at fea; we have examined the readings by all the three verniers, at the ends and middle of every half fign with great care, by the help of a microfcope with an illuminating reflector, and did not detect a difference between any two readings of more than 40″, which is much lefs than we expected, notwithftanding the nicety with which we previoufly knew this maker's inftruments have long been divided by an engine belonging to himfelf; for when we confider that the three-armed piece of the verniers may be liable to have an eccentricity, as it refpects the circle, the difference we have mentioned may be taken as the whole amount arifing from the eccentricity of the vernier bars and of the inequality of the divifions taken together.

Mr. Troughton, we have feen, has adopted three verniers to effect the correction of eccentricity, which have each 20 fpaces equal to 21 on the limb, and which we have faid perfectly correct this error; but as captain Mendoza has afferted in his paper contained in the "Philofophical Tranfactions of London for the year 1801," that two verniers placed oppofite one another correct the eccentricity better than any other number, nay, that "a greater number ought not in any cafe to be ufed;" and alfo as we find that Borda has preferred *four* verniers in his repeating circle without reflection, which we fhall fhortly defcribe; we feel it incumbent on us, after what we have faid, to prove the accuracy of three verniers for correcting the eccentricity of their pofition, and alfo to fhew the probability there is of their correcting moreover the inequalities in the divifions of the divided circle. We thought it would be of importance to have the reafons of Mr. Troughton himfelf for having preferred three verniers to any other number, and therefore we wrote to him on the fubject; to which inquiry his reply was nearly in thefe words, which we think worthy of public notice; viz. "The eccentricity of a circular inftrument fuppofes the divifions to be in a true circle, but that the index revolves round a centre at a diftance from that which the divifions of the circle radiate from. Now it is plain that two oppofite indices will correct this kind of error perfectly; and it is equally true, though not fo obvious, that three indices will do the fame."

If we fuppofe a circle to be compreffed on one fide, and elongated on the other, *i. e.* transformed into an ellipfe, but having the index revolving round a point bifected by both the long and fhort diameters; in this cafe oppofite readings fhew no error, and therefore correct none, notwithftanding the end and fide divifions are altered by the compreffion, becaufe the alternations correfpond at the oppofite ends of any diameter; but three verniers, though they do not afford an exact mathematical correction, yet approximate extremely near to it.

If the inftrument were both elliptical and eccentric, like the orbit of a planet, oppofite readings would correct that part of the error which arifes from the eccentricity, but would leave the elliptical error uncorrected; but three equidiftant readings would entirely correct that part of the error which arifes from eccentricity, and would alfo approximate towards the correction of the elliptical error likewife. Four readings at right angles to each other do no more than two oppofite ones, but do the fame thing twice over; nor are fix better than three for the fame reafon. I have not tried five readings, but I dare fay they will correct for eccentricity, (which I fancy every number, odd or even, greater than unity, will do), but I have no doubt of their falling fhort of correcting the elliptical error fo well as three do."

We have no need, however, to reft the proof merely on the authority of this quotation, the comparifon is capable of geometrical demonftration fo far as relates to the eccentricity only, and with refpect to the inequality of the divifions, or what is here called the elliptic error, the tables of the planetary orbits will afford the means of comparing the errors alfo which arife from a fcale of divifions analogous to the equated daily motions of a planet, which Mr. Troughton has alluded to in his letter in confequence of our having firft fuggefted the analogy between the eccentric index of a graduated circle and the radius vector of a planet's orbit.

Let *fig.* 1 of *Plate* IV. of *Aftronomical Inftruments* reprefent a graduated circle with two oppofite verniers; let *a* be the centre of this circle, and *b* the point out of the centre, round which the bar of the two verniers revolves; and let the diametrical line 0° 180° pafs through the points *a* and *b*; now it is evident, that if this line reprefents the bar of the verniers, one being at 0° and the other at 180°, there will be no error fhewn; the fame would be the cafe if the bar were reverfed; but fuppofe the end now at 0° to move forwards to *c*, round the eccentric point *b*, and the end at 180° to *d*; in this new fituation it is equally evident, that the circle would not be bifected into two equal halves; for the femi-circle, *ced*, would be lefs than the femi-circle *dfc*, by the two fmall arcs *gc* and *dh*; again, it is equally clear that the point *c* of the vernier bar would be too forward by the arc *gc*, and the end *d* too backward by the arc *dh*, which is fimilar and equal to the former: therefore, in this pofition of the oppofite verniers, it is evident that the + error *gc* is an exact balance for the — error *dh*; this evidence refults from the nature of the figure, for as the four angles 0° *ag*, 0° *bc*, 180° *bd*, and 180° *ah*, are all refpectively equal to each other, and the dotted diametrical line *hg* parallel to the line *dc*, the arcs *gc* and *hd* are neceffarily equal to each other, the one pofitive and the other negative, as they are fituated with refpect to the index-bar *dc*.

Again, fuppofe the end *c* of the index-bar carried forwards to *e*, at right angles to its original fituation, here the demonftration is equally true, and the error is a maximum, the arc 90° *e* being the pofitive error, and *f* 270° the negative one, which two are as before equal to each other; and in the fame way it may be proved, that the two oppofite errors will correct one another in any other fituation of the eccentric bar of the verniers, where the errors in the femi-circle to the right of 0° will be all pofitive, and thofe in the femi-circle to the left will be all negative, fuppofing the verniers to move agreeably to the divifions in the direction of 0° 90° 180° and 270°.

Let us now try what three verniers will do in correcting the errors of eccentricity.

In *fig.* 2 of the fame *Plate*, let 1, 2, and 3, reprefent the three verniers revolving round the eccentric point *b*, as before, at 120° diftance from each other, and let No. 1 ftand at 180° of the circle, then the other two verniers will ftand at equal diftances at each fide of the point 0°, namely at 60° and at 300° of the graduated circle; in which fituation No. 1 has no error, but No. 2 has a minus error of the arc 2 *f*, and No. 3 exactly a fimilar plus error *e* 3, on account of the dotted lines *af* and *ae* being parallel to the lines *b* 2 and *b* 3, reprefenting the two arms of the verniers 2 and 3; the correction is therefore complete.

Secondly, let the arms of the verniers be placed as in figure 3, where the errors are the greateft poffible, by reafon of the arm 1, or arm of the pofitive correction, being at right angles to the line 0° 180° paffing through the centre and alfo the eccentric point *b*; as Mr. Troughton very juftly faid, the correction here is not fo obvious; it is, however, demonftrably juft. What we have to prove is, that the pofitive arc 90° 1 is equal to the fum of the two negative arcs 2 *f* and 3 *e*: the proof may be had thus; from the centre *a* demit the fmall perpendicular *ad*, which will be equal to the chord of the fmall arc 3 *e*, alfo demit the perpendicular *bc* from the eccentric point *b*, which will be the length of the chord of arc 2 *f*; *ba* is of itfelf the chord of the pofitive arc 90° 1: now, in the firft place, we have given in the fmall right-angled triangle *abc*, right-angled at *c*, the angle at *a* equal 30° (120° — 90°) to determine the fide *bc*, which, if we make *ab* = radius, will be the fine of 30°; likewife in the fimilar right-angled triangle *abd*, right-angled at *d*, we have the angle at *b* given equal 30° (alfo 120° — 90°) to determine the fide *ad*; but by reafon of the fimilarity of the two triangles, which have a common hypothenufe, the fide *ad* is alfo the fine of the angle *abd* to the fame radius, and therefore equal to the fide *bc* of the former triangle; hence the fum of the two fines of 30° each ought to be equal to radius, if the correction be perfect; but the fine of any angle doubled is the chord line of double that angle, therefore double the fine of 30° is equal to the chord of 60°, which is always equal to radius in any circle; confequently the correction in this pofition of the verniers is alfo perfect.

Thirdly, let us fuppofe the pofition of the verniers to be as in *fig.* 4, fuch, that No. 1 ftands halfway between 90° and 180°, *viz.* at 135°; then No. 2 will be at 255°, and No. 3 at 15°; fo that the errors of No. 3 and 1 will be plus, and that of No. 2 minus; in this pofition we have firft the three angles of the triangle *abe* given to determine the relative magnitudes of the fides, of which *be*, equal the chord of 1 *f*, is wanted; the angle *fa* 180° (= 1 *b* 180°) is known to be 45°, confequently the angle *abe*, its complement, is alfo 45°, and if the line, *ab*, be made radius, the required line *be* is the fine of 45°; alfo in the triangle *abd*, right-angled at *d*, the angle at *b* is 15° (= 180° — 120° + 45°), and the fide *ad* is the fine of 15° to the fame radius *ab*; likewife in the right-angled triangle *abc*, with the right angle at *c*, the angle at *a* is given = 75°, (= 120° — 45°) and the required fide *bc* is its fine, equal to the chord of the negative arc 2 *g*, which is taken as a balance to the two pofitive arcs *f* 1 and *h* 3. If now we take from a table of natural fines the three determined quantities, we fhall have

Nat. fine of 45°	-	-	+ 7071068
Nat. fine of 15°	-	-	+ 2588190
			+ 9659258
Nat. fine of 75°	-	-	— 9659258
		Uncorrected error	0000000

Hence

Hence the correction is here likewise perfect; and the method we have last used is equally applicable to any other position of the verniers that can be given them in the circle; *i. e.* the natural sines of the angular distances from the nearest points 0° or 180°, put down with their proper signs, will always be found to afford as perfect a correction for the simple eccentricity of the indices, as if two only had been used. But Mr. Troughton has said that his three verniers approximate, moreover, very nearly to the correction of the inequalities of the divisions, or what may, by analogy, be called the elliptic error, where we suppose the divisions gradually increasing and decreasing alternately in magnitude to and from certain points in the circle; this source of errors, being a contingent one, cannot so well be exemplified in a state separate from the errors of eccentricity: we may, however, take a case in which both sources of error exist together, and try how three verniers will succeed in correcting both at the same time.

For this purpose we propose to avail ourselves of the orbit of a planet with small eccentricity; such, for instance, as that of Venus, where the eccentricity is only $\frac{1}{142}$ part of radius; the form of which orbit, therefore, does not sensibly vary from an eccentric circle. According to the elliptic hypothesis of bishop Ward, if a body should move equably in one focus of an ellipse, an eye fixed in the other focus would view it moving unequably very nearly according to the laws of true planetary motion; so much so, indeed, that where the eccentricity is small, it may be taken as exactly so, without sensible error: but the distance between the two foci of an ellipse is equal to double the eccentricity; therefore a single index moving round a point out of the centre of a circle will have a series of errors alternately increasing and decreasing in quantity, exactly like the *equation of the centre* of a planetary orbit, excepting that the scale of errors will be only *one half*, at each point of the eccentric circle, what they would have been if the index had moved round a point at double the distance of the quantity expressed by the circle's eccentricity. Hence, if we take the scale of equations of Venus, as calculated by Dr. Halley, they will afford the ready means of trying the effect of three verniers used in a circle with an eccentricity equal to *twice* that of Venus's orbit; namely, in which the eccentricity is $\frac{1}{71}$ of radius; and in which the divisions alternately increase and decrease like the diurnal spaces in a planet's orbit.

We have taken the trouble of arranging the table of Dr. Halley, which contains the mean anomaly and corresponding equations of Venus, in such a way, that when No. 1. of the three verniers stands at any degree of distance from the aphelion point (or end of a line passing through the eccentric point) in Column 1. No. 2. of the verniers will then be at the proper degree in Col. 2. 120° forwards; and also No. 3. of the verniers will be at its proper number in the same horizontal line in Col. 3. 240° forwards; likewise the equations standing in the same line in the second set of three columns, marked also 1, 2, and 3, agreeably to their corresponding distances, will be the corresponding *errors* of the respective verniers in that situation; two of which errors will be − and one +, or two + and one − always: then if the three errors, which we have called equations, be added together, in such a way that their signs may counteract one another algebraically, the remaining portion, if any, is the quantity of the uncorrected error, which we have inserted in the last column, where it will appear that in no one point round the circle is there an uncorrected error of more than 2″; and what may be considered as a proof of the truth of our arrangement, and also of the calculations, the + and − errors, being each in the whole amount 33″, annihilate one another.

Angular Distances from the Aphelion Point. Verniers. 1	2	3	Corresponding Equations for Eccentricity of $\frac{1}{71}$ of Radius. 1	2	3	Errors uncorrected by 3 Verniers.
0°	120°	240°	−0′ 0″	−41′ 45″	+41′ 45′	0′ 0″
1	121	241	0 50	41 19	42 9	0 0
2	122	242	1 40	40 53	42 33	0 0
3	123	243	2 30	40 26	42 56	0 0
4	124	244	3 20	39 59	43 18	−0 1
5	125	245	4 10	39 31	43 39	0 2
6	126	246	4 59	39 2	43 59	0 2
7	127	247	5 48	38 32	44 19	0 1
8	128	248	6 37	38 1	44 38	0 0
9	129	249	7 26	37 30	44 56	0 0
10	130	250	8 15	36 58	45 14	+0 1
11	131	251	9 5	36 26	45 30	−0 1
12	132	252	9 54	35 52	45 46	0 0
13	133	253	10 43	35 19	46 1	0 1
14	134	254	11 31	34 44	46 15	0 0
15	135	255	12 19	34 9	46 28	0 0
16	136	256	13 7	33 34	46 40	0 0
17	137	257	13 55	32 57	46 51	0 1
18	138	258	14 42	32 19	47 2	+0 1
19	139	259	15 30	31 42	47 11	−0 1
20	140	260	16 17	31 3	47 20	0 0
21	141	261	17 4	30 24	47 27	0 1
22	142	262	17 50	29 45	47 34	0 1
23	143	263	18 36	29 5	47 41	0 0
24	144	264	19 22	28 25	47 46	0 1
25	145	265	20 7	27 44	47 50	0 1
26	146	266	20 52	27 2	47 54	0 0
27	147	267	21 37	26 20	47 57	0 0
28	148	268	22 22	25 37	47 59	0 0
29	149	269	23 6	24 54	48 0	0 0
30	150	270	23 50	24 10	48 0	0 0
31	151	271	24 33	23 26	47 59	0 0
32	152	272	25 15	22 42	47 58	+0 1
33	153	273	25 57	21 57	47 55	0 1
34	154	274	26 39	21 12	47 52	0 1
35	155	275	27 20	20 27	47 47	0 0
36	156	276	28 1	19 41	47 42	0 0
37	157	277	28 41	18 55	47 35	−0 1
38	158	278	29 21	18 7	47 28	0 0
39	159	279	30 0	17 20	47 20	0 0
40	160	280	30 39	16 33	47 12	0 0
41	161	281	31 17	15 45	47 3	+0 1
42	162	282	31 54	14 57	46 53	0 2
43	163	283	32 31	14 9	46 41	0 1
44	164	284	33 8	13 20	46 29	0 1
45	165	285	33 44	12 32	46 16	0 0
46	166	286	34 19	11 43	46 2	0 0
47	167	287	34 53	10 54	45 48	0 1
48	168	288	35 27	10 4	45 32	0 1
49	169	289	36 1	9 14	45 16	0 1
50	170	290	36 33	8 24	44 58	0 1
51	171	291	37 5	7 34	44 40	0 1
52	172	292	37 37	6 44	44 21	0 0
53	173	293	38 8	5 54	44 1	−0 1
54	174	294	38 38	5 3	43 41	0 0
55	175	295	39 7	4 12	43 20	+0 1
56	176	296	39 36	3 22	42 58	0 0
57	177	297	40 4	2 31	42 35	0 0
58	178	298	40 31	1 41	42 12	0 0
59	179	299	40 58	0 51	41 48	−0 1
60	180	300	41 24	0 0	41 24	0 0
Carried forward						

Angular Distances from the Aphelion Point. Verniers. 1	2	3	Corresponding Equations for Eccentricity of $\frac{1}{71}$ of Radius. 1	2	3	Errors uncorrected by 3 Verniers.
			Brought forward			
61°	181°	301°	−41 48″	+ 51″	+40′ 58″	+0′ 1′
62	182	302	42 12	1 41	40 31	0 0
63	183	303	42 35	2 31	40 4	0 0
64	184	304	42 58	3 22	39 36	0 0
65	185	305	43 20	4 12	39 7	0 1
66	186	306	43 41	5 3	38 38	0 0
67	187	307	44 1	5 54	38 8	0 1
68	188	308	44 21	6 44	37 37	0 0
69	189	309	44 40	7 34	37 5	−0 1
70	190	310	44 58	8 24	36 33	0 1
71	191	311	45 16	9 14	36 1	0 1
72	192	312	45 32	10 4	35 27	0 1
73	193	313	45 48	10 54	34 53	+0 1
74	194	314	46 2	11 43	34 19	0 0
75	195	315	46 16	12 32	33 44	0 0
76	196	316	46 29	13 20	33 8	−0 1
77	197	317	46. 41	14 9	32 31	0 1
78	198	318	46 53	14 57	31 54	0 2
79	199	319	47 3	15 45	31 17	0 1
80	200	320	47 12	16 33	30 39	0 0
81	201	321	47 20	17 20	30 0	0 0
82	202	322	47 28	18 7	29 21	0 0
83	203	323	47 35	18 55	28 41	+0 1
84	204	324	47 42	19 41	28 1	0 0
85	205	325	47 47	20 27	27 20	0 0
86	206	326	47 52	21 12	26 39	−0 1
87	207	327	47 55	21 57	25 57	0 1
88	208	328	47 58	22 42	25 15	0 1
89	209	329	47 59	23 26	24 33	0 0
90	210	330	48 0	24 10	23 50	0 0
91	211	331	48 0	24 54	23 6	0 0
92	212	332	47 59	25 37	22 22	0 0
93	213	333	47 57	26 20	21 37	0 0
94	214	334	47 54	27 2	20 52	0 0
95	215	335	47 50	27 44	20 7	+0 1
96	216	336	47 46	28 25	19 22	0 1
97	217	337	47 41	29 5	18 36	0 0
98	218	338	47 34	29 45	17 50	0 1
99	219	339	47 27	30 24	17 4	0 1
100	220	340	47 20	31 3	16 17	0 0
101	221	341	47 11	31 42	15 30	0 1
102	222	342	47 2	32 19	14 42	−0 1
103	223	343	46 51	32 57	13 55	+0 1
104	224	344	46 40	33 33	13 7	0 0
105	225	345	46 28	34 9	12 19	0 0
106	226	346	46 15	34 44	11 31	0 0
107	227	347	46 1	35 19	10 43	0 1
108	228	348	45 46	35 52	9 54	0 0
109	229	349	45 30	36 26	9 5	0 1
110	230	350	45 14	36 58	8 15	−0 1
111	231	351	44 56	37 30	7 26	0 0
112	232	352	44 38	38 1	6 37	0 0
113	233	353	44 19	38 32	5 48	+0 1
114	234	354	43 59	39 2	4 59	0 2
115	235	355	43 39	39 31	4 10	0 2
116	236	356	43 18	39 59	3 20	0 1
117	237	357	42 56	40 26	2 30	0 0
118	238	358	42 33	40 53	1 40	0 0
119	239	359	42 9	41 19	0 50	0 0
120	240	360	41 45	41 45	0 0	0 0
						+0 33.
						−0 33
						0 0

The conſtruction and uſe of this table will be very obvious when we have exemplified one poſition of the verniers. Suppoſe the principal vernier, which has got the tangent-ſcrew, to be made to reſt at 20° (which is 40° in the circle, as it is divided into 720°), and ſuppoſe that it be required to know the three reſpective errors of the three verniers? Look at 20° in Col. 1. of angular diſtances, and there will be in the ſame line the diſtances of the other two verniers 140° and 260°, and in the columns 1, 2, and 3 of equations, there are $-16' 17'' - 31' 3''$ and $+ 47' 20''$; but the ſum of the *minus* quantities is equal to the *plus* quantity, therefore the poſitive error of the third vernier exactly balances the amount of the negative errors of the firſt and ſecond verniers; conſequently the correction is perfect, and in the laſt column are a couple of ciphers.

Again, ſuppoſe the firſt vernier ſtanding at (the double of) 40° with an equation of $- 30' 39''$, then the ſecond will reſt at (the double of) 160°, with an equation of $- 16' 33''$, and the laſt vernier will reſt at (the double of) 280°, with an equation of $+ 47' 12''$, which ſum is exactly a balance for the amount of the other two negative ſums, and the uncorrected error is, as before, nothing.

The few very minute errors which appear in the laſt column may be attributed, perhaps, to a want of perfect accuracy in the computation of the table, which is not carried to decimal parts of a ſecond, rather than to a want of accuracy in the mode of applying the verniers; becauſe the change from plus to minus, and back again, would not have been ſo frequent, if the errors had been owing to the mode of detection.

When two verniers only are uſed, it is equally eaſy to aſcertain from the table the correſponding equations and relative uncorrected errors; thus at 20°, as before, which is read 40° on the inſtrument, by reaſon of the reflection of the mirrors, the equation is $- 16' 17''$; and at $20° + 180° = 200°$, it is $+ 16' 33''$, ſo that the uncorrected error is $+ 16''$; thus we find that the correction with only two verniers is not perfect at any other points of the eccentric circle, except at 0°, 90°, 180°, and 270°. At 45° this uncorrected error is a maximum, *viz.* 25″ with $\frac{1}{71}$ of eccentricity, but it gradually decreaſes both ways to 0° and 90°; the ſame obſervation is true of the points 135°, 225°, and 315°, which are each 45° diſtant from the beginnings of the other three quadrants reſpectively; ſo that on the whole the ſcale of uncorrected errors with two verniers aſcends four times to a maximum, and deſcends as often during the whole circuit; which is a ſufficient proof that two verniers are by no means ſo accurate as three for the elliptic error, in our planetary trial; and as four verniers correct only as two pair of oppoſite verniers, they are alſo inferior in accuracy to three, where the correction appears as perfect as could be wiſhed.

We are free to confeſs, however, that accurate as three verniers are for all caſes of eccentricity and unequal diviſions which are at all likely to occur in the conſtruction of an inſtrument, yet there is a limit beyond which their accuracy ceaſes: for inſtance, if we ſuppoſe the eccentricity and radius of an eccentric circle as 4 to 10, which would have a ſet of equations equal to thoſe of Mercury's orbit, including the eccentric and large elliptic errors, the maximum of uncorrected error, when three verniers are uſed, would be as much as 46′, but when two only are uſed, it would be very nearly 6°, which diſparity ſhews ſtill more clearly the advantage that three verniers have over two, even in an extreme caſe. This mode of aſcertaining the preference to be given to a certain number of verniers, is, we believe, an original one; which is our apology for its introduction here at full length.

The reflecting circle which we have examined has a circle of ſolid ſilver let into, or, we believe, melted into a groove in the braſs limb, which renders the diviſions diſtinctly viſible through the microſcope, though they are too delicately made for the naked eye to read. The ſtrokes appear not to be more than one-third of the thickneſs of thoſe which we have had occaſion to examine before in Mayer's, and particularly in Borda's circle. There are three teleſcopic tubes for viewing an object, one for celeſtial purpoſes that has two powers, and a couple of croſs hairs or wires in each; a ſecond, which does not invert, for terreſtrial objects; and a third, which is only a ſimple tube, for confining the line of ſight. The parts appear to be all as ſteady and perfect after uſe, as they were when the inſtrument was new. After the conſideration which we have here given to the conſtruction of Troughton's reflecting circle, we ſhould be guilty of a ſpecies of ſcepticiſm, if we heſitated to pronounce it the beſt inſtrument that has hitherto been made for taking the lunar obſervations accurately, and for the other purpoſes of nautical aſtronomy. When this inſtrument is uſed on ſhore, the maker packs up an artificial horizon of quickſilver, and a claw-foot ſtand, as a ſupport, which ſcrews into the cock inſtead of the handle, and relieves the obſerver greatly when angular diſtances are meaſured.

The reflecting and doubly-multiplying CIRCLE, *by Joſeph de Mendoza Rios, Eſq. F.R.S.*

We have already given a brief notice of captain Mendoza's improved circle, and have ſaid that it is different from the one which he publiſhed in the Philoſophical Tranſactions of London in the year 1801, the account of which was copied into Mr. Nicholſon's Journal (vol. i. 8vo. ſeries); we ſhall therefore, without further preface, proceed to deſcribe its preſent conſtruction and manner of being uſed.

In all the circles which preceded the preſent one, there was but one principal circular plane which held the graduations indicated by the verniers of the index-bars, but here are three principal circular parts, two moveable round a common centre, and one concentrically fixed; alſo, what will be conſidered as a further peculiarity, the bar which bears the central mirror, and which has uſually the vernier, or one of the verniers where there are more than one, has here no vernier attached to it, but is uſed to convey the verniers and a circle of 360° alternately to the right and left of their original ſituation, by a vibratory motion ſomewhat analogous to the motion of a pendulum rod, alternately laying hold on one and letting go the other, during a ſeries of croſſed obſervations. *Fig.* 5 of *Plate* IV. is a repreſentation of one ſide of the doubly-multiplying circle, in which the frame, the diſpoſition of the glaſſes, and the application of the handles, are preciſely like thoſe of Troughton's circle, juſt deſcribed, and therefore need not be again explained. C is the fixed circle, uſually called the limb of the inſtrument, over which is placed a ſecond circle D, and alſo over that a third one E; the two latter of which move freely and ſeparately round the centre of the inſtrument; above the laſt circle E the index F has its ſituation, and carries at the low end of its axis the index-mirror, which being at preſent at the under-ſide cannot be ſeen in the figure. The fixed circle C has its inferior ſurface divided to the right and left into two ſets of diviſions as far as 140°, like two ſeparate ſextants, their reſpective zeros commencing not at the ſame point, but at the diſtance from one another of the breadth of the index, ſo that one of them touches one edge of the index when the other touches the other at the divided part of the limb; on theſe two portions of the circular limb ſlide two ſimilar ſtops, *a* and *a*, which may be made to remain in any given points. The index-mirror and horizon-mirror are juſt parallel to each other when the end of the index F occupies the ſituation between the two zeros; and as it is generally known pretty nearly what the angular distance of two heavenly bodies is when a lunar observation is made, these stops may be slided along the right and left divisions of the limb respectively till their inner edges stand on the supposed degree of angular distance from their zeros respectively, in which situations they will serve as guides, in the night particularly, for fixing the index alternately, in a crossed observation, in order to find the places of successive contact more conveniently than they could be found without some such rough guide; nor will these stops be serviceable for the first crossed observation only, but for every subsequent one; seeing the successive observations require not the index to have any other than alternate, backward and forward motions between the two stops, how often soever repeated. The circle D is nicely divided into 360° and their subdivisions, and the adjoining circle E carries two verniers, A and B, diametrically opposite each other, which read off to 10″. On the index F is the usual tangent-screw for procuring a slow motion when the index-bar is clamped to the limb, which clamping is effected by the action of a small lever *c*. There are, moreover, four other clamps with fixing-screws that have milled heads, which may be called dead-clamps, and which open by means of their own springs when their fixing-screws are turned back, but lay hold of their respective moveable circles when acted on by the finger or fixing screws. The clamps *d* and *g* are attached fast to the fixed circle C at opposite sides, and the clamps *e* and *f* are attached to and carried by the index F; the clamps *d* and *f* clamp the upper circle E to the limb; and *e* and *g* clamp the lower one D. Also when an observation with the motion of the index and its mirror to the left, *f* and *g* must both be fast, but *d* and *e* both loose; on the contrary, when the motion of the index is to the right, *d* and *e* must be fast, and *f* and *g* loose. The heads of the clamps *d* and *e* have each a protuberance or knob, by which they may be easily distinguished in the dark from those on the other side. In making an observation with an instrument of this construction, which appears more complex than it really is, the reader may now conceive, that when the clamp of the index has seized one of the two moveable circles and carried it to the stop on the right, where it is deposited and clamped fast, and then has taken up the other and brought it back to the left the same distance, before it is deposited in its turn, which two alternate motions complete two crossed observations, one to the right and the other to the left, the verniers have departed from their original situations, with respect to a given point on the divided contiguous circles, just as many degrees as are equal to two crossed observations, or four simple angular distances; for the verniers moved from the original point, which we will suppose to have been zero, one half, and again zero of the divided circle moved from the vernier, by a motion in a contrary direction, the other half.

The minutiæ attending the taking of a series of crossed observations may be thus explained more fully; in the first place slide the stops to the reputed angle to be measured, which we will suppose to be 50°, as read on the under side of the fixed circle C, and fix them there, one at each side of their respective zeros; let the index for the present remain at the point of parallelism, which we have said is between the two zeros on the inferior surface of the fixed circle; in the next place arrange the two moveable circles so that vernier A of the circle E may be beyond the nearest stop, and may have its zero coincident with zero of the circle D divided into 360°, in which situation fix the two clamps *e* and *f* of the index, and carry it with a quick motion to touch the stop on the right, and having fixed it by the lever *c*, complete the contact by the tangent-screw of slow motion, and the instrument is then in a state of rectification, if the glasses are truly placed, for beginning a series of crossed observations; for as both the clamps *e* and *f* of the index were made fast while it was at the point of parallelism, when the index moved to the right it brought both the moveable circles along with it, without altering the respective positions of vernier A and zero of D. The index has first to move from right to left as seen in the figure, therefore the clamps *d* and *e* must be both loose, and also that of the lever *c*, and the clamps *f* and *g* fast; but *f* is a clamp of E the vernier circle, and *g* one of D, the graduated circle; therefore when the index moves the whole space of a crossed observation to the stop on the left, it leaves the graduated circle D behind fast, and takes the verniers along with it; suppose the second contact to be completed by the tangent-screw again as before, then the vernier will read off in this situation 100° more or less, the amount of the crossed observation; but the whole circle is divided into only 360° instead of 720°, as Borda's is, the observed angle may consequently, though a crossed observation, be considered as the simple angular distance taken as a mean of two successive simple angular distances, if there had been 720° in the circle, agreeably to the division of an Hadley's octant or sextant; but it is not necessary to read off yet. Change now the state of all the clamps by fastening *d* and *e*, and loosening *f* and *g*, and carry the index back again to the stop on the right; during this motion of the index the verniers being fixed by *d* will remain behind, and the graduated circle D being clamped by *e* to the index, will now, in its turn, move along with it the exact space of the second crossed observation, and the vernier A will read off 200° more or less, which is four times the angle required to be measured; and this quadruple of the angle has been obtained by two crossed observations made alternately to the left and to the right, without any useless motion of the index; which result at this stage of the series of crossed observations explains the reason why the instrument is called not only a reflecting but also a doubly-multiplying circle, for we have seen that it doubles the simple angle required to be measured at each crossed observation taken both backwards and forwards any number of times. The quadruple angle however is read off, as being only double, by reason, as we have before seen, of the circle having only 360°. This process of alternately fixing and releasing the two pair of clamps, and of moving the index as many times alternately back and forwards between the stops, and ending with as many exact contacts by the help of the tangent-screw, will give a final result, as read by the vernier A, which divided by the number of crossed observations used, exclusive of the angle of primary rectification, will give as a quotient the true distance sought, which distance will be the more accurate the greater the number of crossed observations. Should the second vernier B be also read off, the mean of the two results will be still more accurate, inasmuch as not only the inequalities of simple division will be partly corrected, but also the eccentricity of the divided circle D completely, if there should happen to be any. Of course the mean of the times must be taken in the use of this instrument as well as in Mayer's and Borda's, but as the expedition with which a series of observations may be made, will be much greater in using this instrument, noting the times of the first and last contact may be sufficient, when the observer is expert and has no interruption; but perhaps it will be the safest method to mark down the times of each successive contact. If the errors of eccentricity and of unequal divisions had not been so perfectly corrected by Troughton's three verniers, and if instruments were not now divided with an almost incredible degree of accuracy, we should have felt disposed strongly to to recommend Mr. Mendoza's inſtrument in preference to any other one for meaſuring large angles accurately; particularly if we could perſuade ourſelves that the alternate clamping and unclamping, many times repeated, did not in ſome degree affect the accuracy of the readings; but under the circumſtances in which this inſtrument is produced, we leave to the public and to future experience the determination how far it may be put in competition with its predeceſſor, or claim a preference over it. At all events, Mr. Mendoza deſerves well of the public for this as well as for former labours to benefit the intereſts of navigation.

Aſtronomical CIRCLE *by the late Jeſſe Ramſden.*

Profeſſor Gieuſeppe Piazzi, the celebrated aſtronomer of Palermo, who firſt diſcovered the new planet which bears his name, publiſhed a work in two folio volumes in the Italian language, the title of which is "Della Specola Aſtronomica," &c. in which work the author has given a very minute account of all the different parts of Ramſden's firſt aſtronomical circle, as made for him, that is capable of taking altitudes and azimuths at the ſame time, and alſo of being uſed as a tranſit inſtrument occaſionally when placed in the meridian. It would render our account of this inſtrument too long, if we were here to make and introduce a tranſlation of Piazzi's deſcription of all the minutiæ of the different parts and ſections at full length; but we ſhould hold ourſelves wanting in reſpect to the memory of an excellent inſtrument maker, if we did not give a deſcription at ſome length of an inſtrument, which though probably not the beſt that has been made, yet was the firſt of ſuch conſiderable extent, and has in its conſtruction an union of various contrivances, many of which were at the time original.

Mr. Piazzi informs us, that Ramſden twice undertook the taſk of conſtructing the aſtronomical circle, and as often abandoned it; but at length in January, in the year 1788, he entered on the buſineſs in earneſt, and completed his labour in Auguſt 1789. The whole inſtrument, which is repreſented in perſpective in *Plate* V. of *Aſtronomical Inſtruments*, may be divided into ſix principal parts, with their appendages; 1. the vertical axis, and azimuth circle; 2. the ſuperior ſupport of the vertical axis; 3. the inferior ſupport of the ſame; 4. the baluſtrade; 5. the achromatic teleſcope, and vertical circle; and 6. the three microſcopes with their micrometers in the foci of their eye-pieces. For the ſake of order we will give an account of the parts nearly in this ſucceſſion accompanied by occaſional remarks.

The vertical axis of Ramſden's circle is compoſed of various parts, which revolve together, and which may be conſidered, when firmly united, as one piece; at the lower end is a cone T inverted, the ſmalleſt diameter of which is five inches, where it is attached to the azimuth or horizontal circle with ten conical radii, and the greateſt diameter is 14.2, where it is fixed to the oblong ſtage of braſs A; which ſtage is further ſtrengthened by gibbet pieces, at the four corners. The azimuth circle is three feet in diameter, divided into 180° twice over, and each of the degrees again into ten ſubdiviſions of 6′ each. The extreme inferior end of the axis, below the azimuth circle, is a ſmall cone of hard ſteel. On the ſtage A are faſtened four ſtrong braſs pillars, each $6\frac{1}{2}$ feet long and $3\frac{1}{2}$ inches in diameter, deſignated by the letters C C C C, and placed near the corners of the ſtage A, which is 25.3 inches by 16.8. Above the ſuperior ends of theſe four pillars, is another ſtage B of ſimilar dimenſions, in the centre of which is a tube ſtanding up, which conſtitutes the upper pivot of the axis: at each ſide of the central tube of this upper ſtage is an opening cut, which nearly divides the ſtage into two, except at the middle and two extreme edges, which edges are made firm by lateral connecting pieces: the uſe of the open parts of the upper ſtage is to admit the object end of the teleſcope to view ſtars near the zenith.

The two large pillars, each 7 feet high, and 4 inches diam. aſcending from marble baſes on the floor of the obſervatory, and terminating with a large arch, which connects their ſuperior ends, conſtitute a part of the ſuperior ſupport of the vertical axis; two ſimilar pillars with a ſimilar arch croſſing the other at right angles are left out of the drawing, but may eaſily be conceived to be ſtanding over the other diagonal of the marble baſe, and fixed in the dark circles which are ſeen at the reſpective corners; at the top of the arches, however, a croſs or piece of four ſtraight bars is ſcrewed to the four portions of the diſcontinued arches, and a hole in the centre of this uppermoſt croſs piece, receives the tubular pivot of the vertical axis. The lower ſupport of the vertical axis conſiſts of three concentric circles of iron, laid one over another on friction rollers; the uppermoſt of which bears the inferior pivot of the axis, and the other two have each an adjuſtable motion, one from eaſt to weſt, and the other from north to ſouth, effected by the univerſal joints, ſeen without the baluſtrade at 90° from each other, which joints have handles at one ſide, and each a horizontal ſcrew at the other, which ſcrews, acting as preſſing ſcrews, move the large iron circles in their reſpective directions, when the axis is to be placed exactly perpendicular to a horizontal line drawn in any azimuth.

A more particular deſcription of theſe concentric iron circles of adjuſtment, for perpendicularity of the vertical axis, would not be intelligible without ſeparate plans, ſuch as are given in Mr. Piazzi's *Plate* II.

M is a mahogany circle placed on the uppermoſt iron circle; its diameter is 3 feet 2 inches, and its thickneſs 3 inches. On this circle of wood is ſurmounted a baluſtrade of metal, R R, compoſed of a ſuperior and inferior large ring, of each 3 feet diameter, connected by 20 cylindrical pillars, each of one inch diameter, and 13 inches high; this baluſtrade defends the azimuth circle, and ſerves to give either a ſlow or quick motion from it to the axis of the inſtrument, by means of the clamping mechaniſm, connected with an univerſal joint, of which the handle Q only is ſeen in the figure, but which may be apprehended from what has been ſaid of this kind of mechaniſm, when we deſcribed Borda's reflecting circle and its clamps with tangent ſcrews. The microſcopic micrometer N, which reads off the graduations of the azimuth circle, is alſo carried between two of the pillars of this baluſtrade, together with the ſubjoined reflector of ſilver for the illumination of the dividing marks of the azimuth circle: the field of view of the compound microſcope contains but a very ſmall ſpace of the image of the divided limb; it was therefore found neceſſary, not only to mark every degree with ten ſucceſſive Arabic numerals, and alſo each tenth ſpace, with larger numerals of the Roman character, but alſo to inſert *points* for diſcriminating the ten ſubdividing lines, thus, ı ı ı ı ı ı . .. ., ... ı ı ı ı ı, which are counted 0, 1, 2, 3, &c. the diſtance between each of which we have already ſaid is 6′, therefore the correſponding values are 0′, 6′, 12′, 18′, 24′, &c. up to a degree, as read without the aid of the micrometer.

The compound microſcope N has the mechaniſm of the micrometer in the point where the focus of the eye-glaſs, or perhaps we ſhould rather ſay, where the united focus of the glaſſes of the compound eye-piece, meets the image of the ſubdiviſions of the limb, as formed in the tube by the object lens; this mechaniſm is rather complex, and cannot be be very clearly apprehended perhaps by a mere verbal defcription; it confifts of two parallel horizontal plates of metal having each an oblong hole along its middle, the upper of brafs, and the lower of fteel; the brafs one is divided into ten fpaces of each 1′, counted each way from zero, which is a point in the middle, and is moveable feparately by the horizontal fcrew on the left hand; the fteel plate carries a crofs hair or wire, and is adjuftable to the right or left by a fcrew of 70 threads per inch, which has a nut, as a head, divided into 60 equal parts, one of which parts correfponds to a *fecond* of a degree; this divided head is placed at the right hand of the microfcope, fo that one of the two fcrews cannot be miftaken for the other, and both may be held at the fame time, and turned by the feparate hands of an obferver, if neceffary. To prevent a lofs of motion in the fcrew of the divided head, or micrometer fcrew, a fpring of contrary preffure is applied in conftant action, which makes the crofs wire move backwards or forwards, without the lofs of even a *fecond*, as counted on the divided head.

The microfcope as ufual has two adjuftments, one for the object lens to make the image fall diftinctly on the micrometer's thread and fcale, and another for the eye-piece to render this image clear to the eye; alfo the micrometer has two adjuftments, one to adjuft zero of the fcale, under the eye-piece, to zero of the image of the divided limb; and the other to fet zero on the divided head to zero on the faid fcale, confequently to zero alfo on the divided limb: thefe two latter adjuftments are effected by the different fixing fcrews, which are invifible in the figure.

The vertical circle has not its dimenfions given by Piazzi in his account, but we learn from a French notice taken of this inftrument in another place, that its diameter is five feet, which correfponds to the length of the telefcope of which Piazzi fays the focal length of the object glafs is five feet; the circumfcribing boundary of the circle, correfponding to the felly of a wheel, is formed of two feparate rings, united in various equidiftant points by parallel cylindrical pieces, fo that the appearance of the compound piece is that of a circular ladder; which form gives ftrength without great addition to the weight. On the plane of one of thefe rings is firmly fixed, Piazzi fays foldered if we underftand him rightly, a third circle, which contains the lines of graduation, which lines are faintly feen in the figure. The central piece, or nave of the wheel, into which the fpokes, or radii, are faft, is a fegment of a cylinder of caft brafs, nicely perforated in the middle, and the fpokes are compofed of eight metallic cones and the telefcope, which paffes through the nave and forms two more. The horizontal axis of this large circle, or wheel, as we have defcribed it, is formed of a double cone, which is hollow throughout, and has pivots of hard fteel at the extreme ends; it has four fupports, from an idea that the weight would be too much for the pivots alone to bear. One of the fupports is feen at D D, which is a kind of frame attached to the perpendicular pillars C C next to the eye; the extreme end of the axis *a*, which is not perforated, bears on a Y formed in the middle of the crofs bar of this frame, which bar has an adjuftable motion up and down, by means of the fcrew *p*, with a head divided into 50 parts, each of which parts correfponds to $\frac{3}{150}$ of an inch. Another fupport, every way fimilar to D D, is attached to the two upright pillars C C, behind the circle, which therefore cannot be feen, but requires no further defcription. The third and fourth fupports of the axis are a fifth pillar, the top of which is feen through the arch of the frame D D and its bottom near G, and a fixth pillar, P, oppofite to the former. Thefe two pillars placed nearer the middle of the ftage A, than the four corner pillars, C C C C, are each three feet and three inches high, and eleven inches diftant from each other, meafured from the interior fides we prefume; they are made fteady at their fuperior ends, each by two crofs-bracing pieces, *t t*, faftened to the long pillars, C C and C C, refpectively; one of which pieces *t* only can be feen attached to the right hand fupporting pillar, owing to the pofition of the figure. On the top of pillar P may be feen a fmall frame, carrying a pair of friction rollers; which frame can be lowered or raifed by a rod paffing through the pillar down to below the ftage A, under which is hid from the fight a fcrew of adjuftment for the height of the faid rod and frame of friction rollers. The rollers are placed edge to edge in the fame plane, forming a kind of curved V between them, on which the projecting ring of the conical axis is fupported. The fituation of this ring piece, attached to the cone, is at the mean point, between the centre of the circle and the back fteel pivot, which pivot is invifible in the figure. Thus one-half, or any fmaller part of the weight of the circle may be made to bear on this fupport, by adjufting the fcrew of the long rod within the pillar, the nut of which we have faid is under the ftage A. Another fupport, with a frame of two friction rollers, exactly fimilar to the one defcribed, is placed over the correfponding pillar, and under a correfponding annular piece embracing the fecond cone of the axis at its middle point; but the rod of this pillar, which adjufts the height and quantum of bearing of this fecond frame, does not defcend fo low as to the ftage A, but terminates a little below the middle of this pillar, which is cut into two and joined again by a fmall frame of four little pillars near I, fo that a hand may be put into the vacant fpace of the fmall frame, to adjuft by a tapped nut acting here, inftead of being put under the ftage A; the reafon of which is not quite evident from the appearance of the figure, nor is it explained in the original account. The end of the axis which is turned from view is perforated, and admits a lens that receives the light of a fmall lantern H, placed in a line with it, and tranfmits this light, without the entrance of fmoke or duft, to a diagonal mirror, that has got a central hole in it, placed at the point of interfection of the telefcope's line of fight, and of the central line of the circle's axis: this mirror again reflects the received light towards the eye-piece of the telefcope, and renders the two adjuftable hairs, which crofs one another at right angles in the united focus of the eye-glaffes, diftinctly vifible to the eye of an obferver on the darkeft night. It was found, however, that when much light was admitted into the telefcope, the ftars of fmall magnitude became invifible; on which account a contrivance was introduced for proportioning the quantity of light, according to circumftances. This contrivance confifts of a parallelopiped compofed of three pieces of glafs, the middle one white, and the two extreme ones green, contained in a frame which has an adjuftable motion by means of pullies, two of which may be feen on the infide of the back pillars, C C, which pullies affift the adjuftment during the time of making an obfervation, if neceffary, and limit the quantity of light, agreeably to the afcent and defcent of the parallelopiped interpofed between the lantern and the end of the axis. The reafon of the green glaffes being at both fides of the white glafs, is that the refraction of the light may be corrected by the fecond green glafs, fo as to prevent the wires in the focus of the eye-piece from appearing double. In this telefcope there are fix eye-pieces, five direct, and one diagonal, or what Piazzi calls prifmatic, becaufe the piece of glafs that is placed at the elbow of a bent tube, put on as an eye-piece, is a prifm bounded by one curved fide and two rectilinear ones, the latter two of which are placed at an angle of 45°, with refpect to each other;

other; the curved fide being that which firft received the rays of light, and the diagonal one, we prefume, filvered. The peculiarity of this prifmatic eye-piece is, that it inverts the object without reverfing it; that is, the pofition is changed with refpect to top and bottom, but not with refpect to right and left. The prifmatic eye-piece has two powers; one making the magnifying property of the telefcope 75, and the other 130. The powers with the five direct eye-pieces, are refpectively 50, 75, 100, 130, and 170. The principal ufe of the prifmatic powers is to fearch for ftars and meafure altitudes of bodies placed near the zenith; the faid eye-piece with its additional tube being horizontal when the telefcope is in a vertical pofition.

The vertical circle is graduated into 360° and figured into 90° four times over; each feparate degree is alfo figured with arabics, and the fubdivifions dotted or pointed like the azimuth circle. The obferved angle is read off by two different microfcopes with micrometers, placed above and below the vertical circle, at the diftance from each other of a femicircle; the frame E of the fuperior microfcope is attached to the neareft pillars, C, C, as fhewn in the figure, juft under the upper ftage B, which frame contains fliding pieces of adjuftment for fetting the microfcope in the required pofition with refpect to the divifions on the limb of the circle; the adjuftments both of the microfcope when placed, and alfo of its contained micrometer, are fimilar to thofe of the micrometer placed over the azimuth circle already defcribed. The inferior microfcope F I of the vertical circle is in every refpect fimilar to the fuperior one, the micrometer's divided nut in both being placed to the right. The micrometers of thefe microfcopes, however, have each two horizontal adjuftments of motion, one parallel to the plane of the vertical circle, and the other perpendicular to that plane, and alfo each a vertical adjuftment.

Befides thefe microfcopes for reading off the fubdivifions, each frame contains moreover a fmaller one, which we will call the fecondary microfcopes, the ufe of which is for viewing a fine plumb-line, fufpended by a fmall cock over the fuperior frame E, and paffing down to G through a wooden fquare pipe, where the plumb may be feen immerfed in the fmall veffel G full of water, above a fmall ftage *u*, in order to keep the line from ofcillating. This veffel G may be raifed or lowered by the fcrew that fupports it. The fecondary microfcopes have each the fame adjuftments as the above-mentioned microfcopes; and the plumb-line has alfo its point of fufpenfion fo adjuftable, that it can be brought into the foci of the upper and lower eye-pieces fo as to bifect the fields of view, when the microfcopes are both properly adjufted.

The plumb-line ferves two feparate, and both very important purpofes; its peculiar application to both which was another of Ramfden's happy thoughts; firft, it not only ferves to fet the vertical axis perpendicular in one pofition, but by being carried round in azimuth with the axis and all the other appendages, ferves to fhew if the perpendicular direction of the faid axis is preferved with refpect to all the points of eaft, weft, north, and fouth, and if any deviation is detected by the thread being at one fide of the original fituation, then one of the adjuftments of the iron circles, under the inferior pivot of the axis, as effected by the handle of the compound-joint under the mahogany ring M, muft be made to verify the pofition; and, fecondly, the horizontal axis of the vertical circle is made perfectly level by the fame plumb-line; this is effected by an additional apparatus, in a very ingenious, as well as very accurate manner, which may be thus explained without a figure: fuppofe a bar of metal to be made of fuch a length as, when ufed as a horizontal meafure, would juft reach from the divided face of the vertical circle to a point directly oppofite it in one of the pillars as the upper end; and fuppofe again this meafuring bar to be applied below to a point at the lower part of the faid pillar, to try if in this fituation it will alfo juft touch the graduated face of the fame circle; then, if the diftance is found to be precifely the fame in both cafes, the conclufion would be from fuch a rough meafure, that the pillar and the plane of the vertical circle are parallel, or very nearly parallel, to each other; now, as the circle was originally made by being turned on its own pivots in a large frame, its axis is neceffarily at right angles to its plane, and confequently alfo to the furface of the pillar; hence, if the pillar were perfectly perpendicular, the axis, on a fuppofition that the meafures were accurately taken, would be perfectly horizontal. But we know that a plumb-line is perpendicular whenever it is at reft, therefore any contrivance that will meafure very minutely the diftance from the plumb-line to the plane of the circle, both above and below, will determine whether or not the axis is horizontal; this contrivance is what we have to defcribe: conceive the faid bar of meafurement to terminate at one end after the manner of a two-pronged fork, and fuppofe one half of a compound-microfcope, *viz.* the object, object lens, and body of the inftrument, to be carried by one prong of the fork, and the eye-glafs in a feparate tube, borne by the other prong; and it is eafy to apprehend, that the image of any fmall object, whatever it may be, may, by the adjuftment of the object lens, be made to fall in the open fpace between the prongs, which image may again be rendered diftinct to the eye by the focal adjuftment of the eye-glafs; we have now got a meafuring-bar with a compound microfcope carried by it, in two feparate halves, fo that any fubftance, that will pafs between the prongs of its forked end, may be brought into the field of view, and be feen magnified by the eye-glafs, ufed on the principle of a fimple microfcope: let the thread of the plumb-line be this interpofed body, which, indeed, will cover only a fmall portion of the field of view; but as the plumb-line is not to be moved, except by the fcrew at the point of fufpenfion, nor even touched by any external object, the microfcope muft neceffarily be brought to it, and placed in fuch a manner, that the thread will bifect the field of view; this is done by fitting the forked end of the meafuring bar into the upper frame E firft, in fuch a way, that it may be made to flide in and out any number of times to the fame fituation; then the adjuftments of the frame, or of the cock of fufpenfion will bring the thread into the field of view; let now the object be a round dot on a flip of ivory, or mother-of-pearl would be better perhaps, and its image may be fo adjufted that the plumb-line will bifect it in its magnified ftate. This ingenious contrivance of producing an image in the open air has been denominated *Ramfden's ghoft* by fucceeding inftrument-makers from the name of its inventor. Let now the meafuring bar, which we will fuppofe to be too fhort, be laid, and fupported horizontally in a direction juft perpendicular to the plane of the circle, and let there be a thick pin fcrewed into its end next the circle, which, by being unfcrewed, will approach the plane of the circle till it juft touches it as the circle revolves, then the diftance from the extreme end of this pin to the plumb-line is exactly gauged; it is of no importance what may be the total length of this gauge, provided it be kept unaltered; remove, in the next place, the meafuring rod and its apparatus at each end in ftatu quo, to a fimilar fitting made for it in the inferior frame I F, and if, when the plumb-line bifects

the

the image of the dot here as before above, which the adjuſtments of the frame only muſt now effect, the pin at the oppoſite end turns out to touch the plane of the circle below at the ſame right angle that it did above, then the plane is perpendicular, and the axis neceſſarily horizontal; but if there is any deviation, the adjuſting ſcrew *p* on the bearing frame D D muſt rectify one-half of this deviation, and the pin which ſcrews into the meaſuring bar the other half; after a few trials above and below the horizontal poſition may be given to the axis in queſtion to the exactitude of a *ſingle ſecond*; for we have ſaid, that a microſcope may be depended on to that degree of accuracy in reading off a micrometer's ſcale. When the vertical circle is truly fixed, a ſecond meaſuring bar may be added at the lower frame while the firſt remains at the upper one, and then turning the circle round on its axis would ſhow both above and below when any alteration takes place in the true poſition from whatever cauſe. But inſtead of uſing the plane of the circle itſelf, Ramſden judged it better to fix a little bridge, *x y*, over the object glaſs of the teleſcope with a prominence *h*, which he made to come in contact with the pins of the meaſuring rod above and below ſucceſſively, by which means the contact is more nicely obſerved, and the method equally accurate. Whenever the line of collimation of the teleſcope is thus adjuſted, it will be certain to deſcribe a ſemi-circle in the heavens, when turned half round, which ſhall be truly perpendicular to the horizon, whether that ſemi-circle be in the meridian or in any given azimuth. Whenever Piazzi rectified the ſuperior and inferior micrometers and plumb-line, he took care to uſe the zeros of the vertical circle as the points that biſected the circle belt into two equal ſemi-circles; and he gives as a reaſon, that he found theſe did not deviate more than a quarter of a ſecond from their true places. When the vertical circle is uſed in taking altitudes, it may be clamped by a piece *k*, on the pillar P, which, when looſe, will allow a quick motion, but when faſt will only permit a very ſlow one by means of the handle V of the compound-joint, which, like that at Q, is connected with the tangent-ſcrew out of ſight. Theſe, we believe, are all the eſſential parts of the grand inſtrument before us, which we have thought it better to deſcribe in our own manner, than to make a ſervile tranſlation of the original, which muſt have been, as we have ſaid, not only too long, but imperfect without at leaſt three additional plates on a reduced ſcale.

It remains now, that we point out the advantages and diſadvantages peculiar to the conſtruction of the aſtronomical circle of Ramſden above deſcribed. Piazzi has enumerated eight advantages that his inſtrument poſſeſſes, as compared with a mural quadrant; which advantages may be claſſed thus: *viz.*

1. The graduated circles are not encumbered with verniers, ſo as to have its diviſions defaced, or its ſteadineſs moleſted.

2. The ſubdiviſions are read by microſcopes which magnify nine times, ſo that the leaſt quantity may be eſtimated.

3. The vertical circle has its plane made by revolving on its own axis, and alſo its circular lines ſtruck therefrom; conſequently both a deviation of the plane and eccentricity of the divided circles are avoided.

4. The compound circle preſerves its figure much better than it would have done if it had been caſt in one ſolid piece.

5. The obſervations may be reverſed with reſpect to both altitudes and azimuths; therefore a mean of two reverſed obſervations of an altitude will correct the ſimple errors of diviſion, and alſo the error of the croſs-hair or wire of the teleſcope, which, in one caſe, will be +, and in the other —.

6. The inſtrument may be placed in the meridian, and be uſed conveniently as a ſimple tranſit-inſtrument, when clamped to the baluſtrade.

7. It gives altitudes and azimuths at the ſame time; and therefore is particularly uſeful in ſingle obſervations of a comet, or other temporary phenomenon.

8. The refraction of the atmoſphere, correſponding to a given temperature, may be determined by calculation from an obſerved altitude and azimuth, taken at any hour, of any ſtar of a given declination.

We wiſh it had been in our power to have concluded this account by ſaying that we ſee no diſadvantage attending the conſtruction of the inſtrument before us, as it is a fabric of great ingenuity and labour; but a regard for the duty of juſtice, which we feel incumbent on us, obliges us to ſay, that one great objection to the conſtruction before us ſtruck us very forcibly at the firſt ſight of the inſtrument, which has been confirmed by profeſſor Piazzi's own candid account of its uſes: the objection, we allude to, is that which ariſes out of the manner in which the upper end of the vertical axis is ſupported; the pillars and ſurrounding arches of metal can ſeldom, if ever, be all kept at the ſame degree of temperature in ſo large an inſtrument, in any ſituation where it can be placed to be permanently uſeful in taking obſervations; conſequently, we were, in the firſt inſtance, led to fear, that the unequal expanſion of the warm and cold parts of the ſaid bearing-pieces would throw the vertical axis frequently out of its true perpendicular ſituation; accordingly we find, from the proprietor's own candid confeſſion, that obſervations of the ſun cannot be relied on, and that, even in obſervations of the ſtars, a new rectification uſually becomes neceſſary every hour that elapſes from the laſt rectification: when the ſun ſhines, there is alſo a difference in the two ſemi-circles of the vertical circle of 10″ or 12″ occaſioned by unequal expanſion: and the variation in perpendicularity is ſtated to amount to 4″ or even 5″ in the direction of a line from Eaſt to Weſt, in a ſingle hour; but in a direction at right angles to this line the error of deviation will not uſually be more than 2″. The greateſt error in ſimple graduations of the vertical circle does not exceed 3″; but in the azimuth circle there is an error of + 6″ in each of two quadrants, and a correſponding error of — 6″ in each of the other two, as determined by reverſed horizontal obſervations. Theſe laſt, however, are minor errors, compared with the liability of the vertical axis, to have frequent and conſiderable deviations from a true vertical poſition; which deviation muſt not only be very troubleſome to rectify every hour, but muſt ſometimes render an obſervation doubtful notwithſtanding every precaution.

Profeſſor Vince of Cambridge has given a ſketch and brief account of the principles of this inſtrument in his "Practical Aſtronomy," but has not given a detail of the parts of the inſtrument as it was actually conſtructed; he has alſo given a ſimilar deſcription of the principles of Ramſden's large inſtrument for meaſuring horizontal angles in the ſame work, which we propoſe to introduce under our article THEODOLITE, of which it may be conſidered as an improvement; and, in the mean time, thoſe readers, who wiſh to ſee an earlier account of it in detail, are reſpectfully referred to general Roy's account contained in vol. lxxx. p. 145, of the "Philoſophical Tranſactions of London," and alſo to the account of the "Trigonometrical Survey," publiſhed in 1799, by captain William Mudge, and Mr. Iſaac

Iſaac Dalby; in the latter of which publications all the neceſſary information may be obtained.

Repeating CIRCLE *of Chevalier de Borda, without Reflection.*

The happy idea of meaſuring the angle which two terreſtrial objects form, by repeating ſucceſſively the obſervations on all the parts of the circumference of a circle, we have already ſaid, is due to the celebrated Tobias Mayer; but there remained to contrive. conformably to this idea, an inſtrument calculated for geometrical operations, and which, if poſſible, might equally ſerve for aſtronomical obſervations. This was done about the year 1789, by chevalier de Borda, to whom geometry and navigation, as well as aſtronomy, owe many obligations. The circle of Borda has been executed chiefly by Lenoir, of Paris, and is uſually 19 inches in diameter; it is divided into 400 parts, according to the ſyſtem of diviſion adopted by the Academy of Sciences, on the 27th of February, 1793, and which has already been employed in the inſtruments of the ſame kind, which Mechain and Delambre uſed in 1792, and the following years, for meaſuring the arch of the terreſtrial meridian from Dunkirk to Barcelona. The axis of this circle which is fixed in the centre, and turned with the limb, carries two moveable teleſcopes, B, D, (*Plate* VI.) the one before and the other behind, which turn freely and independently of each other, quite round the circumference, on the axis of the circle itſelf, and which ſlide over its anterior and poſterior limbs. This axis is 10 inches long; it goes through a hollow cylinder A, which is fixed on the ſtand E F of the inſtrument: beyond this cylinder the axis bears a circular piece G of $5\frac{1}{4}$ inches diameter, indented all round to be moved by an endleſs ſcrew H, connected with the cylinder or ſocket on the ſtand; and which may be detached or made to act at pleaſure, in order that the whole inſtrument may be made to turn with a rapid motion, or move ſlowly by means of the ſcrew. Borda wiſhed to render this motion ſtill more gentle, by having the head of the endleſs ſcrew moved by another ſcrew.

The hollow cylinder A, which receives the axis of the circle, carries a weight K, $5\frac{1}{4}$ inches diameter, and $1\frac{1}{2}$ inch in thickneſs, to counterpoiſe the circle, in order that it may be placed ſteadily in an inclined poſition. It is this cylindrical piece which bears the ſcrew that catches the indented circle connected with the axis.

The front teleſcope B carries a croſs index piece which has four verniers, L, M, N, O, by means of which the diviſions are read in four points of the circumference; whereby Borda has done away the errors that reſult from the eccentricity of the inſtrument, and alſo thoſe of ſimple diviſion are diminiſhed. The back teleſcope D carries a level filled with pure ether and an air bubble; this level ſerves to place the circle in the ſame ſituation with regard to the zenith and horizon, whether the limb be eaſtward or weſtward; it is ſo ſenſible that the motion of one line ($\frac{1}{12}$ of a French inch) in the bubble makes only $7''\frac{1}{2}$ inclination, ſo that its ſituation may be aſcertained within 2 ſeconds. This back teleſcope alſo ſerves to take angles horizontally, by pointing it againſt one of the two terreſtrial objects, the diſtance of which is to be meaſured. The teleſcopes are 27 inches long, with an aperture of 23 (French) lines; they are achromatic made by Lerebours.

Each of the four verniers carries a magnifying glaſs to look at the diviſions, and a tangent ſcrew R to effect an exact contact; two of which verniers have beſides a clamping ſcrew each to fix the index to the limb, and an adjuſtment to bring the ſtar or other object to the thread of the teleſcope by a ſlow motion. The teleſcope that carries the level has alſo a lamp and an adjuſtment S to give it a ſlow motion, and to bring the bubble to the middle of its tube; an ivory ſcale divided along the bubble ſerves to bring it back to the ſame point. The reticule, a kind of micrometer in the eyepiece of the teleſcope, is inclined 45°, becauſe, in order to take angles on the ground, it is convenient to place the object within the angle of the two threads. Each teleſcope's reticule has a motion by means of a ſcrew, to make the line of collimation parallel to the plane of the inſtrument, which is done by the help of a proof teleſcope. The circle carries, moreover, a ſix-inch axis, parallel to its plane, at a diſtance of $3\frac{1}{2}$ inches, which axis is fixed acroſs the cylinder A, at right angles; laſtly, it carries a quadrant V, to ſtop it at any elevation, which quadrant turns within a frame E of ſix inches opening, into which the counterpoiſe K may paſs when the plane of the circle is placed horizontally. Parallel to the hollow cylinder A is a tranſverſe level X, five inches long, which ſerves to adjuſt the ſtand F and the limb of the circle to be exactly vertical. The frame E over the ſtand is at the top of a hollow vertical cylinder F, which is moveable round a vertical ſteel rod placed faſt within it, and exactly turned to the length of 18 inches. At the bottom of the hollow cylinder is an azimuth or horizontal circle Y, 10 inches diameter, divided into half degrees, with a vernier which gives the minutes. This circle is indented, and the vertical rod Z, which is within reach of the hand of the obſerver, terminates with a pinion *e* which catches the circumference, and makes it turn, moving at the ſame time the hollow cylinder that ſurrounds the axis, and ſupports the frame E, on which the circle is fixed. The three feet bear on bridges which are contrived to make the motion of the ſcrews inſenſible on the axis. The ſcrew *a* raiſes a bridge *a b*, that has its bearing point at *c*; but the ſcrew of the foot bears on *d*, and by turning the ſcrew *a*, the foot is made to move on the point *d*, which, being nearer to the bearing point *c* than the extremity *b* of the lever, receives and communicates to the circle a motion leſs than that of the ſcrew *a* and the bridge *a b*. By theſe ſmall triangles, Borda has hit upon the means of avoiding the jerks which are often produced in an inſtrument by turning the ſcrew of the ſtand.

In uſing this circle for aſtronomical obſervations, the axis of the inſtrument muſt firſt be placed in a poſition nearly horizontal, by means of the ſmall quadrant V, that ſerves to incline the plane of the circle; then by uſing the ſcrews of the ſtand, ſuch a ſituation may be given to the inſtrument, that, when it makes a whole revolution round the vertical axis, the bubble of the level P will continue nearly in the middle of its tube. This precaution is very important, for it was found that 15 minutes of inclination in the plane would produce an error of two ſeconds on the inferior altitude of the pole ſtar; and that 33′ in the inclination would produce 10″; when the caſe happened, it was with ſome difficulty, that the cauſe of this diſcordance was found out. This level muſt alſo be verified by the addition of a plumb-line ſuſpended over the limb. The obſervations are always made by pairs, the one on the right of the inſtrument, and the other on the left; we ſhall therefore deſcribe them by pairs of obſervations.

Firſt obſervation of the pair.—Bring the vernier of the teleſcope B to zero of the limb and fix it faſt with the clamp; then move the whole circle by diſengaging it from the endleſs ſcrew, until the teleſcope points nearly to the ſtar obſerved; then the ſcrew H being made to catch the teeth, either this ſcrew or that of the ſtand of the inſtrument muſt be uſed to keep the thread of the teleſcope conſtantly on the ſtar obſerved; in the mean time the teleſcope D of the level behind the inſtrument is brought back to a horizontal poſition,

ſition, until the bubble be in the middle of the tube, which is done by uſing the adjuſtment ſcrew of the teleſcope; the level X is next brought back to the poſition it ought to have by means of the ſcrews of the ſtand of the inſtrument; and, laſtly, when the two levels, that of the teleſcope and that of the axis, are rightly placed, and the teleſcope is at the ſame time directed to the ſtar, the firſt obſervation is gone through.

Second obſervation.—To complete the ſecond obſervation of this pair, the inſtrument muſt be made firſt to revolve quite round its vertical axis, and the teleſcope being brought back on the ſtar, muſt be fixed by means of its fixing ſcrew, then the adjuſtment ſcrew muſt be uſed to keep it conſtantly directed to the ſtar; in the mean time the inſtrument is levelled, either with the ſcrews of the ſtand, or with the ſcrew H, to give the two levels the ſame poſition as they had before the firſt obſervation; but it is to be obſerved, that it is not neceſſary to uſe the ſame ſcrupulouſneſs for the ſmall level X, unleſs obſervations are made near to the zenith, for at a diſtance of 43° from the zenith, an error of 7 or 8 minutes in the poſition of the bubble produces only half a ſecond in the meaſured angle; but the level of the teleſcope muſt be placed as exactly as poſſible in the ſame poſition as it had originally, which will be eaſily obtained by means of the bridge *a b*; this level being thus exactly adjuſted, and its teleſcope being properly directed on the ſtar, the ſecond obſervation of the pair is gone through, and in this ſituation the vernier of the teleſcope will mark a quantity juſt double the angle required to be meaſured.

Firſt obſervation of the *ſecond* pair.—If a ſtill greater preciſion is wanted, a ſecond pair of obſervations are thus uſed; the inſtrument is brought back to its former ſituation, and the limb to the weſt; the endleſs ſcrew is detached; the whole circle is turned, and the teleſcope is again directed to the ſtar. The level is then made to turn, and the bubble brought to the middle with the adjuſtment ſcrew of the level alone, without touching the circle.

Second obſervation of the *ſecond* pair.—The circle being turned back again from weſt to eaſt, as in the ſecond obſervation of the firſt pair, the level muſt be adjuſted, and the bubble brought again to the middle by the motion of one of the feet ſcrews, or by the endleſs ſcrew H; after which the teleſcope is brought again to the ſtar, by making it paſs through double the zenith diſtance, as in the ſecond obſervation of the firſt pair; in this ſituation the vernier ſhews four times the diſtance, ſeeing that it began ſecondly at that point of the limb where the index was after the firſt pair of obſervations, in like manner as it began from zero in the firſt inſtance.

After the firſt pair of obſervations, which have given double the true zenith diſtance, are completed, the level muſt always be placed again preciſely as it was at firſt, which attention is very important when the obſervation is to be connected by a continued multiplication; for if the level ſhould be put 2″ differently, a diſtance from the zenith will be found, that being doubled, will make this ſimple error amount to 4″ more or leſs than it ought to do, ſo that the exactneſs ariſing out of the multiplication of the angle, which is the great advantage of the circle, will be counteracted.

A third pair of obſervations may be thus made, and ſix times the angle obtained, and ſo on for any number of pairs.

By this method of obſerving the angle, the error ariſing from the diviſions will continually decreaſe, and it may be conſidered as nearly annihilated after a certain number of obſervations. Six obſervations on the ſtars that revolve the moſt rapidly, may be made before they come to the meridian to the ſouth, and ſix after; and as the error in each is not 10″, the reſult may be depended upon to 1″ nearly. An expert obſerver will only want one minute and a quarter for each obſervation, ſuppoſing one perſon to be at hand to place the level, and another to note the ſecond. With the pole ſtar 48 obſervations may be made in one hour, and in one revolution the meridian altitude of this ſtar may be obtained within the accuracy of half a ſecond. For this purpoſe it is neceſſary, every time that the ſtar has been brought to the thread, to count the minute and ſeconds, to obtain its diſtance from the meridian, in order to get an account of the reduction; but it is not neceſſary to apply each reduction to the zenith diſtance which has been obſerved; it is even uſeleſs to note this diſtance, the laſt, that is, the ſum of all the preceding ones, is ſufficient.

To render this operation more intelligible, let us conſider the two firſt obſervations on the ſtar made in the two ſituations of the circle; they would give double the zenith diſtance if the ſtar had not changed; but let us ſuppoſe that one minute has elapſed between the two obſervations, and that the ſtar has aſcended 10″ during that minute; inſtead of double the zenith diſtance that would be obtained if the ſtar had not changed, we have the ſum of two diſtances, the ſecond of which is ſmaller than the firſt by 10″, if they were calculated ſeparately; the ſum found ſhould be divided into two parts, the one of which would exceed the other by 10″, and the two zenith diſtances for the two moments of obſervation would be obtained; it would beſides be eaſy to refer them immediately to the meridian.

For inſtance, let us ſuppoſe that at the moment of the firſt obſervation, we find, either by calculation, or by a table ſuch as Borda's, that the ſtar was 50″ lower than in the meridian, and in the ſecond obſervation only 40″, the ſtar having aſcended 10″ in the interval; 90″ ſhould be added to the obſerved ſum of the two zenith diſtances, this ſum ſhould be divided into two equal parts, and double the zenith diſtance in the meridian itſelf would be had; for we had two parts, the one of which was 10″ greater than the other; but 40″ were to be added to the former, and 50″ to the latter, to make them equal, hence 90″ have been added to their ſum, therefore they are equal, and half their ſum gives the diſtance ſought for, that is to ſay, the zenith diſtance in the meridian; but it is more eaſy to pay no regard to this change of altitude till after ten obſervations, or even more, are finiſhed.

When we have ten obſervations, and we take the tenth part of the amount of the degrees, we have the diſtance from the zenith, but this total is too conſiderable by ten reductions to the meridian, ſince this zenith diſtance, which is not taken in the meridian itſelf, is too conſiderable; we muſt then calculate each of thoſe reductions, and take the tenth part of their ſum, to be ſubtracted from the tenth part of the obſerved degrees, which is the ſame as if we had ſubtracted from each of the zenith diſtances the reduction belonging to itſelf.

When we take another ſeries of ten ſubſequent obſervations, we find nearly the ſame ſum; they only differ becauſe the ſum of the reductions is not the ſame as in the firſt ſet of ten.

In order to calculate the reduction of the different obſervations to the meridian, when this ſyſtem of repeating is uſed, general tables, ſuch as are contained in Caſſini's book, will be found uſeful; where an example of thoſe calculations is given at full length: there is alſo in the French "Connoiſſance des Tems," a table of reduction for the pole ſtar in particular, which is carried to 45′ from the meridian, calculated by C. Borda, the inventor of the inſtrument we have been deſcribing.

The

The repeating Circle *without reflection, as made by Troughton.*

Plate VII. exhibits the repeating circle for measuring celestial and terrestrial angles, as it has been constructed in London, on a scale of magnitude where the vertical circle is of 18 inches diameter: the construction differs in many respects from that of the instrument made in France, from the directions of Borda, and as we conceive it may be considered as an improved instrument, we think it will be rendering astronomers and surveyors an acceptable service to describe it in this place, by way of contrast with the preceding one.

Fig. 1 represents a general view of this instrument, and *fig.* 2 has the circle, index, telescopes, level, &c. detached, in order to shew more distinctly some of the smaller parts. The great letters refer to the general view, the small ones to the partial one.

The circle, A A A, consists of eight conical tubes joined to an octagonal centre piece at one end, and the strong circular border at the other: this circular limb is strengthened by another in the form of a hoop, which forms an edge bar thereto. The circle is divided into degrees and every 10′. The index B has the usual contrivance for fast and slow motion, and consists of four branches, each of which is furnished with a vernier that subdivides the limb to 10″. C is the front telescope, 25 inches long, placed at half right angles with the branches of the index, to which it is fastened near the centre; but in order that it should obey the motion of the axis alone, it has no connection whatever with the limb. The axis of this index and telescope occupies the whole length from *a* to *a*. On the back of the circle is another index D, the single branch of which carries the apparatus for fast and flow motion, and clamps to the edge bar portion of the limb, to which it is contiguous. The back telescope E, similar in every respect to the other, is fixed near the centre to this index, and as near as possible to the axis, and below it: the spirit level F is also fastened to the same index above the axis, where it forms a counterpoise to the telescope; they all revolve together round the axis of the circle on a socket, with a length of bearing equal to *b b*. The general motion, where the circle, indices, telescopes, and level, all turn round together, is formed at the posterior part of the axis of the circle, which fits the socket that crosses the horizontal axis *c*, in a bearing reaching from *c* to *d*; *e* is the flaunch of the axis on which the front telescope turns; *f* is that by which the circle is fixed to its hollow axis; the part *g* passes through the octagonal centre piece, and *h* is the flaunch of the back index. G is the counterpoise fixed upon the socket of the general motion, whereby the whole is balanced on the horizontal axis. A clamp *i* in three pieces, jointed like a watch chain, embraces a collar on the hollow axis of the circle, and is acted on by the screw *j*, by which the general motion may be clamped at pleasure. To the upper part of the clamp is fixed a cock *k*, and to the upper part of the horizontal axis is fixed a cock *l*; these two cocks are connected by a screw *m*, which, when *j* is clamped, gives slow motion to the circle, telescopes, &c. but when *j* is loose, allows a free motion.

Two microscopes appear, in the general view, looking at two opposite verniers of the index; by an easy motion round the centre, these may be turned to read off also at the other two verniers. By the semi-circle *n n n*, which is fast to the horizontal axis *o o*, the circle may be made fast in any position respecting its motion round this axis; this is done by a clamp at the lower end of one of the supporters, opposite to its fellow supporter H; on this semi-circle are three divisions, which correctly mark its two quadrants; the circle being brought into the horizontal position by means of a nice spirit level applied to its surface, and an index adjusted to the middle line, the extreme lines will shew when the plane is vertical on either side the pillar.

The azimuth motion of this instrument is formed by the pillar turning round a strong steel axis, which is fixed in the tripod, and reaches up to the top. The circle is 12 inches diameter, turns with the pillar, and is divided like the other circle; three verniers, which subdivide it to 10″, are fixed to the tripod, which, with many other parts, are too plainly exhibited in the figure to need a particular account in words.

With Borda's repeating circle without reflection, as formerly constructed, it was nearly impossible to observe bright stars and planets by day, and small stars also, because not easily distinguished one from another in the night time. To remedy this, Mr. Behrnauer of Budissin, an ingenious amateur of astronomy, proposed to Troughton, a few years since, an apparatus for stopping the telescope and level at their relative positions, similar, in some respects, to what he had before successfully applied for stopping the indices of Borda's reflecting circle. The apparatus consists of a divided semi-circle, attached to the back index, having two sliding stops, which, being set to the proper zenith distance of an object to be observed, will be touched alternately in the reverse positions by a pointer annexed to the front telescope. In the figure this semi-circle is seen at I, near which letter, one of the stopping sliders rests at about 30° of zenith distance; the pointer J is in contact with the other slider. This having fully answered the purpose, Troughton thought it would be almost equally desirable that the azimuth motion should have its stops also. For this end a small cylinder, with an obtuse point, is inclosed in a tube, which, pushed forwards by a spiral spring, enters alternately a couple of holes made opposite to each other in the edge of the azimuth circle, at 360° and 180°, and thereby produces a stop, which may be felt when the face of the vertical circle is east or west, but withdraws from the holes with a small force, and allows the instrument to turn. By these simple contrivances, the object to be observed will always be found in the field of view, without the trouble of having recourse to the divisions.

This may be regarded as a considerable improvement, not only because the bright stars may be observed by day, and faint ones by night, but also because the business of repeating or multiplying the angle will be facilitated thereby; and consequently the astronomer enabled to make a sufficient number of observations proportionally nearer the meridian.

Lastly, it may be remarked that in England there exists an ungenerous prejudice against this instrument; while on the neighbouring continent, perhaps, its value may be too much extolled. It is certain, however, that while the trigonometrical operations, between Paris and Dunkirk, for ascertaining the distance between the national observatories of England and France, or the more recent and extensive measurements of the same nature in the south of France and in Spain shall remain upon record, the repeating land circle of Borda will be estimated among the very first instruments, for the general purposes of astronomy and topography, with every one who is in the least acquainted with these subjects; to which we may add, as our concluding remark, that the alterations and additions made in this instrument by Troughton have greatly contributed to its improvement, whether we regard the accuracy or facility of its operations.

Circle, *by the Rev. Francis Wollaston, LL.B. and F.R.S.*

In a paper read before the Royal Society of London

don on May 9, 1793, and publifhed in the "Philofophical Tranfactions," Dr. Wollafton has given an account of a *tranf't circle*, which he contrived, by the affiftance of Mr. Ramfden and Mr. John Smeaton, and which was made by Mr. W. Cary of the Strand, after Mr. Ramfden and Mr. Edward Troughton had declined undertaking the conftruction under the doctor's fuperintendance. The undertaking originated from an impreffion, that an inftrument, which would at the fame time determine with precifion both the right afcenfion and declination of a heavenly object was, notwithftanding Ramfden's aftronomical circle, a defideratum in aftronomy, and though the doctor at firft intended only to fuggeft to fome one of the beft inftrument-makers the notion he had entertained of an inftrument of extenfive application in afcertaining the relative fituations of the heavenly bodies, yet, on finding that his plan was not likely to be readily adopted, he fet about the bufinefs at his own expence, and, fortunately, met with a maker whofe merit did ample juftice to the defign, notwithftanding the obftacles that occurred to impede his progrefs in the different ftages of an original conftruction. It will not be neceffary for us to accompany the doctor through all his narrative of difappointments and reafonings contained in his paper, but to felect thofe portions principally that relate to the defcription of his inftrument; which office we propofe to do in his own words, as nearly as our mode of arrangement will admit.

"The drawing accompanying this account (in *Plate* VIII. of *Aftronomical Inftruments*), will fhew the general form of the inftrument; and needs very little explanation. The whole ftands on three feet, adjuftable by fcrews, on a cylinder of one folid ftone of $25\frac{1}{2}$ inches diameter and three feet fix inches long, bedded on a pier of brick, well bonded together, and rifing from a good foundation, deep in the earth. The bottom plate, of $21\frac{3}{4}$ inches diameter, turns in azimuth, not on a long axis, but on a centre; and rides on a bell-metal circle, truly turned, and to which the bottom plate itfelf is ground. In this way it moves very fmooth by hand; but it is capable of being turned by a winch, with tooth and pinion. The intent of its turning thus is merely for the convenience of reverfing the inftrument: for, though it might be ufed out of the meridian, and for azimuths, yet, fince it is defigned principally for meridian paffages, when it is in its place the whole is clamped firmly to the bottom frame by four clamps, which confine it to the circle on which it rides: and this method of turning proves itfelf to be fteady, by the levels on the bottom plate never altering in the leaft upon fcrewing the clamps.

"The four pillars, and their braces, explain themfelves. They ftand over the bell-metal circle; and the clamps are placed near the foot of each for greater fteadinefs; fince they carry the Ys for the pivot of the tranfit.

"The conftruction of thefe Ys is peculiar: they hang, as it were, in gimmals, or gimbols, though of a very firm kind, and have a horizontal motion, fmooth and fteady: the T, or frame which carries them, turning on a perpendicular axis of $2\frac{1}{2}$ inches ground to its focket, on the outfide of the plate which connects them with the pillars, and refting on that plate to which the bottom of the frame itfelf is ground likewife. In this frame they have a vertical motion: the Ys themfelves carrying a horizontal axis, which, confifting of two frufta of cones on each fide, in contrary directions, with a collar over them, guards againft any fhake whatfoever, while it admits of the Y adapting itfelf to the direction of the pivot. The idea of hanging them in this way, as well as that of turning the whole inftrument in azimuth on a ground plate, was fuggefted by Mr. John Smeaton; to whom the world has been indebted for repeated capital improvements in mechanics.

"By thus hanging the Ys, the pivots have a bearing on them from end to end; inftead of riding on a bell-metal ridge, as is the ufual method where the Ys are fixed, and cannot fet themfelves in the direction of the axis. This feems to be a better bearing, and much lefs likely to wear the pivots.

"Yet, to guard againft any wear, a pair of cylindrical fprings, included in a tube, are applied through rings within the connecting plate above mentioned. Thefe carry, each of them, a pair of rollers, on which a brafs collar on each end of the axis of the telefcope rides. The fprings may be ufed or removed at pleafure; and they can be ftrengthened or weakened, by means of a fcrew at the bottom of the tube, fo as to take off from the pivots any part of the weight that may be judged beft: and, fince they are in a line with the axis, and are made capable of obeying it in every direction, there is no danger of their deranging its adjuftments, while they render its motion exceedingly light and fmooth indeed.

"The adjuftments of the Ys are both of them at the fame end of the axis, oppofite to the divided circle and the microfcopes; becaufe the fmalleft adjuftment of that end of the axis between the microfcopes would have affected them fo as to require an entire re-adjuftment of them too. At the farther end the axis is perforated, to admit light for illuminating the wires. The axis itfelf is 18 inches long, exclufive of the pivots, which are about $1\frac{1}{4}$ each.

"The microfcopes need no defcription. They are on the fame principle as thofe in Ramfden's inftrument, which are more fully defcribed by major-general Roy, (Phil. Tranf. vol. lxxx. p. 145.) and in captain Mudge's account of the "Trigonometrical Survey," vol. i. Lond. 1799. Mine are 9 inches long; the object-end at 2 inches from the limb of the circle. They magnify 24 times. One revolution of the micrometer-fcrew is equal to one minute; and the head is divided to feconds.

"The fixed, or ftationary wire in them, is at the firft notch, or minute itfelf; and it is adjufted by means of a plumb-line, which hangs from the top plate, and paffes by the fide of the axis; at about 8 degrees, from the centre. For this purpofe, there are dots made on the limb, at a fuitable diftance on each fide of the zero, both above and below, whether the telefcope be horizontal or perpendicular either way. Thefe are viewed through two compound microfcopes, (of $5\frac{1}{2}$ inches long, and their object-glafs at 3 inches diftance from the limb) carried by the fame frames as the other microfcopes.

"The curfor, or moveable wire, in the micrometer-microfcopes, is adjufted much in the fame way as general Roy's; excepting that the micrometer head is made to turn ftiffly on the neck of the fcrew, fo as to allow of bringing the point of zero to front the eye, without the trouble of re-adjuftment, if it happened to fall behind.

"There is, of courfe, a very fenfible level for adjufting the axis. The circle was ordered to have ten radii; that when the telefcope is horizontal, and pointing to a meridian mark, there might be a vacancy between the cones, above or below, for introducing a level. In the brace between the pillars, over the moveable Y, (at A), it may be obferved, the bottom bar is omitted, in order to give the better room for paffing the level, without inclining it, or running any hazard of ftriking it. From the lower bar of the oppofite brace B, over the fixed Y, there ftands out a forked piece of brafs, to receive the leg of the level, and direct it to its place;

place; as alfo for keeping it upright when the foot ftands on the pivot, and juft allowing a very little fhake, fo as not to cramp it. By this contrivance the level is eafily handled, and reverfed without danger of difturbing it or the inftrument.

"The top plate, as may be feen in the drawing, has a large opening cut more than half way acrofs it. The defign of this is, to allow you to obferve quite up to the zenith, and a little beyond it, clear of all obftruction whatfoever. And fince the whole inftrument is capable of being reverfed, or turned half way round in azimuth; when you have occafion to obferve the tranfit of the ftars, in that part of the heavens where they would be intercepted by the plate in one pofition, it is entirely out of the way in the other.

"The circle itfelf is of full two feet diameter at the divifions; being $25\frac{1}{2}$ inches at the edge. The undivided circle, on the fide of the telefcope next to the open end of the axis, ferves for ftrength and uniformity; and to it is applied the clamp of elevation. That clamp is fo made, as to allow the circle to run freely all round, not bearing at all againft it, but fupporting itfelf, and yet being eafily removeable. It has no command over the circle whatever, when handled with care, excepting in the altitude of the telefcope, by an adjufting fcrew when the clamp is fet: and, as that fcrew has a milled head at each end, it is as conveniently turned from the one as from the other fide of the inftrument, to bring the horizontal wire to bifect the object.

"The telefcope is of 2 inches aperture, and 33 focal length. The object glafs does not flide within the tube, but fcrews into the end of a piece of falfe tube, of 4 inches length, which flides on the outfide of the principal tube, and is fixed in its place by 3 fcrews and collars running in grooves, when its diftance from the wires is adjufted.

"In this way one has the whole aperture of the tube, and no greater length than is abfolutely neceffary for ufe, which, in fuch an inftrument, appeared to be an advantage. In fome refpects it is fo; yet the hazard of difturbing the collimation by touching the outfide of the tube is an objection.

"The wires are not in one cell, but in two diftinct cells, with their faces towards each other. The perpendicular wires are 5, at 35 feconds of time diftance in the equator, and are adjuftable horizontally for collimation by a fcrew. The horizontal wires are 3, at about 15 minutes of a degree afunder, placed fo as juft not to touch, but to pafs clear of the other wires; and they are adjuftable in collimation by another fcrew peculiar to them. The two cells have each a power of turning feparately on the axis of vifion; but when once the two fets of wires are brought to be truly at right angles to each other, the cells can then be fixed together, and turned together, and finally fettled in their place by fcrews and collars at the outfide of the tube. Thefe things, I believe (fays the Doctor) are new; I thought they might be improvements on the ufual method; yet I find the adjuftment of the horizontal wires in collimation might be difpenfed with.

"My reafon for having three horizontal wires, and at about that diftance, was, that after having afcertained what the difference is, I might obferve the lower limb of the fun or moon at the one, and the upper limb at the other of the extreme wires, without much altering the elevation of the telefcope, and removing the centre of the object, or preceding and fubfequent limbs of the fun and moon, far out of the centre of the field.

"The divifions on the circle itfelf come now to be fpoken of. They were done by hand, and have been executed with great care. The original divifions are by dots, or points, at every ten minutes. Within is another row, by ftrokes or cuts, laid off from the points to every ten minutes likewife. The dots are what we will regard firft, the cuts afterwards.

"As it always appears to me convenient, in actual obfervation, to contrive that every thing fhall do itfelf, as far as I can, and to leave the mind as well as the body at perfect eafe, and totally difengaged from calculation, I confidered that making both the microfcopes talk the fame language, read off the fame way, with the guiding figure always to the fame hand, and the dot to be obferved to the fame hand too, and the readings always pofitive, would conduce much to one's eafe, and thereby very greatly indeed to the accuracy and certainty of the obfervation.

"With this intent, fince the microfcopes are, the one above, I ordered that to be marked A; the other below, B; confidering that the numbers deduced from them could never be miftaken, if one got into the habit of examining A firft, and noting that down, and then examining and fetting B under it; which, if all things are true, ought to be the complement to 90 degrees.

"To make the reading pleafant, I ordered the micrometer-fcrew in each to be placed on the right hand, and confidered the moveable wire as always to be kept to the right hand of the other. This will, of courfe, in all cafes meafure the diftance of the fixed wire from the neareft dot apparently on the right, or, fince the microfcopes invert, the neareft dot really to the left, which will be either the degree itfelf on that hand, or fome multiple of ten minutes from it.

"That the numbering of the degrees might coincide with this idea, I confidered that the figures fhould be made to appear erect in the microfcopes in every pofition of the telefcope, which they might be whenever it does not point below the horizon, and that they fhould be reckoned backwards. To effect this, they ought to be reckoned backwards in themfelves, but to ftand the contrary way, or inverted in reality. This would be different in the two microfcopes in refpect of the centre of the circle, but that could create no difficulty. For, fince the two quadrants neareft to the object-end of the telefcope would always be thofe coming under the examination of microfcope A, and the two neareft to the eye-end, thofe to be obferved at microfcope B, they might be figured accordingly. Hence, fuppofing the inftrument placed in the meridian, with the graduated face turned towards the eaft; if, when the telefcope is horizontal, and points to the fouth, the upper quadrant neareft to the object-end be numbered from that end from 1 to 90°, with the head of the figures towards the centre of the inftrument, and the other upper quadrant be numbered from the eye-end, with the feet of the figures towards the centre, they both would give the zenith-diftances of the objects obferved. The former at microfcope A, while the telefcope points to the fouth of the zenith; the latter at microfcope B, when you are obferving towards the north.

"The two other, or lower quadrants, follow a fimilar rule, and ferve to fhew the altitudes, if both be numbered from the quadrature, inftead of either end of the telefcope; thofe leading towards the object-end being placed with their heads, while thofe towards the eye-end ftand with their feet towards the centre of the circle.

"The inftrument has a figure at every degree, that one may always be in the field of view of the microfcope. Hereby it may be feen, that all on one fide of the telefcope give zenith diftances, while all on the other fide give altitudes; and yet, that the figures in both the quadrants neareft to the object-end are placed with their heads towards the centre, and all towards the eye-end with their feet. This became neceffary; and though it was a little perplexing at firft to contrive

trive and see executed properly, it is found very convenient indeed in use.

"The interior divisions, or cuts, are also numbered at every degree each way, from the eye-end to the object end of the telescope, with the feet of the figures always towards the centre. The use of them is likewise very great, not for reading off the observations, but for setting the instrument. For, at a proper distance from the main pillars, there is a small pillar, carrying a compound microscope with a wire in its focus, which being adjustable, and once set to the latitude of the place, gives immediately the north polar distance of any object seen; or, by fixing the instrument according to the polar distance of an object sought, one is certain of its entering at the proper time the field of the telescope, near the centre wire. This pillar for the polar microscope is removable to the other side of the main pillars, which becomes necessary when the instrument is reversed.

"This in general is the form, and these are the peculiarities in the construction of this instrument, which being designed for meridian observations, or transits, I apprehend may best be named a *transit circle*.

"In observing, I always study to be as much at my ease as possible, and therefore I always sit, and use a prismatic eye-glass. To avoid touching the instrument itself, or even the stone on which it stands, I have four upright poles from the floor to the roof, with cross-braces on a level with the bottom plate of the instrument, against which I may lean while I observe, or when I handle any part of the instrument. These I find to be of great comfort and use. Against two of the poles I hang a curtain occasionally to keep off the sun, or to lessen a false light when I observe a star in the day.

"The two exterior horizontal wires, mentioned above, I find very convenient. They are really 14′, 43″, 5 of a great circle distant from the centre. By means of them I can without any hurry observe the preceding limb of the sun at 3 wires; I set the lower limb to the upper wire, and read that off; then the upper limb to the lower wire; and am ready to observe the second limb of the sun at the 3d, 4th, and 5th wires; and lastly I read off the upper limb after the observation is ended. In this way one has the meridian passage through the middle of the field, or within 2′ of it; and the meridian altitude of both the limbs, while the sun's centre is on the meridian; for the little alteration in altitude is soon done, and can disturb nothing.

"Indeed, upon the whole, this instrument itself is capable of doing a great deal of good work, and convinces me fully that one between piers would be highly advantageous to astronomy. As a transit, mine is perfect, so far as that size permits: indeed it is in fact to all intents a transit-instrument. And for altitudes, since the readings are totally independent of the circle, though you have it in your power to re-examine your microscopes by the plumb-line between each observation, if you please, you find there is no occasion for it. In that respect it has the advantage over a quadrant. No force is used in setting this instrument; the whole, from its form, is counterpoised in itself; there is no more probability of deranging it in altitude, than in azimuth, and therefore all you have to do in actual observation beyond a common transit-instrument, is to bisect the star as it passes, or as soon as ever it has passed the meridian wire, and read off the microscopes afterwards. Thus every observation is complete, by ascertaining the right ascension and altitude of every object at once, and with very little trouble, which must tend greatly to the improvement of our catalogues.

"There is one additional advantage in an instrument of this form, that you have it in your power to reverse the whole in a few minutes without any hazard, which I do regularly; because thereby you discover and destroy any errors which there may be in the instrument itself, or which may at any time arise in observing."

Portable Circular Instrument for Transits, Altitudes, and Azimuths, by Troughton.

About the year 1790 the portable astronomical quadrant began to give place to the circular instrument; previously to that year, indeed, a few circles had been made for the sole purpose of observing altitudes, but their improved state cannot be dated farther back than the time we have mentioned.

The instrument, represented in *Plate* IX. of *Astronomical Instruments*, is of the most improved kind: in the construction of which are combined the means of applying it to the various purposes of practical astronomy; namely, for observing right ascensions, declinations, azimuths, and equal altitudes; and also, to all the purposes of the most improved theodolite, and levelling instrument. It is contrived so that the joint effect injures not any particular part, but improves the strength and symmetry of the whole.

It has been made of different magnitudes, from one foot to three feet diameter; which dimensions are supposed to be the boundaries of this construction. Those of three feet, however, can hardly be called portable: fifteen and eighteen inch ones are the sizes usually made: the one under consideration partakes of both, the lower circle being fifteen, the upper one eighteen inches diameter.

This being designed for a traveling instrument, its own packing-box is intended for a pedestal, where a better cannot be procured, and may do well enough when the purposes of surveying, &c. require its presence in the field; but in the observatory it ought to be mounted upon a firm stone.

The base of this instrument is a strong tripod supported on feet screws, two only of which are seen in the figure A and B. To the centre of the tripod is fixed the axis of the azimuth motion, about sixteen inches long: in close contact with the tripod is the azimuth circle C, which is one entire plate; it is nicely centered upon the vertical axis, but only capable of being turned round through an angle of about three degrees; and for that purpose is acted on by a slow moving screw, the head of which is seen below, a little to the left of the centre. The use of this motion is for setting the telescope to the meridian, when the index of the proper azimuth motion has been previously set to zero; or it is for adjusting the instrument to the point of commencement, when horizontal angles are measured. A telescope is affixed to the lower side of the tripod having universal motion, which being set to any object, becomes a sentinel for watching the position of the instrument, and pointing out any deviation that may happen to take place during the time required in any operation. The index of the azimuth circle is also one entire plate D, having, for the sake of strength and lightness, an half contrate edge one inch deep: the middle cone E is attached to this, and centered upon the vertical axis by two inside collars nicely fitted thereto: this forms the azimuth motion, the weight resting on the centre at the lower end. The tangent screw is fastened to the index plate, and goes round with it when quick motion is required. Two microscopes opposite to each other, one of which F appears in the figure, read off the azimuth, and subdivide the graduations of the limb. On the azimuth plate are also fixed the two strong pillars G G, which support the upper circle and remaining parts. A little below the top of the vertical axis is a strong bracing bar H, which, from its connection with the centre cone and two pillars, bind them firmly together,

gether, and prevent the incumbent weight from altering the figure of the attached plate. Higher up is seen the screw apparatus I, for procuring fast and slow motion for the vertical circle; this is fixed to the right hand pillar.

The vertical circle, K, is next to be noticed: it is composed of two entire circles, being flat plates crossed out into six radii, having each a circular border, and circular centre. The centres are perforated to receive the larger ends of the cones of the transit axis. The axis has a cylindrical part in the middle, equal to the distance of two circles; and this cylinder being terminated at each end by a flaunch L, the two circles are screwed fast to it, and here form the central pillar. The two circles are otherwise bound together along the radii, and round the limb, by a number of pillars placed perpendicularly between them. The side of the divisions is overlaid with another circular border, which covers the holes which the fixing pillars occasion; this ring used to be of fine brass for dividing upon, but recently one of the more perfect metals, gold, platina, or silver, has been used for that purpose. The telescope M is thirty inches long, and of two inches aperture; it passes through the cylindrical part of the axis, to which it is attached, and nearly fills the distance between the two circles, to which it is also fastened at their extreme borders. On the middle of the cones of the axis are soldered two rings S S, at a distance from each other, exactly equal to the distance between the two pillars. Two rollers at the top of the pillars are, by the force of springs, urged upwards against the rings so as to sustain the whole weight of the axis and circle, and thereby to relieve the parts of action from being injured by unnecessary pressure. The distance of the pillars being too short for the transit axis, its length of 16 inches is firmly supported by a bar N, screwed fast to each of the pillars, extending in a line with the axis, and is terminated by a Y, or angle, in which is secured the pivot or end of the axis: the bar is braced by a prop near the Y, which joins the pillars at a distance below. Two strong tubes O are firmly connected with the left hand pillar, with their ends bent upwards; these carry two opposite reading microscopes, R, R; they are finished with adjustments, P, P, for bringing them both upon a level; but the angles whereon the axis rests may be raised or depressed, so as to bring the horizontal diameter of the circle to suit their height; an adjustment by which also the level of the axis is effected. A spirit level Q Q is seen in the figure hanging upon the bent tubes, which, after having assisted in placing the vertical axis perpendicular, remains in its place, for marking any alteration of position that may happen in either the instrument or pedestal. This level may occasionally be removed to the telescope, and there helps to verify the position of the reading microscopes. Another level applies to the horizontal axis, just within the angles, resting thereon with two forks, and passing through between the bars of the circle: with this also the vertical axis may be adjusted, but its direct use is for levelling the one to which it applies. The instrument from which our sketch was taken has no plumb-line, although this size is sometimes furnished with that apparatus. However, it is rather doubtful whether the levels are not here quite as good; for the accuracy of the plumb-line increasing in proportion to its length, seems better adapted for large instruments than for the size before us; particularly, as levels may be used as good as in those of larger dimensions. The telescope has four eye-pieces, which give it different powers; one of which having a diagonal mirror affords a convenient view of the heavens about the zenith. T is a small support for the lantern which throws light into the end of the conical axis, and illuminates the wires of the eye-piece in the usual manner.

Respecting the powers of this instrument, it may be remarked, that the limbs of both circles are divided into degrees, and every five minutes; and that the microscopes of both sub-divide to single seconds; by which means an angle may certainly be read off to two seconds. The powers of the telescope are fully equal to this quantity, and shew the pole star in bright day light: the levels, which are furnished with graduated scales, are sensible to an inclination of one second, and the adjustments being few and simple are easily rectified, and not subject to derangement.

This circle seems better adapted for the use of the private observatory, or for a gentleman travelling, than the repeating circle of Borda without reflection; the latter being destitute of the properties of the transit instrument; whereas, this is a complete one. Besides, it is of a stronger frame, easier to manage, and equally portable.

We confess we cannot but admire the portable instrument we have here described, whether we consider its various properties, its stability, its accuracy, or its beauty of figure.

The mural Transit CIRCLE *by Troughton.*

In our account of the rise and progress of astronomical instruments in the first part of our present article CIRCLE, we had occasion to remark, that Romer was the first person who applied what he called a *reticulum*, which we have translated *reticule*, in the focus of a microscope as a measure of the divisions on the limb of an instrument; we also mentioned that Horrebow fixed a *circle* in the *meridian*, read off the divisions by microscopes before the year 1735; since which time there has been much conversation in England about substituting a mural circle for a mural quadrant in an observatory; and indeed various instruments, as we have seen, have been produced, to which a desire of rendering them as extensive as possible in their uses, has generally added an azimuth circle, which has proved detrimental to the requisite steadiness of a meridian instrument; but no instrument entirely answering the description of the title we have here given has been completed, at least in England, till so lately as March of the year 1806, when Troughton, whose mind seems to have been formed by nature for the very business that he is occupied in, delivered out of his hands a mural transit circle, which is contrived to give at the same instant both the right ascension and declination of any heavenly body, by the aid of a good astronomical clock, with a degree of accuracy that probably has never before been equalled. This instrument is in the possession of Stephen Groombridge, Esq. of Blackheath, to whom we beg leave to express our obligation for his obliging permission, granted to our draftsman, of taking the perspective drawing of his circle, which is contained in *Plate* X. of *Astronomical Instruments*.

This circle, which is four feet diameter, and formed principally of hollow cones, is framed upon a strong axis three feet in length; and consists of two complete circles, fastened together in a manner sufficiently explained by the figure. The telescope A, five feet long, and three inches and a half aperture, crosses the middle of the axis, and passes between the two circles, to the bodies of which it is attached. Each of the circles has a hoop, or edge-bar, at its back, to give it strength; and is further braced by many parts, which tend to unite the two together. There also passes through the axis another tube B at right angles to the telescope; this forms part of the plumb-line apparatus to be described hereafter. The axis is supported at its extreme ends on the top of two stone piers, about five feet four inches high; the pivots of the axis rest in angles, formed in brass-work, which is cemented to the tops of the stones. The angle at the end

end to the right is acted on by a ſcrew which gives it a very ſlow motion vertically, for the purpoſe of adjuſting the axis to be horizontal; and a ſimilar ſcrew at the left angle gives a ſimilar motion for bringing the plane of the circle into the meridian. The figure of the ſtone-piers is priſmatical, and their inner ſurfaces, 27 inches apart, are parallel and perpendicular. The circle is divided on both ſides into degrees and every 5′. Upon the ends of two ſtrong horizontal bars, D, D, are fixed four micrometer microſcopes, two on each ſide, exactly in the horizontal diameters of the circles: theſe, three of which appear in the figure, ſubdivide the diviſions of the limbs to ſingle ſeconds; and are the indices by which the value of the obſervations are read off. Another microſcope, at right angles to the former, is ſeen, which paſſes through the left pier, and, from its ſituation, is ſuppoſed to be ſteadier than the other parts. It is uſeful in examining the accuracy of the diviſions, and for detecting ſmall motions in the more expoſed parts of the inſtrument. Upon the axis, half-way between the centre and pivots, are ſoldered and turned two rings; immediately below there is cemented into the inner ſurfaces of the ſtones, an apparatus which, by means of a ſpiral ſpring, incloſed in a tube or barrel E, is made to puſh up a roller againſt thoſe rings, ſo as to ſuſtain almoſt the whole weight of the circle, and thereby to relieve the pivots of the axis and the angle from unneceſſary preſſure. This work is well expoſed to view on the left ſide, but partly concealed on the right-ſide by the intervening circle.

On the inner ſurface of the pier, to the right, is fixed a frame which ſupports the uſual apparatus for quick and ſlow motion, which the figure ſufficiently explains; this in the eaſt or weſt direction is extremely pliable; but in the direction of the meridian furniſhes a ſtout reſiſtance; it is eaſily got at, when the obſerver is looking to north or ſouth, and in thoſe caſes where the milled heads are out of his reach, a jointed handle aſſiſts him very conveniently. When the inſtrument is reverſed, this apparatus engages with the oppoſite limb. A ſmall ſtool is ſhewn in the figure between the two piers, below the centre of the inſtrument; on its top is repreſented the water veſſel for the plummet to ſwing in; this veſſel may be raiſed or depreſſed an inch or more by a rack and pinion, to ſuit the length of the plumb-line. The teleſcope, being turned round to the horizontal poſition, brings the plumb-line tube B, mentioned before, into a vertical one. The plumb-wire hangs from an angle at the upper end, againſt which it is drawn into cloſe contact by the weight below, and is here conſidered as depending from a fixed point. At the lower end the main tube is croſſed at right angles by two ſmaller tubes; one of them parallel to the teleſcope, the other parallel to the axis. At one end of each is placed a luminous point, formed by a fine round hole, in a braſs pin, which is ſet in a diaphragm of mother-of-pearl; a lens in the ſame tube forms an image of the luminous point, upon the plumb-line, in the axis of the main tube. Theſe are viewed by eye-glaſſes in the oppoſite ends of the croſſing tubes, by which the plumb-line is ſeen directly paſſing through the image of the luminous point, which appears like the diſc of a ſmall planet. The tube which is parallel to the teleſcope regards the axis, and that which is parallel to the axis regards the reading microſcopes; by adjuſtments in the former, and reverſing the poſition of the inſtrument, the axis may be ſet truly level, and by ſimilar adjuſtments in the latter, and the ſame means, the reading microſcopes are brought to ſhew the true zenith diſtance. It ſhould have been mentioned, perhaps ſooner, that a ſmall pincher takes hold of the lower end of the plumb-line, the weight of which is ſufficient to paſs the wire through the main tube, having a hook at the lower end by which it is connected with the plummet. A cap ſcrews into the lower end of the main tube, furniſhed with a bolt for ſecuring the pincher, thereby preventing the plumb-line, when out of uſe, from being entangled or broken. By theſe means, the plumb-line is always in its place, ready for uſe, and the parts of the inſtrument are verified thereby in a few minutes.

The mechaniſm of the eye-piece of the teleſcope is intereſting, and in many reſpects new. The eye-glaſs, by touching a lever which is connected with a pinion, is carried along parallel to the axis, and readily ſet oppoſite any of the wires in obſerving a tranſit. This motion may in a moment be changed into a vertical one, while the upper and lower limbs of the ſun or moon are brought in contact with the declination wires. At about half the mean diameter of the ſun from the central horizontal wire, is a fixed wire on one ſide, and on the other ſide a moveable one all parallel; the latter is acted on by a micrometer ſcrew, which marks the quantity of motion by a nice graduation, croſſing the central wire a little way, but in its proper direction meaſures about 40′. By theſe contrivances, while the right aſcenſion of the ſun or moon is obſerved, without the loſs of a ſingle contact, one limb may be brought to the fixed wire, and the moveable wire ſet to the other limb, and the whole may be read off after the obſervation is finiſhed. We have ſpoken of the wires here, and elſewhere in Troughton's inſtruments, as though they were always metallic, but in many of his inſtruments he has introduced the fine threads ſpun by a ſpider, which are not only ſmaller than any other, but, what will appear remarkable, will bear the focal rays of the ſun without injury. A ſpirit level half the length of the axis, hangs upon two pivots, which project from two cocks ſcrewed faſt to the axis, on theſe it turns, and by its gravity keeps the right ſide up, and thus ſhews the level of the axis in every poſition of the teleſcope. This level does not appear in the plate, being completely hid behind the axis. Another level, ſeen in the figure, hangs upon two pivots which are attached to the eye-end of the teleſcope: this, on being brought to an horizontal poſition, will verify the adjuſtments of the microſcopes and other parts more quickly than the plumb-lines; it is not however ſo accurate. The axis is perforated, and by an illuminator placed at a proper angle in the centre, the light of a lamp placed oppoſite one end of the axis is reflected to the eye, and ſhews the wires by night. The quantity of light is regulated by letting it paſs through glaſſes differently coloured. Other parts, (ſuch as the circular plates at the object-ends of the microſcopes, furniſhed with univerſal motion, for illuminating the diviſions of the limbs), moſtly common to all inſtruments, are ſeen in the figure, but do not require particular notice.

In an obſervatory where there is but one inſtrument, the one under conſideration ſeems to be the beſt, though aſtronomers are not quite agreed upon this ſubject, ſome thinking, that the right aſcenſion, and declination inſtruments ſhould ever be ſeparate; they all, however, confeſs now, that, in an obſervatory, the azimuth circle is of little value.

It is reported that a large mural tranſit circle is in contemplation for Greenwich, (where, when there are two obſervers, it cannot be wanted) which promiſes to be greatly ſuperior, for the purpoſe of obſerving the declinations of the heavenly bodies, to any that has yet been ſeen; but this has not yet been even ordered, and therefore cannot now be given; ſhould it however be executed, we may hereafter

hereafter present our readers with its figure and description under the article *Observatory*, or some other appropriate title.

In our description of this our last instrument, coming under the denomination of a CIRCLE, we have judged it expedient to omit the letters of reference, except in three instances, partly because the figure being already sufficiently crowded would thereby be rendered less distinct, and partly because the reader, who has perused the accounts of the other circles, cannot but understand the parts that have been verbally described, when he has the figure before him, and therefore will not be sorry to dispense with a long alphabetical enumeration of the different parts. It may be proper to subjoin, before we take our leave of the subject, that, as there is no azimuth circle in the instrument at present before us, the *reversed* adjustment and *reversed* observation are effected, by carefully lifting the whole circle out of the angles of bearing, and returning it when the ends of the axis are reversed; which is a more certain way of making the second position of the telescope at 180° from the former, than can be expected by any method that requires measurement, even when a distant object is viewed as a mark; for a deviation of the central wire from the true line of collimation, may escape notice, and deceive the observer.

In the Philosophical Transactions of London, for the year 1806, is a description of an astronomical circle of John Pond Esq. of Westbury, as made for him by Troughton; with which instrument, aided by Dr. Hamilton's observations at Armagh, and Piazzi's at Palermo, he has corrected the declinations of many stars as given in Dr. Maskelyne's Catalogue published in 1802. The account is copied by Mr. Nicholson in his Journal for March 1807, but without the table of observations, as annexed in the original.

Another of Troughton's astronomical circles may also be seen described in Count Bruhl's pamphlet, entitled "On the Investigation of astronomical Circles," which is an interesting publication.

If it should be remarked by any of our readers, that we appear to have been partial to Troughton, in our selection of circular instruments, our answer is, that we have found in him not only a very intelligent, but a communicative man, who, moreover, was ever ready to procure access to our draftsman to the instruments we wanted, though not in his own possession: besides, when we consider that his instruments are not only made in the most perfect manner, but have never before been described, we presume the public will thank us and him, for the opportunity we here give the world of being acquainted with the characteristic marks of their construction. With respect to ourselves, we cannot in justice do less than publicly thank Mr. Troughton for the aid he has afforded us in this article, which, however, we should have withheld from motives of delicacy, did we not conceive that his well earned fame soars far above the reach of any support of ours.

CIRCLE, CIRCULUS, in *Geometry*, a plane figure, comprehended under one single line, which returns into itself, having a point in the middle, from which all the lines, drawn to its circumference, and called radii, are equal.

Properly speaking, it is the space included within the circumference, or periphery, that is the circle: though in the popular use of the word, circle is frequently used for the periphery alone. See CIRCUMFERENCE and DEGREE.

We shall here introduce some of the chief properties of the circle, referring for others to the articles ANGLE, CHORD, CIRCUMFERENCE, DIAMETER, POLYGON, SINE, TANGENT, TRAPEZIUM, &c.

1. Any two chords of a circle, equally distant from its centre, are equal to each other. Let O (*Plate* III. *Geometry*, *fig.* 49.) be the centre, A B and D E two chords; and having let fall the perpendiculars, O C, O F, draw the radii O A and O D. The triangles, O F D and O C A, have evidently the sides and angles equal; and therefore A C or $\frac{1}{2}$ A B (see CHORD) = F D or $\frac{1}{2}$ D E: consequently A B = D E.

2. The angle B D C (*fig.* 50.) at the centre of a circle is double of the angle B A C at the circumference, when both stand upon the same arc, B C. Drawing the diameter, A D E, it is plain (No. 1.) that, as the angles at the base of an isosceles triangle are equal, and the external angle of a triangle is equal to both the internal and opposite angles, B D C is = A + C = 2A. In No. 2. B D E = 2B A E, and E D C = 2E A C, ∵ by addition B D C = 2B A C. In No. 3 C D E = 2C A E, and B D E = 2B A E, ∵ by subtraction B D C = 2B A C.

Hence, 3. All angles in the same segment of a circle, or standing upon the same arc, whether that segment be greater or less than a semicircle, are equal to each other.

4. Angles D, G, (*fig.* 51.) in the circumferences, standing upon equal subtenses, A B, E F, of circles, having equal diameters, are equal to each other; and *vice versâ*. From the centres, P and Q, draw the radii P A, P B, and Q E, Q F. Since A B = E F, and the radii are equal, the triangles, A P B, E Q F, are mutually equilateral, and consequently equiangular; ∵ P = Q, and D = $\frac{1}{2}$ P = $\frac{1}{2}$ Q = G. Moreover, D being supposed = G, P will be equal to Q, and the two triangles, A P B and E Q F, having two sides and the included angles respectively equal, have A B = E F.

5. The angle, A C B, (*fig.* 52.) in a semicircle is a right angle. For, drawing the diameter, A C D = $\frac{1}{2}$ A D E (by art. 2.) and B C D = $\frac{1}{2}$ B D E; ∵ A C B = $\frac{1}{2}$ A D E + $\frac{1}{2}$ B D E = half two right angles = one right angle.

6. If two lines, D E B, C E A, intersect each other within or without a circle, the angle, D E C, (*fig.* 53.) is equal, in the former case, to the sum, and in the latter, to the difference of two angles in the circumference, standing on the two arcs intercepted by those lines. Draw the chord, C B; and, *first*, D E C, the external angle, = D B C + A C B, the sum of the two internal angles; and, *secondly*, D E C, one of the internal angles, = D B C − A C B, the difference of the external angle and the other internal angle. Hence, an angle formed below or above the circumference of a circle, is greater or less than an angle in the circumference, standing on the same arc.

7. If an oblique-angled triangle, A C B, (*fig.* 54.) be inscribed in a circle, its vertical angle, A B C, will be greater or less than a right angle, by the angle C A D, comprehended under the base A C, and the diameter, A D, drawn from the extremity of the base. For, drawing B D, A B D will be a right angle, and C A D = C B D (by art. 3.); ∵ 1st, A B C = a right angle + C A D, and, 2dly, A B C = a right angle − C A D.

8. Inscribe a quadrilateral, A B C D, (*fig.* 55.) in a circle, and produce the side, B C, out of it, and the external angle, E C D, will be equal to the opposite internal angle, B A D. Draw the diameter, and join A F and C F; then the angle, B A F, in a semicircle, being a right angle (= B C F) = E C F, also a right angle, and D A F = D C F (by art. 3.); we shall have the remainders B A D and E C D equal. Hence it follows, that the opposite angles, B A D, B C D, of a quadrilateral inscribed in a circle, are, together, equal to two right angles; for B A D being = E C D, we shall have B A D + B C D = E C D + B C D = two right angles. Hence also, if the opposite angles of a quadrilateral be equal to two right angles, a circle may be described about that quadrilateral. Hence, also, it appears, that

that no oblique-angled parallelogram can have a circle deſcribed about it; becauſe its oppoſite angles being equal, their ſums muſt together, be either greater or leſs than two right angles.

9. The right lines, BE, CE, and BF, CF, (*fig.* 56.) drawn by pairs from two points, B and C, at equal diſtances in the ſame diameter from the centre of a circle, to meet in the circumference; the ſums of the ſquares of any two correſponding ones will be reſpectively equal. For, drawing OE and OF, $BE^2 + CE^2 =$ (ſee TRIANGLE) $2BO^2 + 2OE^2 \; (2OF^2) = BF^2 + CF^2$. Hence, $BE^2 + CE^2 = AC^2 + CD^2$. For, $BE^2 + CE^2 = 2BO^2 + 2OE^2 = 2AO^2 + 2OC^2$. But $AC^2 + CD^2 = \overline{AO + OC}^2 + \overline{AO - OC}^2 = AO^2 + OC^2 + 2AO \times OC + AO^2 + OC^2 - 2AO \times OC = 2AO^2 + 2OC^2 = BE^2 + CE^2$.

10. If two lines, AB, CD, (*fig.* 57.) terminated at each extremity by the circumference, interſect each other within a circle, the rectangle $AP \times BP$, under the parts of the one, will be equal to the rectangle, $CD \times DP$, under the parts of the other. If one line paſſes through the centre, (No. 1.) and OQ be drawn perpendicular to the other line, then, joining O and C, $QC = QD$ (ſee CHORD), and $DP = CQ - PQ$; but the rectangle under the ſum and difference of the two ſides, OC, OP, of any triangle, COP (ſee TRIANGLE), is equal to the rectangle under the whole baſe, CP, and the difference of its two ſegments; conſequently, ſince $OC + OP = OA + OP = AP$, and $OC - OP = OB - OP = BP$, the rectangle $AP \times BP = CP \times DP$. If neither of the two lines paſs through the centre (No. 2.), draw the diameter, EPF, and, by the former caſe, $AP \times BP = FP \times EP = CP \times DP$.

11. If two lines, AP, CP, (*fig.* 58.) be drawn from two points, A, C, in the circumference of a circle, and produced to meet without the circle, the rectangle, $AP \times BP$, contained under the whole and external part of the one will be equal to the rectangle, $CP \times DP$, contained under the whole and external part of the other. Draw PF through the centre, make OQ perpendicular to AP, and join A and O: then the rectangle $PF \; (= PO + OA) \times PE \; (= PO - OA)$ is $= AP \; (= PQ + QA) \times PB \; (= PQ - QA)$. In the ſame manner, $PF \times PE = CP \times DP$: conſequently $AP \times BP = CP \times DP$. Hence, if PS be a tangent at S, and the radius, OS, be drawn; it follows, ſince $PF = PO + OS$, and $PE = PO - OS$, that $PS^2 \; (= PF \times PE) = PC \times PD$. Hence, alſo, if another tangent, PT, be drawn, and the radius, OT, PT will be $= PS$, *i. e.* two tangents drawn from the ſame point to the ſame circle are equal, becauſe the two triangles, POT, POS, are right-angled, and have two ſides of the one equal to two ſides of the other.

12. If a line, CA, (*fig.* 59.) be drawn from C, the centre of a circle, to a point, A, in any chord, BD, the ſquare of that line, together with the rectangle contained under the two parts of the chord, will be equal to the ſquare of the radius of the circle. Let EAF be another chord perpendicular to CA, and C, E be joined. Since $EA = AF$ (ſee CHORD), $AE^2 = AE \times AF = AB \times AD$ (art. 10.); and, adding to each quantity AC^2, we ſhall have $CE^2 \; (= CA^2 + AE^2) = AB \times AD + AC^2$. Hence it follows, that the ſquare of a line, CA, drawn from any point in the baſe of an iſoſceles triangle, BCD, to the oppoſite angle, together with the rectangle of the parts of the baſe, is equal to the ſquare of one of the equal ſides of the triangle.

13. The rectangles contained under the correſponding ſides of equiangular triangles, ABC, DEF, (*fig.* 60.) taken alternately, are equal; *i. e.* $AB \times DF = AC \times DE$. Produce BA, take $AG = DF$, and let the circumference of a circle paſs through the three points, B, C, G, and meet CA produced in H, and G, H be joined. The triangles, GAH and DEF, having the angle $H = B$ (ſtanding upon the ſame arc) $= E$, and $HAG = BAC$ (as vertical) $= D$, and the ſide $AG = DF$, we have alſo $AH = DE$; and therefore $AC \times DE = AC \times AH = AB \times AG = AB \times DF$.

14. The rectangle under the two ſides AC, BC, of any triangle ABC (*fig.* 61.) is equal to the rectangle under CD, perpendicular to its baſe, and the diameter, CE, of the circumſcribing circle. For, B and E being joined, the angles, A and E, will be equal, and ADC, EBC, are both right angles; conſequently the triangles, ACD, ECB, are equiangular; and, as AC and EC, CD and CB are correſponding ſides, the rectangle $AC \times CB = EC \times CD$, by the laſt article.

15. The rectangle of the two diagonals, AC, BD, of any quadrilateral, ABCD (*fig.* 62.), inſcribed in a circle, is equal to the ſum of the two rectangles, $AB \times DC$, $AD \times BC$, contained under the oppoſite ſides. Draw BF, and make the angle $CBF = ABD$. The triangles, CBF, DBA, are evidently equiangular, and the rectangles, $BC \times AD$, $BD \times CF$, under the correſponding ſides, taken alternately, are equal. The triangles ABF and BDC are alſo equiangular, and the rectangles $AB \times DC$, and $BD \times AF$ are equal, as before: to theſe latter rectangles let the former be reſpectively added, and we ſhall have $AB \times DC + BC \times AD = BD \times AF + BD \times CF = BD \times AC$. We are indebted to Ptolemy for the knowledge of this property, applied to the conſtruction of his table of arcs and chords.

16. A perpendicular, CD (*fig.* 63.) let fall from the right angle upon the hypothenuſe, AB, of a right-angled triangle ABC, will be a mean proportional between the two ſegments, AD, BD, of the hypothenuſe; and each of the ſides, containing the right angle, will be a mean proportional between its adjacent ſegment, and the whole hypothenuſe. For the triangles BDC, BCA are equiangular, as are alſo ADC, ABC, and ADC, BDC; conſequently, as the correſponding ſides of equiangular triangles are proportional, $BD : CD :: CD : AD$; $AB : BC :: BC : BD$; and $AB : AC :: AC : AD$. Hence it follows, and alſo by art. 5, that, if from any point C, in the circumference of a ſemicircle, a perpendicular, CD, be let fall upon the diameter AB, and two chords, CA, CB, be drawn from the ſame point, C, to the extremities of that diameter, the ſquare of the ſaid perpendicular will be equal to a rectangle, under the two ſegments of the diameter; and the ſquare of each chord will be equal to a rectangle under the whole diameter, and its adjacent ſegment; *i. e.* $CD^2 = BD \times AD$, $BC^2 = AB \times BD$, and $AC^2 = AB \times AD$. The firſt of theſe properties gives us what is uſually called "the equation of the circle:" for, if d denote the diameter AB, x the abſciſs AD, and y the ordinate CD, we ſhall have $y^2 = x \times \overline{d - x} = dx - x^2$. Hence it alſo follows, that if another chord, AE, be drawn, and a perpendicular, EF, be let fall upon the diameter, the ſquares of the chords will be as the ſegments of the diameter; *i. e.* $AD : AF :: AC^2 : AE^2$, for $AC^2 = AB \times AD$, and $AE^2 = AB \times AF$, $\because AC^2 : AE^2 :: AB \times AD : AB \times AF :: AD : AF$.

17. If a line PFC, (*fig.* 64) be drawn perpendicular to

to the diameter A D of a circle, and any line be drawn from A to interfect the circle and perpendicular; the rectangle of the diftances of the points of interfection from A will be equal to the rectangle of the diameter, and the diftance of the perpendicular from A; *i. e.* $AB \times AC = AP \times AD$. For, if B D be drawn, the triangles A B D, A P C, having the angle at A common, and the angles at P and B right, are equiangular and fimilar; confequently $AD : AB :: AC : AP$, and $AD \times AP = AB \times AC$. Hence, if P F interfects the circle in K, $AB \times AC = AK^2$; and if more lines be drawn, all the rectangles $EA \times AF$, $BA \times AC$ are equal, becaufe they are all refpectively equal to the rectangle $AD \times AP$.

18. If, in a circle E D F (*fig.* 65), whofe centre is C, and radius C E, the points B, A, be fo placed in the diameter produced, that C B, C E, C A, be in continual proportion, two lines, B D, A D, drawn from thefe points to any point in the circumference of the circle, will always be in the given ratio of B E to A E. For, drawing D P perpendicular to the diameter E F, $DP^2 = EP \times PF$ (art. 16) $= 2CE \times EP - EP^2$; whence $AD^2 = \overline{AE + EP}|^2 + PD^2 = AE^2 + EP^2 + 2AE \times EP + 2CE \times EP - EP^2 = AE^2 + 2CE \times EP + 2AE \times EP$. Alfo $BD^2 = \overline{BE - EP}|^2 + PD^2 = BE^2 - 2BE \times EP + EP^2 + 2CE \times EP - EP^2 = BE^2 + 2CE \times EP - 2BE \times EP$. But C A, CE, and C B, are in continued proportion, therefore $AE : CE :: EB : CB$, or $AE : EB :: CE : CB$. Alfo, $AE^2 : EB^2 :: CE^2 : CB^2 :: CA : CB :: CE + AE : CE - EB :: 2CE \times EP + 2AE \times EP : 2CE \times EP - 2EB \times EP$. And $AE^2 : EB^2 :: AE^2 + 2CE \times EP + 2AE \times EP : EB^2 + 2CE \times EP - 2EB \times EP :: AD^2 : BD^2$. Confequently, $AE : EB :: AD : BD$.

19. If any chord, P Q, (*fig.* 66), be drawn parallel to the diameter A B of a circle, and from a given point C, in that diameter, the lines C P, C Q, be drawn to the extremities of the chord; the fum of the fquares of thefe lines is equal to the fum of the fquares of the fegments of the diameter; *i. e.* $CP^2 + CQ^2 = AC^2 + CB^2$. For, drawing P S, Q R perpendicular to the diameter AB, we fhall have PS^2, or $QR^2 = PC^2 - SC^2 = QC^2 - RC^2$, *i. e.* $PC^2 - \overline{SO + OC}|^2 = QC^2 - \overline{SO - OC}|^2$; or $PC^2 - SO^2 - 2SO \times OC - OC^2 = QC^2 - SO^2 + 2SO \times OC - OC^2$, becaufe $OR = OS$. Confequently $PC^2 = QC^2 + 4\overline{SO \times OC}$; but $AC^2 + CB^2 = \overline{AO + OC}|^2 + \overline{AO - OC}|^2 = 2AO^2 + 2OC^2$. But $PC^2 = AO^2 + OC^2 + 2SO \times OC = QC^2 + 4\overline{SO \times OC}$. Confequently, $QC^2 = AO^2 + OC^2 - 2\overline{SO \times OC}$, and $PC^2 = AO^2 + OC^2 + 2\overline{SO \times OC}$; $\because PC^2 + QC^2 = 2AO^2 + 2OC^2 = AC^2 + CB^2$.

N. B. It will be the fame, if the point C be taken without the circle.

20. The circle is the moft capacious of all plain figures, or it contains the greateft area within the fame perimeter, or it has the leaft perimeter about the fame area; being the limit and laft of all regular polygons, having the number of its fides infinite. See POLYGON.

21. The area of a circle is always lefs than the area of any regular polygon circumfcribed about it, and its circumference always lefs than the perimeter of the polygon. But on the other hand, its area is always greater than that of its infcribed polygon, and its circumference greater than the perimeter of the faid infcribed polygon. Neverthelefs, the area and perimeter of the circle approach nearer and nearer to thofe of the two polygons, as the number of their fides increafes; the circle being always limited between the two polygons.

22. The area of a circle is equal to that of a triangle whofe bafe is equal to the circumference, and altitude equal to the radius. *N. B.* This was firft demonftrated by Archimedes in his treatife entitled Κυκλου Μετρησις, or Circuli Dimenfio.—Prop. I. Or, the area of a circle, *e. g.* A C E (*fig.* 67.) is equal to a rectangle, O R S T, under its radius O R, and a right line, O T, equal to half the circumference. It is evident, in the firft place, that the propofed rectangle, O R S T, is greater than any polygon, A B C D E F, that can be defcribed in the circle; for, drawing O A, O B, &c. and alfo O v perpendicular to A B, it is plain, that the triangle A O B ($Ov \times \frac{1}{2} AB$) will be lefs than $OA \times \frac{1}{2} AB$, or $OR \times \frac{1}{2} AB$. In the fame manner, B O C is lefs than $OR \times \frac{1}{2} BC$, &c. Confequently, the whole polygon A B C D E F is lefs than $OR \times \frac{1}{2} AB + OR \times \frac{1}{2} BC$, &c.; that is, lefs than a rectangle (Om) under O R and Op = half the perimeter ($AB + BC + CD$, &c.) But this rectangle Om is itfelf lefs than O S, becaufe Op (half the perimeter of the polygon) is lefs than O T (half the circumference of the circle). Confequently, the polygon A B C D E F is lefs than the rectangle O S. But it will apppear, in the fecond place, that the fame rectangle O R S T is lefs than any polygon H I K L M N that can be defcribed about the circle: for, if O H, O I, &c. be joined, and the radius O P be drawn to the point of contact of H I, then the triangle H O I will be $= OP \times \frac{1}{2} HI = OR \times \frac{1}{2} HI$. In the fame manner, $IOK = OR \times \frac{1}{2} IK$, &c.; and, therefore, the whole polygon H I K L M N $= OR \times \frac{1}{2} HI + OR \times \frac{1}{2} IK$, &c. = a rectangle ($On$) under O R and Oq = half the perimeter ($HI + IK + KL$, &c.), which rectangle is, manifeftly, greater than O S, fince Oq (= half the perimeter of the polygon) is greater than O T. Hence, therefore, as the rectangle O S is greater than any polygon that can be infcribed in the circle, and lefs than any polygon that can be defcribed about it; it muft be equal to the circle itfelf.

Hence, in order to find the area of a circle, half the circumference is to be multiplied into half the diameter, or the whole circumference into the whole diameter and a fourth part of the product be taken.

This rule may be otherwife demonftrated, by the aid of fluxions. Put r = the radius AC, (*fig.* 68.) c = the whole circumference A E B A, or any part of it, and x = the radius C D of a circle continually expanded. Then $\frac{c}{r} x\dot{x}$ will exprefs the fluxion of the whole circle or fector whofe circumference is c; and, confequently, $\frac{cxx}{2r}$ = the area C D F; and $\frac{1}{2} cr$ = the area C A E of the whole circle or fector accordingly. Otherwife, multiply the fquare of the diameter by .7854, and the product will be the area. For the proof of this rule it fhould be obferved, that all circles, being fimilar figures, are as the fquares of their diameters, (fee next article); confequently, by the preceding article, the area of a circle whofe diameter is 1, is $\frac{1 \times 3.14159, \&c.}{2 \times 2 = 4} = .78539$, &c.; whence $1^2 : d^2$ (the fquare of any diameter) :: .78539, &c. : .78539 d^2, the area of the circle, whofe diameter is d. Hence, and from the next article, fuppofing D the diameter, C the circumference, and A the area of any circle, and p = 3.14159, &c. we may deduce the following equations: *viz.*

2. D

$$1.\ D = \frac{C}{p} = \frac{4A}{C} = 2\sqrt{\frac{A}{p}}.$$

$$2.\ C = pD = \frac{4A}{D} = 2\sqrt{pA}.$$

$$3.\ A = \frac{pD^2}{4} = \frac{C^2}{4p} = \frac{DC}{4}.$$

$$4.\ p = \frac{C}{D} = \frac{4A}{DD} = \frac{CC}{4A}$$

Hutton's Menſ. p. 128, &c.

Other rules may eaſily be formed by aſſuming different numbers for expreſſing the proportion of the diameter to the circumference. See each of theſe articles.

23. All circles, like other ſimilar plane figures, are to one another as the ſquares of their diameters or radii. Let A C E and *ace* (*fig.* 69) be two circles, and they will be as the ſquares of their radii, or AO^2 to ao^2. Let Q be to the circle *ace* :: $AO^2 : ao^2$; and Q = circle A C E. For, *firſt*, it is evident, that Q is greater than any polygon A B C D E F that can be inſcribed in the circle A C E; becauſe, if another polygon, *abcdef*, ſimilar to it, be inſcribed in the circle *ace*; then we ſhall have the polygon A B C D E F : polyg. *abcdef* (:: $AO^2 : ao^2$) :: Q : circle *ace*; but the firſt conſequent being leſs than the ſecond, the firſt antecedent A B C D E F muſt be leſs than the ſecond Q. In the ſame manner it will appear, that Q is leſs than any polygon H I K L M N that can poſſibly be deſcribed about the circle A C E; for deſcribing another ſimilar polygon *hiklmn* about the circle *ace*, we ſhall have H I K L M N : *hiklmn* (:: $AO^2 : ao^2$) :: Q : circle *ace*; but the firſt conſequent is greater than the ſecond, and, therefore, the firſt antecedent muſt be greater than the ſecond Q. Conſequently, as Q is greater than any polygon that can be inſcribed in the circle A C E and leſs than any polygon that can be deſcribed about it, it muſt be equal to the circle: whence A C E : *ace* :: $AO^2 : ao^2$. According to Archimedes, the area of the circle is to the ſquare of the diameter, as 11 to 14, or, more nearly, as .7854 to 1; or ſtill more nearly, as

.7853981633,9744830961,5660845819,8757210492, 9234984377,6455243736,1480769541,0157155224, 9657008706,3355292669,9553702162,831807666, 7734611 + to 1; as it has been found by modern mathematicians. Dr. Wallis's "Arithmetic of Infinites" contains the firſt infinite ſeries for expreſſing the ratio of a circle to the ſquare of its diameter: *viz.*

1ſt. The circle is to the ſquare of its diameter

$$\left.\begin{array}{l} \text{As 1 to } \dfrac{3 \times 3 \times 5 \times 5 \times 7 \times 7,\ \&c.}{2 \times 4 \times 4 \times 6 \times 6 \times 8,\ \&c.} \\ \text{Or 1 to } \dfrac{9}{8} \times \dfrac{25}{24} \times \dfrac{49}{48},\ \&c. \end{array}\right\}\ \text{found out by Wallis himſelf.}$$

$$\text{Or as 1 to } 1 + \cfrac{1}{2 + \cfrac{9}{2 + \cfrac{25}{2 + \cfrac{49}{2 \times \&c.}}}}, \text{ by lord Brounker;}$$

$$\text{Or as } 1 - \frac{1}{2 \times 3} - \frac{1}{2 \times 4 \times 5} - \frac{1 \times 3}{2 \times 4 \times 6 \times 7} - \frac{1 \times 3 \times 5}{2 \times 4 \times 6 \times 8 \times 9}, \&c. \text{ to 1, by ſir Iſaac Newton;}$$

$$\text{Or as } 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11}, \&c. \text{ to 1, by Gregory and Leibnitz:}$$

and many other forms of ſeries have been invented by different authors, for expreſſing the ſame ratio between the circle and the circumſcribed ſquare. See QUADRATURE.

24. The circumferences of all circles, *e. g.* A B C D, *abcd* (*fig.* 70.) are in the ſame proportion as their diameters, or their radii, O B, *ob*. Let O E, *oe*, be ſquares on the radii O B, *ob*; and let O G, *og*, be two rectangles contained under the ſame radii and right lines O H, *oh*, reſpectively equal to the ſemi-circumferences A B C, *abc*. Then, theſe rectangles being equal to the circles themſelves, we ſhall have O E : O G :: *oe* : *og*. The baſes alſo, O C, O H, *oc*, *oh*, are in the ſame ratio; whence (by equality and alternation) O C (O B) : *oc* (*ob*) :: O H : *oh* :: 2 O H (circumference A B C D) : 2 *oh* (circumference *abcd*.) As the areas of circles are proportional to the rectangles of their radii and circumferences, the quadrature of the circle would be effected by the rectification of its circumference; or in other words, if the length of the circumference could be accurately aſcertained, the true area might alſo be found. Many attempts have been made, in the way of approximation, to accompliſh this object, and different reſults, aproaching nearer and nearer to the truth, have been obtained from different proportions of the diameter to the circumference: but, after all, the determination of the true area of the circle has been generally thought impracticable. For an account of what has been done in this way by ancient and modern mathematicians, ſee the articles DIAMETER, CIRCUMFERENCE, QUADRATURE, and RECTIFICATION.

Beſides the foregoing well-known properties of the circle, it may not be improper to give the formations of the following very beautiful, general, and intereſting theorems reſpecting it, which were publiſhed at Edinburgh in 1746, by the late Dr. Matthew Stewart, the ſucceſſor of Mr. Maclaurin, without demonſtrations, and remained ſo for a period of 59 years, till 1805, when they were not only demonſtrated by James Glenie, eſq. A.M. F.R.S. Lond. and Edin. in a paper printed in the "Philoſophical Tranſactions of the Royal Society of Edinburgh," for that year, but alſo derived as mere corollaries from a general geometrical inveſtigation delivered by him in the ſaid paper. They are the following:

Let there be any regular figure of a greater number of ſides than three circumſcribed about a circle, and from any point in the circumference of the circle let there be drawn perpendiculars to the ſides of the figure; twice the ſum of the cubes of the perpendiculars will be equal to five times the multiple of the cube of the ſemi-diameter of the circle by the number of the ſides of the figure. Thus, if n denote the number of the ſides of the figure, and r the radius or ſemi-diameter of the circle, twice the ſum of the cubes of theſe perpendiculars will be equal to $5nr^3$.

Let there be any regular figure circumſcribed about a circle of a greater number of ſides than three, and from any point within the figure let there be drawn perpendiculars to the ſides of the figure, and likewiſe let there be drawn a right line to the centre of the circle; twice the ſum of the cubes of the perpendiculars drawn to the ſides of the figure, will be equal to twice the multiple of the cube of the ſemi-diameter of the circle by the number of the ſides of the figure, together with thrice the multiple by the ſame number of the ſolid, whoſe baſe is the ſquare of the line drawn to the centre, and altitude the ſemi-diameter of the circle.

Thus, if n denote the number of the ſides of the figure, and l the line drawn from the point within the figure to the

centre

centre of the circle, twice the ſum of the cubes of theſe perpendiculars will be equal to $2nr^3 + 3l^2r$.

Let there be any regular figure inſcribed in a circle, and from all the angles of the figure let there be drawn right lines to any point in the circumference of the circle; the ſum of the fourth powers of the chords will be equal to ſix times the multiple of the fourth power of radius, or the ſemidiameter of the circle, by the number of the ſides of the figure.

Let there be any regular figure inſcribed in a circle, and from all the angles of the figure and the centre of the circle let there be drawn right lines to any point; the ſum of the fourth powers of the lines drawn from the angles of the figures, will be equal to the multiple by the number of the ſides of the figure of the fourth power of the ſemi-diameter of the circle, together with four times the multiple by the ſame number of the fourth power of the line, whoſe ſquare is equal to the rectangle contained by the ſemi-diameter and the line drawn from the centre, together with the multiple by the ſame number of the fourth power of the line drawn from the centre.

Let there be any regular figure of a greater number of ſides than four circumſcribed about a circle, and from any point in the circumference of the circle, let there be drawn perpendiculars to the ſides of the figure; 8 times the ſum of the fourth powers of the perpendiculars will be equal to 35 times the multiple by the number of the ſides of the figure, of the fourth power of the ſemidiameter of the circle.

Let there be any regular figure of a greater number of ſides than four circumſcribed about a circle, and from *any point* let there be drawn perpendiculars to the ſides of the figure, and likewiſe a right line to the centre of the circle; 8 times the ſum of the fourth powers of the perpendiculars will be equal to eight times the multiple by the number of the ſides of the figure of the fourth power of the ſemidiameter of the circle, together with 24 times the multiple by the ſame number of the fourth power of the line, whoſe ſquare is equal to the rectangle contained by the ſemidiameter, and the line drawn to the centre, together with 3 times the multiple of the fourth power of the line drawn to the centre of the circle by the number of the ſides of the figure.

And in general, let there be any regular figure circumſcribed about a circle; and let the number of the ſides of the figure be n, and let m be any number leſs than n; let r be the ſemidiameter of the circle; and from any point in the circumference of the circle let there be drawn perpendiculars to the ſides of the figure, the ſum of the m powers of the perpendiculars will be equal to $n \times \frac{1 \cdot 3 \cdot 5 \cdot 7 \cdot \cdot \cdot 2m - 1}{1 \cdot 2 \cdot 3 \cdot 4 \cdot \quad \cdot \cdot \cdot \cdot m}$ $\times rm$, in which expreſſion the numbers in the numerator are to be continued, till the laſt number be equal to $2m - 1$ and are to be continually multiplied into one another, and thoſe in the denominator are to be continued till the laſt number be m, and are to be continually multiplied into one another.

Let there be any regular figure circumſcribed about a circle, and let n be the number of the ſides of the figure; let m be any number leſs than n, and let r be the ſemidiameter of the circle; and from any point (within the figure, if m be an odd number, but if even from any point either within or without) let there be drawn perpendiculars to the ſides of the figure; and likewiſe let there be drawn a right line to the centre of the circle, and let v be the line drawn to the centre; let a be the co-efficient of the third term of a binomial raiſed to the m power, b the co-efficient of the fifth term, c the co-efficient of the ſeventh term, and ſo on; the ſum of the m powers of the perpendiculars will be equal to $nr^m + nAv^2r^{m-2} \times nBv^4r^{m-4} \times nCv^6r^{m-6} \times$, &c. ſubſtituting A for $a \times \frac{1}{2}$, B for $b \times \frac{1.3}{2.4}$, C for $c \times \frac{1 \cdot 3 \cdot 5}{2 \cdot 4 \cdot 6}$ and ſo on.

Let there be any regular figure inſcribed in a circle, and let the number of the ſides of the figure be n, and let m be any number leſs than n; let r be the ſemi-diameter of the circle; and from all the angles of the figure let there be drawn right lines to any point in the circumference of the circle; the ſum of the $2m$ powers of the chords will be equal $n \times \frac{1 \cdot 3 \cdot 5 \cdot 7 \cdots\cdots 2m - 1}{1 \cdot 2 \cdot 3 \cdot 4 \cdots\cdots m} \times 2^m r^{2m}$, in which expreſſion the numbers in the numerator are to be continued till the laſt number be $2m - 1$, and are to be continually multiplied into one another; and thoſe in the denominator are to be continued till the laſt number be m, and are to be continually multiplied into one another.

Theſe and a number of other general theorems reſpecting the circle are not only demonſtrated by Mr. Glenie, in a conciſe and ſimple manner in the ſaid curious geometrical paper, but are derived as mere corollaries from a general inveſtigation, that extends not only to regular but alſo to irregular figures circumſcribed about, and inſcribed in, the circle; and from which may eaſily be deduced an endleſs number of theorems much more general than even thoſe of Dr. Stewart, that remained for 59 years undemonſtrated, and though publiſhed without demonſtrations were the principal cauſe of his being appointed ſucceſſor to the celebrated Mr. Maclaurin.

For the method of inſcribing within the circle, or deſcribing about it triangles, polygons, quadrilaterals, ſquares, trapeziums, &c., and the properties thence reſulting, ſee the ſeveral articles.

For the method of deſcribing a circle through three given points, ſee CHORD.

For the mode of obtaining a circle from the ſection of a cone; ſee CONIC SECTION.

CIRCLES, *parallel* or *concentric*, are ſuch as are equally diſtant from each other in every point of their peripheries; or are deſcribed from the ſame centre; as, on the contrary, thoſe ſtruck from different centres are ſaid to be *eccentric*.

CIRCLE, *arc of*. See ARC.

CIRCLE, *the quadrature of the*, or the manner of making a ſquare, whoſe ſurface is perfectly and geometrically equal to that of a circle, is a problem that has employed the geometricians of all ages. See the article QUADRATURE.

CIRCLE, *ſector of a*. See SECTOR.

CIRCLE, *ſegment of a*. See SEGMENT.

CIRCLES *of the higher orders*, are curves wherein $AP^m : PM^m :: PM : PB$, or, $AP^m : PM^m :: PM^n : PB^n$. *Plate* V. *Geometry*, *fig*. 71. When m and n are each equal to 1, then $AP : PM :: PM : PB$, which is a property of the common circle. *Cor*. I. Suppoſe $AP = x$, $PM = y$, $AB = a$: then will $PB = a - x$. And conſequently $x^m : y^m :: y : a - x$. Hence we have an equation that defines infinite circles, viz. $y^{m+1} = ax^m - x^{m+1}$; and another defining other infinite circles, viz. $y^{m+n} = \overline{a - x}|^n x^m$.

Cor. II. If $m = 1$, then will $y^2 = ax - x^2$; and therefore a circle of the firſt order is contained under this equation alone. If $m = 3$, the equation becomes $y^4 = x^3, \overline{a - x}$ or $ax^3 - x^4$, which denotes a curve of the form A B (*fig*. 72). But when m denotes an even number, the curve will have two infinite legs; thus if $m = 2$, $y^3 = ax^2 - x^3$, which equation defines a circle of the ſecond order; and alſo one of Newton's defective hyperbolas, being his 37th ſpecies of curves,

curves, whose asymptote is the right line E F (*fig.* 73), making an angle of 40° with the absciss A B.

CIRCLE *of curvature*, in *Geometry*, that circle the curvature of which is equal to that of any curve at a certain point. It is also called the circle of equi-curvature. See CURVATURE.

CIRCLES *of the sphere*, are such as cut the mundane sphere, and have the periphery either on its moveable surface, or in another immoveable, conterminous, and equi-distant surface. Hence arise two kinds of circles, *moveable* and *immoveable*. The first are those whose peripheries are in the moveable surface, and which therefore revolve with its diurnal motion, as the meridians, &c. The latter, having their periphery in the immoveable surface, do not revolve; as the ecliptic, equator, and its parallels, &c.

If a sphere be cut in any manner, the plane of the section will be a circle, whose centre is in the diameter of the sphere. Hence the diameter of a circle passing through the centre, being equal to that of the circle which generated the sphere; and that of a circle which does not pass through the centre, being only equal to some chord of the generating circle; the diameter being the greatest of all chords; there hence arises another division of the circles of the sphere, *viz.* into *great* and *lesser*.

CIRCLE, *great, of the sphere*, is that which divides it into two equal parts, or hemispheres; having its centre in the centre thereof. Hence all great circles are equal, and cut each other into equal portions, or semicircles.

The great circles are the horizon, meridian, equator, ecliptic; the colures, and the azimuths; which see in their places.

CIRCLE, *lesser, of a sphere*, is that which divides the sphere into two unequal parts, and has its centre in the axis of the sphere, but not in the centre thereof. These are usually denominated from the great circles to which they are parallel; as parallels of the equator, &c.

CIRCLES *of altitude*, otherwise called *almucantars*, are lesser circles parallel to the horizon, whence they are also called parallels of altitude, having their common pole in the zenith, and still diminishing as they approach the zenith. They have their names from their use, which is to shew the altitude of a star above the horizon.

Some have suspected a variation in the apparent solstitial altitudes of the sun. Something of this kind was perceived by M. Cassini in 1655, by means of the great gnomon in the church of St. Petronius at Bologna; which was further confirmed by other observations at the royal observatory at Paris. The variation observed by M. Cassini, during the course of twenty-two years, only amounted to a few seconds. And by comparing the observation made by Pytheas at Marseilles three hundred years before Christ, with another made by Cassini in 1672 at the same place, it appears, that in two thousand years time this difference of altitude has only amounted to a few minutes. V. Mem. Acad. Scienc. 1693, p. 180, seq. See ECLIPTIC. See also ALTITUDE.

CIRCLES *of declination*, are great circles intersecting each other in the poles of the world.

CIRCLE *of dissipation*, in *Optics*. See the article DISSIPATION.

CIRCLES, *diurnal*, are immoveable circles, supposed to be described by the several stars, and other points of the heavens, in their apparent diurnal rotation round the earth.

Thus if a right line be conceived to be continued from the centre of a star, perpendicular to the axis of the world, as far as the surface of the sphere of the world, it will describe a diurnal circle for it, in making one revolution about its axis. The diurnal circles are all unequal: the equator is the greatest.

CIRCLE *equant*, in the *Ptolemaic Astronomy*, is a circle described on the centre of the equant. Its chief use is, to find the variation of the first inequality.

CIRCLES *of excursion*, are lesser circles parallel to the ecliptic, and at such a distance from it, as that the excursions of the planets towards the poles of the ecliptic may be included within them; being usually fixed at about 10 degrees.

It may here be added, that all the circles of the sphere above described, are transferred from the heavens to the earth; and thence come to have a place in geography, as well as in astronomy; all the points of each circle being conceived to be let fall perpendicularly on the surface of the terrestrial globe, and so to trace out circles perfectly similar to them. Thus, the terrestrial equator is a line, conceived precisely under the equinoctial line, which is in the heavens; and so of the rest.

CIRCLES, *horary*, in *Dialling*, are the lines which shew the hours on dials; though these be not drawn circular, but nearly straight.

CIRCLE, *horary, on the artificial globe*, a brazen circle fixed to the north pole divided into 24 hours, and furnished with an index, shewing the difference of meridians, and serving for the solution of many problems. The usual position of this circle prevents the brass meridian from moving quite round in the horizon; so that globes of the common sort cannot be applied to the purpose above mentioned. Mr. Harris contrived to remedy this inconvenience, by placing two horary circles under the meridian, one at each pole; these are fixed tight between two brass collars placed about the axis, but so that they may be easily turned by the hand when the globe is at rest; and when the globe is turned, they are carried round with it, the meridian serving as an index to mark out the horary division. The globe, thus prepared, will serve for solving problems in all latitudes, as well as in places near the equator. Philosophical Transactions abridged, vol. viii. p. 352. See GLOBE.

CIRCLE *of illumination*, is that imaginary circle on the surface of the earth, which is formed by a plane passing through the centre of the earth, so that the line which joins the centres of the sun and earth may be perpendicular to it, and which separates the illuminated hemisphere of the earth from the dark. This Mr. Keil calls the illuminated disc of the earth; and all lines passing from the sun to the earth, which are physically parallel, are perpendicular to the plane of this circle.

CIRCLES *of latitude*, or *secondaries of the ecliptic*, are great circles perpendicular to the plane of the ecliptic, passing through the poles thereof, and through every star and planet. They are so called, because they serve to measure the latitude of the stars, which is nothing but an arc of one of these circles, intercepted between the star and the ecliptic.

CIRCLES *of longitude*, are lesser circles, parallel to the ecliptic; still diminishing, in proportion as they recede from it. On the arcs of these circles, the longitude of the stars is reckoned.

CIRCLE *of perpetual apparition*, one of the lesser circles, parallel to the equator; described by any point of the sphere touching the northern point of the horizon, and carried about with the diurnal motion. All the stars included within this circle never set, but are always visible above the horizon.

CIRCLE *of perpetual occultation*, is another lesser circle at a like distance from the equator, described by the southern point

point of the horizon, and containing all thofe ftars which never appear in our hemifphere.

The ftars fituate between thefe circles alternately rife and fet at certain times, during the diurnal rotation.

CIRCLES, *polar*, are immoveable circles, parallel to the equator, and at a diftance from the poles equal to the greateft declination of the ecliptic, which is now 23° 28′.

That next the northern pole is called the *artic;* and that next the fouthern one the *antarctic;* which fee refpectively.

CIRCLES *of pofition*, are circles paffing through the common interfections of the horizon and meridian, and through any degree of the ecliptic, or the centre of any ftar, or other point in the heavens; ufed for finding out the fituation or pofition of any ftar. They are ufually fix in number; and cut the equator into twelve equal parts, which the aftrologers call the *celeftial houfes*. Hence fome call them *circles of the celeftial houfes*.

CIRCLE, *arc* or *arch of a*. See ARCH.

CIRCLE, *axis of a*. See AXIS.

CIRCLE, *centre of a*. See CENTRE.

CIRCLE, *eccentric*. See ECCENTRIC.

CIRCLE, *equal*. See EQUAL.

CIRCLE, *fairy*. See FAIRY.

CIRCLE, *right*. See RIGHT.

CIRCLE, *fegment of a*. See SEGMENT.

CIRCLES, *fecondary*. See SECONDARY.

CIRCLES, *vertical*, or *azimuths*. See VERTICAL, and AZIMUTH.

CIRCLE, in *Logic*, that fault of an argument that fuppofes the principle it fhould prove, and afterwards proves the principle by the thing it feemed to have proved.

Or, a circle in logic, called alfo *fyllogiftic circle*, is when the fame terms are proved, *in orbem*; by the fame terms; and the parts of the fyllogifm, alternately, by each other, both directly and indirectly.

Thus the papifts argue, when they prove the Scriptures to be the word of God by the infallible teftimony of their church, and the authority of the church by the Scripture.

There are two kinds of circles; the one *material*, the other *formal*.

The *formal* is that which in two reciprocal fyllogifms begs the medium, which is the next caufe of the greater extreme. This kind is by no means to be admitted: otherwife the fame thing becomes both prior and pofterior; the caufe and effect of itfelf; which is abfurd.

The *material* circle, called alfo *regreffus*, confifts of two fyllogifms, the former whereof proves the caufe by the effect; and the latter the effect by the caufe: this may be admitted.

CIRCLE, CIRCULUS, is underftood among the fchoolmen, of a viciffitude of generations, arifing one out of another. Thus, good concoction caufes a good habit of body; a good habit of body produces ftrength and vigour; thefe occafion frequent exercifes; and thefe a good concoction. It is a celebrated dogma of the Scotifts, "There is no circle in caufes of the fame order, or kind."

CIRCLES *of the empire*, are provinces, and principalities of the empire, compofed of princes, prelates, counts, and imperial cities, poffeffing a provincial and partial jurifdiction, and affembled for the regulation of their common affairs. See DIET.

The divifion of the empire into fix circles was eftablifhed by Maximilian I. in 1500, at Augfburg; twelve years afterwards he divided it afrefh, into ten circles; which partition was confirmed by Charles V. at the diet of Nuremberg, in 1522.

Though the order of thefe circles has never been well regulated; yet, in the imperial matricula, it is as follows: the circle of Auftria, that of Burgundy, that of the Lower Rhine, and that of Upper Saxony, which were the circles added in 1512; thofe of Bavaria, Franconia, Suabia, Upper Rhine, Weftphalia, and the Lower Saxony, the fix that were firft eftablifhed. Each circle, according to the laws of the empire, had its directors or fummoning princes, and its commanding officer under the title of captain, colonel, or field marfhal, &c. It was the province of the firft to convoke affemblies of the ftates of each circle, and to direct and fuperintend its concerns; and the latter had the command of the troops, and the care of the artillery and neceffary ammunition in each circle. The ftates of each circle were required to contribute to the exigencies of the empire, of which they were members, by a tax impofed on them for maintaining the troops and defraying other expences, in proportion to the number of horfe and foot, and other neceffary occafions.

CIRCLES *of judgment*, in *Antiquity*, were ancient monuments of the Runic kind, confifting of upright ftones, found in all the Danifh dominions, in Holftein, Slefwic, Jutland, the ifles, Norway and Iceland; and alfo in Sweden. They feem to have been erected at different ages; fome are more ancient than the 11th century, and others as recent as the 15th. The druidical circles in Britain claim a much higher antiquity. See DRUID.

CIRCOCELE. See CIRSOCELE.

CIRCOLO *mezzo*, in the *Italian Mufic*, is a diminution of four quavers or femiquavers, or notes of equal value, which reprefent a femicircle proceeding by conjoint degrees.

CIRCON, in *Mineralogy*. See ZIRCON.

CIRCUIT, in French *circuit* or *enceinte*, in *Fortification*, is the wall or rampart of ftone or earth, or partly of both, or the dike, ditch, &c. which furrounds or enclofes any city, town, place, or fpot of ground. This term is alfo applicable to the line or lines, which form the perimeter of any, being fynonymous thereto.

CIRCUIT, or CIRCUITY, in *Law*, a longer courfe of proceeding, to recover the thing fued for, than is needful.

Thus, if a man grant a rent-charge of 10 *l.* out of his manor, and after, the grantee diffeifeth the grantor of the fame manor, who brings an affife, and recovers the land, and 20 *l.* damages; which being paid, the grantee brings his action for 10 *l.* of his rent, due during the time of the diffeifin, and which he muft have had, if no diffeifin had been: this is called *circuity of action;* becaufe, as the grantor was to receive 20 *l.* damages, and to pay 10 *l.* rent, he might have received 10 *l.* only for damages, and the grantee have kept the other 10 *l.* in his hands, by way of retainer for his rent, and fo faved his action, which appears to be needlefs. Terms de Ley.

CIRCUIT is alfo the journey or progrefs the judges take, twice every year, through the feveral counties of England and Wales (except as in the cafes ftated under *General* ASSISES), to hold courts, and adminifter juftice, where recourfe cannot fo well be had to the king's courts at Weftminfter.

Thefe were firft eftablifhed, with fome little difference, by Henry II.; who, with the advice of a great council of his prelates, earls, and barons, at Northampton, A.D. 1176, divided the whole kingdom into fix parts, or circuits, and appointed three judges, learned in the law, to hold courts in each of thefe, by a commiffion from the king, empowering them to hear and determine all caufes not exceeding the value of one-half of a knight's fee, unlefs the matter was of fuch importance or difficulty, as to require the judgment of the king's court in his royal prefence. Thefe juftices itinerant took an oath, to adminifter juftice to all perfons with impartiality. They had alfo authority to judge in all criminal caufes and pleas of the crown, and to tranfact a variety of other affairs for the public good. A fmall change was made in this excellent inftitution, A.D. 1179, by dividing the kingdom into four circuits, and allowing a greater number of judges to each of thefe circuits. It is eafy to conceive how great a check the circuits of thefe judges, of fuperior rank, knowledge, and integrity, muft have given to the wantonnefs and partiality of the inferior courts, and how great an advantage they were to the people, by bringing juftice within their reach. It muft, however, be confeffed, that though the honour of bringing this wife inftitution to a fettled ftate is due to Henry II., there is fufficient evidence that courts were held, occafionally at leaft, by itinerant judges in more ancient times. Madox, Hift. Excheq. p. 86—88. See JUSTICES *in eyre*.

Thefe were afterwards exprefsly ordained by *Magna Charta;* which, befides prohibiting all denials or delays in the adminiftration of juftice, fixed the court of common pleas at Weftminfter, that the fuitors might be no longer haraffed with following the king's perfon in all his progreffes; and at the fame time brought the trials of iffues home to the very doors of the freeholders, by directing affifes to be taken in the proper counties, and eftablifhing annual circuits.

Thefe circuits are now ufually made in the refpective vacations after Hilary and Trinity terms; affifes being allowed to be taken in the holy time of Lent by confent of the bifhops at the king's requeft, as expreffed in ftatute Weftm. 1. 3 Edw. I. c. 51. See *General* ASSISES and JUSTICES *of Affife*. The feveral counties of England are divided into fix circuits: viz. 1. *Midland;* containing the counties of Northampton, Rutland, Lincoln, Nottingham, Derby, Leicefter, Warwick. 2. *Norfolk;* including Bucks, Bedford, Huntingdon, Cambridge, Norfolk, Suffolk. 3. *Home;* comprehending Hertford, Effex, Kent, Suffex, Surrey. 4. *Oxford;* containing Berks, Oxford, Hereford, Salop, Gloucefter, Monmouth, Stafford, Worcefter. 5. *Weftern;* including Southampton, Wilts, Dorfet, Cornwall, Devon, Somerfet. 6. *Northern;* comprehending York, Durham, Northumberland, Cumberland, Weftmorland, Lancafhire. Two judges are appointed to each circuit. In Wales there are two circuits, viz. North and South Wales. In Scotland there are three circuits, viz. South, Weft, and North, which the lords of jufticiary go twice a year, *viz.* in May and October, for trial of crimes only: though, by a recent ftatute, they have an appellate jurifdiction in civil cafes under 12 *l.* See JUSTICIARY.

CIRCUIT, *electrical,* denotes the courfe of the electric fluid from the charged furface of an electric body, to the oppofite furface into which the difcharge is made. Some of the firft electricians apprehended, that the fame particles of the electric fluid which were thrown on one fide of the charged glafs, actually made the whole circuit of the intervening conductors, and arrived at the oppofite fide; whereas Dr. Franklin's theory only requires, that the redundancy of electric matter on the charged furface fhould pafs into the bodies, which form that part of the circuit which is contiguous to it, driving forward that part of the fluid which they naturally poffefs, and that the deficiency of the exhaufted furface fhould be fupplied by the neighbouring conductors, which form the laft part of the circuit. On this fuppofition, a vibrating motion is fucceffively communicated through the whole length of the circuit. This circuit is always formed of the beft conductors, let the length of it be ever fo great. Many attempts were made both in France and England, at an early period in the hiftory of electricity, to afcertain the diftance to which the electric fhock might be carried, and the velocity of its motion. The French philofophers, at different times, made it to pafs through a circuit of 900 toifes, and even of 2000 toifes, or about two Englifh miles and a half; and they difcharged the Leyden phial through a bafon of water, the furface of which was about an acre. And M. Monnier found, that, in paffing through an iron wire of 950 toifes in length, it did not fpend a quarter of a fecond: and that its motion was inftantaneous through a wire of 1319 feet. In 1747, Dr. Watfon, and other Englifh philofophers, after many experiments of a fimilar kind, conveyed the electric matter through a circuit of four miles; and they concluded from this and another trial, that its velocity is inftantaneous, or, as we may fuppofe, too rapid to be meafured. Prieftley's Hift. of Electricity, vol. i. fect. 2. p. 128. 8vo. ed. 1775. See ELECTRICAL *fhock*.

CIRCUITORES. See AGONISTICI.

CIRCULAR, any thing that is defcribed, or moved in a round; as the circumference of a circle, or the furface of a globe. The circular form is of all others the beft difpofed for motion, and the moft capacious. The modern aftronomers fhew, that the heavenly bodies do not move in circular, but in elliptic orbits. See PLANET, &c.

CIRCULAR *Arcs*. See ARCH.

CIRCULAR *Inftrument of Reflection*, or *Multiplying Circle*, in *Navigation*. See CIRCLE.

CIRCULAR *Letter*, a letter directed to feveral perfons, who have the fame intereft in fome common affair: as in the convocation of affemblies, &c.

CIRCULAR *Lines*, an appellation given by fome to fuch ftraight lines as are divided by means of the divifions made in the arc of a circle. Such are SINES, TANGENTS, SECANTS, &c.

CIRCULAR *Numbers*, are fuch whofe powers end in the roots themfelves; as 5, whofe fquare is 25, and cube 125. See NUMBER.

CIRCULAR *Parts*, *Neper's*, or *Napier's*, are the complements of the two oblique angles of a right-angled fpherical triangle, the complement of the hypothenufe, and the two legs, by having any two of which the third is known.

Napier, in his treatife, entitled, "Logarithmorum Canonis Defcriptio," gave a general rule, with regard to thefe circular parts, which is as follows: *viz.* "The rectangle under the radius, and the fine of the middle part, is equal to the rectangle under the tangents of the adjacent parts, and to the rectangle under the cofines of the oppofite parts." The right-angle, or quadrantal fide, being neglected, the two fides, and the complements of the other three parts, are called the circular parts, becaufe they follow each other, as it were, in a circular order. If any one of thefe be fixed upon as the middle part, thofe that are next to it are the adjacent, and thofe that are fartheft from it are the oppofite parts. This excellent rule, concife and yet comprehenfive, includes all the particular rules for the folution of right-angled fpherical triangles, and may be eafily applied to oblique fpherical triangles, by letting fall a perpendicular, thofe two cafes excepted in which either the three fides or the three angles are given; and for thefe a fimilar expedient has been devifed by lord Buchan and Dr. Minto. M. Pingré, in the "Memoires de Mathematique et de Phyfique," for 1756, reduces the folution of all the cafes of fpherical triangles to four analogies; which, in reality, are Napier's circular parts, under another form, together with his fecond or fundamental theorem, applied to the fupplemental triangle. Thefe analogies are very difficult to be retained in the memory; and, therefore, Napier's rule, which is fo eafily remembered, ought to be preferved under its prefent form. Indeed, it cannot be eafily forgotten,

forgotten, provided that one circumſtance be regarded; *viz.* that the ſecond letters of the words "tangents" and "coſines" are the ſame with the firſt of the words "adjacent" and "oppoſite." Moreover, the rule for reſolving the two caſes of ſpherical triangles, to which the former rule is inapplicable, may be thus expreſſed: "Of the circular parts of an oblique ſpherical angle, the rectangle under the tangents of half the ſum and half the difference of the ſegments at the middle part (formed by a perpendicular drawn from an angle to the oppoſite ſide) is equal to the rectangle under the tangents of half the ſum and half the difference of the oppoſite parts." By the circular parts of an oblique ſpherical triangle are meant its three ſides and the ſupplements of its three angles. Any one of theſe ſix being aſſumed as a middle part, the oppoſite parts are thoſe two of the ſame denomination with it; *e. g.* if the middle part is one of the ſides, the oppoſite parts are the other two; and if the middle part is the ſupplement of one of the angles, the oppoſite parts are the ſupplements of the other two. Farther, ſince every plane triangle may be conſidered as deſcribed on the ſurface of a ſphere of an infinite radius, theſe two rules may be applied to plane triangles, provided that the middle part be reſtricted to a ſide. Thus it appears, ſays lord Buchan, in his "Life of Napier," that two ſimple rules ſuffice for the ſolution of all the poſſible caſes of plane and ſpherical triangles. Theſe rules, from their neatneſs, and the manner in which they are expreſſed, cannot fail of engraving themſelves deeply on the memory of every one who is a little verſed in trigonometry. It is a circumſtance, he adds, worthy of notice, that a perſon of a very weak memory may carry the whole art of trigonometry in his head. See PART, TRIANGLE, and TRIGONOMETRY.

CIRCULAR *ſailing*, the method of navigating a ſhip upon the arch of a great circle of the globe. See GREAT CIRCLE SAILING.

This mode of ſailing has been theoretically recommended, becauſe the neareſt diſtance between two places on the globe is the arc of a circle, and becauſe it is of importance that a ſhip ſhould arrive at its deſtined port by the ſhorteſt courſe. As in Mercator's ſailing, the ſolution of caſes is performed by plane triangles, ſo in this method of ſailing caſes are reſolved by means of ſpherical triangles; but theſe latter ſerve rather for exerciſes in the ſolution of ſpherical triangles than for any uſeful purpoſes of navigation. See SAILING.

CIRCULAR *ſcale.* See SCALE.

CIRCULAR *ſegment, reſiſtance of.* See RESISTANCE.

CIRCULAR *ſpots* are made on pieces of metal by large electrical exploſions. See experiments and obſervations upon them in Dr. Prieſtley's Hiſtory of Electricity, vol. ii. ſect. 9. ed. 8vo. and Phil. Tranſ. vol. lviii. p. 68.

Theſe beautiful ſpots, produced by the moderate charge of a large battery diſcharged between two ſmooth ſurfaces of metals, or ſemi-metals, lying at a ſmall diſtance from each other, conſiſt of one central ſpot and ſeveral concentric circles, which are more or leſs diſtinct, and more or fewer in number, as the metal upon which they are marked is more eaſy or difficult of fuſion, and as a greater or leſs force is employed. They are compoſed of dots or cavities, which indicate a real fuſion. If the exploſion of a battery, iſſuing from a pointed body, be repeatedly taken on the plain ſurface of a piece of metal near the point, or be received from the ſurface on a point, the metal will be marked with a ſpot, conſiſting of all the priſmatic colours diſpoſed in circles, and formed of the ſcales of the metal ſeparated by the force of the exploſion.

CIRCULAR *velocity*, a term in *Aſtronomy*, ſignifying the velocity of a planet, or revolving body, which is meaſured by the arch of a circle; as ſuppoſe by A B, *Plate, Aſtronomy, fig.* 11.) deſcribed on the centre of attraction S.

The circular velocity of a body moving from B to C is meaſured by the arc B C.

CIRCULAR *winding-ſtairs.* See STAIRS.

CIRCULATING DECIMALS. See REPETEND.

CIRCULATION, the act of moving round, or in a circle. See the following articles.

CIRCULATION *of the blood*, in *Anatomy*, is the courſe which this fluid purſues in the heart and lungs, and in the blood-veſſels of the body. This courſe is very juſtly named a circulation, inaſmuch as the blood is always paſſing round in the ſame track, and its motion conſtantly tends to the point from which it began.

The word *circulation*, when uſed abſolutely, comprehends the whole courſe of the blood, as well in the lungs as in the arteries and veins of the body at large.

The *greater circulation* is the paſſage of the blood from the left ſide of the heart, through the arteries, to the extremities of the body, and its return through the veins to the right ſide of the ſame viſcus.

The *leſſer circulation* is the tranſmiſſion of the blood from the right to the left ſide of the heart, through the lungs.

The uſes of the blood in the animal economy are ſo numerous and important, that every circumſtance relating to its properties, or to the laws of its motion, cannot be too carefully inveſtigated by the phyſiologiſt and practitioner.

By filling the veſſels with ſubtle fluids after death, it appears that the blood is copiouſly diſtributed to every part of the ſyſtem, at leaſt with a very few exceptions, as the inſenſible coverings of the body, the ſubſtance of the teeth, &c. and common experience muſt have convinced every perſon of the ſame fact, for hardly any part can be wounded with the point of the fineſt needle without a flow of blood being produced. This fluid does not, however, as the ancients thought, move backward and forward in one order of veſſels, but is carried, in a circulatory courſe, from the heart to all parts of the body by the arteries, and is thence returned to the ſame part by the veins.

In a ſyſtematic account of this ſubject, we ſhould firſt conſider the ſtructure of the heart and blood-veſſels, and the powers by which they are enabled to receive and to propel the blood, we refer the reader for a more complete account of theſe points to the articles HEART, ARTERY, VEIN.

The arteries receive the blood from the heart, and diſtribute it to all parts of the body. Theſe veſſels are in general leſs capacious than the veins, but of a more ſolid and compact texture; they are highly elaſtic, and probably poſſeſſed of conſiderable muſcular powers. All the arteries of the body are derived from one of two trunks: 1ſt, the pulmonary artery, which, ſpringing from the right ventricle, ramifies through the lungs; 2dly, the aorta, which, commencing from the left ventricle, is diſtributed over the whole body. The arteries, after their various ramifications and anaſtomoſes, terminate by communicating with the origins of the veins; ſo that the blood returns towards the heart in a continuous canal, in which there are no obvious marks of diſtinction to define the limits between the two orders of veſſels.

The ſtructure of the veins ſoon becomes clearly diſtinguiſhed from that of the arteries; they poſſeſs no muſcularity; they are much more capacious; leſs conſtant in their courſe and diviſions; weaker in their texture; and leſs elaſtic than the latter veſſels. They are alſo generally characterized by the poſſeſſion of valves, which prevent the return of blood towards their extremities. There are ſeven large venous trunks opening into the two auricles of the heart. The ſuperior and inferior venæ cavæ return the blood from the

the upper and lower parts of the body to the right or anterior auricle; the coronary vein pours into the ſame cavity that which has circulated through the ſubſtance of the heart itſelf. The two right and two left pulmonary veins diſcharge, into the left or poſterior auricle, the blood which has paſſed through the lungs.

The heart is placed in the centre of the ſanguiferous ſyſtem, and is endowed with great muſcular power, by which it is enabled to diſtribute and circulate the blood through the two orders of veſſels which we have now deſcribed. The trunks of the circulating tubes meet together in this part, which is the firſt mover of the whole animal frame, and ſuſtains, by a perpetual and truly wonderful power, this primary vital function, from the ſecond or third week after conception to the laſt period of our exiſtence.

This organ alternately receives and propels the blood. That which has circulated through the body enters the right auricle by the ſuperior and inferior venæ cavæ; the coronary vein pours into the ſame cavity the blood which has ſupplied the heart itſelf. The right auricle propels this, which is venous blood, through the anulus venoſus into the right or pulmonary ventricle, and it goes from this cavity to circulate through the lungs by the pulmonary artery. It is again brought to the heart by the four pulmonary veins, which open into the left auricle. It becomes changed from the ſtate of venous to that of arterial blood, by the expoſure to the atmoſpheric air, which takes place in its circulation through the lungs; for an account of which change ſee Respiration. From the left auricle it paſſes through the left anulus venoſus, into the ventricle of the ſame ſide, and is thence expelled by the aorta into the arterial ſyſtem of the whole body. From the minute arteries it enters the origins of the venous ſyſtem, and is again poured into the heart by the three venous trunks, which we have already mentioned.

This paſſage of the blood through the cavities of the heart is regulated and maintained in an undiſturbed ſucceſſion by valves placed at the different openings, which prevent all reflux of the circulating fluid. See the account of the *ſtructure of the* Heart.

Having thus deſcribed the courſe of the blood, we think it right to ſubjoin the proofs and experiments on which it is ſupported; although the fact of the circulation has been ſo long admitted, and is now ſo generally eſtabliſhed, that the enumeration may to ſome perſons appear ſuperfluous.

The courſe of the blood through the heart, *i. e.* from the right auricle to the left ventricle, by the medium of the lungs, is manifeſt from the ſtructure of the heart itſelf. The valves, which are placed at its various apertures, actually will not admit of the blood's motion in any other direction than what we have deſcribed.

That the blood paſſes from the heart into the trunk of the aorta, thence into its branches, and ſo on to the moſt minute ramifications, is evinced: 1ſt, by the effect of ligatures on theſe veſſels: the artery becomes turgid between the heart and the ligature, and empty between the ligature and its diſtribution. 2dly, By opening an artery, when tied, above and below the ligature: the blood in this caſe flows only from the opening which is neareſt to the heart. 3dly, By ocular teſtimony: the paſſage of the blood can be ſeen with the aid of glaſſes in frogs, fiſhes, &c.

The paſſage of the blood through the veins, in a contrary courſe to that, in which it flows along the arteries, *i. e.* from the minute ramifications towards the trunks, and thence to the heart, is proved; 1ſt, By the ſtructure and diſpoſition of the valves, which afford an invincible impediment to all retrograde motion. 2dly, By ligatures on theſe veſſels, which make the vein turgid between the extremities of the body and the ligature, and empty in the reſt of its courſe. 3dly, By opening a vein, when tied, above and below the ligature. 4thly, By microſcopical obſervation in the lower animals.

The paſſage of the blood from the arteries into the veins ſeems to flow as a corollary, from what we have ſtated concerning the proofs of its courſe in theſe two ſyſtems of veſſels. We have ſhewn that the ultimate arteries are continuous with the origins of the veins; that the blood moves from the heart to the extremities in the former veſſels, and that it paſſes from the extremities to the heart in the latter. The intermediate paſſage is a direct conſequence of theſe facts. But it may be demonſtrated by inconteſtible proofs independently of this argument. If we tie the artery of a part, its correſpondent vein receives no blood; if we take off the ligature, the vein is again filled. The quantity of blood expelled from the aortic ventricle is ſo conſiderable, that the ſupply can only be kept up by a return of this blood to the heart. We calculate that two ounces of blood are expelled from the heart at each pulſation; if we ſuppoſe eighty pulſations in a minute, 9600 ounces will be thrown into the aorta in an hour, and 14400 lbs. in a day. The ſame blood therefore which the aorta received from the heart muſt return to this viſcus; and the only paſſage by which it can return is through the veins. Nearly the whole blood of the body will be diſcharged from a wound of a ſingle artery or vein. Laſtly, the paſſage of the blood from the arteries into the veins may be proved by the direct teſtimony of the ſenſes in living animals. The uſe of the microſcope affords this proof in the tranſparent parts of cold-blooded animals, as the meſentery and web of the foot in frogs, the tail of fiſhes, &c.

The motions of any part of the heart, conſidered ſingly and individually, conſiſt in a conſtant ſeries of alternate contractions and dilatations; or, as they are technically named, alternate ſtates of *ſyſtole* and *diaſtole.* The contractions take place as in any other muſcles; the dilating cauſe conſiſts in the forcible entrance of blood into the cavity. The auricles and ventricles, when viewed in relation to each other, are ſucceſſively contracted and dilated; the correſponding parts acting at the ſame time on both ſides of the heart. Thus, when the auricles contract, in order to expel the blood which they have juſt received from the ſyſtem at large, and from the lungs, the ventricles are relaxed, and therefore in a ſtate fit for receiving this blood. When, in the following moment, the recently filled ventricles contract, in order to urge forwards the blood into the two arterial trunks, the auricles are relaxed, and become immediately diſtended by the current of venous blood. The action of the heart, and of the veſſels connected with it, may therefore be diſtributed into ſucceſſive periods. In the firſt of theſe, the venæ cavæ and pulmonary veins pour their blood into the two auricles, and thus cauſe a diaſtole of theſe cavities. The ſyſtole of the auricles tranſmits the blood into the ventricles in the ſecond period; and theſe latter cavities expel their contents into the arteries in the third portion of time. Thus the action of the veins takes place at the ſame point of time with that of the ventricles; and the contraction of the auricles is ſynchronous with that of the arteries.

The ſyſtole of the ventricles, which is ſuppoſed to occupy one third of the time of the whole pulſation of the heart, is accompliſhed by an approximation of the ſides of the cavities to the middle partition, and of the apex to the baſis of the heart. The whole viſcus by this means becomes ſhorter and more obtuſe. The well known fact of the heart's ſtriking againſt the left breaſt in its contraction, may ſeem on the firſt glance to refute this account of the ſyſtole of the ventricles. But, on a further examination, it can have no ſuch effect; ſince

ſince the phenomenon in queſtion depends on two cauſes amply ſufficient to produce the effect, which have been long ago explained by Ferrein and Senac. (See Queſtiones Medicæ, 12.—Monſpelii, 1732.—Anatomie de Heiſter avec des Eſſais de Phyſique. Traité de la Structure du Cœur, tom. i p. 354, et ſeq.) The ſwelling of the auricles, which are at the back of the heart, and particularly of the left auricle, which is interpoſed between the ſpine, and the baſe of the left ventricle, neceſſarily cauſes the point of the heart to advance towards the ſide; and this motion may be imitated in the dead body by injecting or inflating the auricles. The other cauſe conſiſts in the connection of the large arteries, particularly of the aorta, with the baſe of the heart. A curved and flexible tube, when ſuddenly diſtended, becomes in ſome meaſure ſtraightened. Thus when the blood is impelled into the aorta, the curve of that veſſel approaches more nearly to a ſtraight line. Its poſterior end being firmly attached to the vertebræ, is immoveable; to its anterior and moveable part is fixed the heart, which, by the ſtraightening of the veſſel, is obliged to deſcribe a portion of a circle, in doing which the apex ſtrikes againſt the ſide. Theſe two circumſtances occur ſimultaneouſly; the venous blood ruſhes into the auricles, at the ſame time that the contraction of the ventricle fills the aorta.

The impulſe of the blood expelled by the ſyſtole of the aortic ventricle is felt in the whole arterial ſyſtem; and it produces, in all arteries which come within the ſphere of the touch, and which have an area of not leſs than one ſixth of a line in diameter, an obvious and perceptible effect, called the pulſe, which is a real ſtate of diaſtole of the artery, and which is aſcertained to correſpond exactly, and to be perfectly ſynchronous with the ſyſtole of the heart. The number of pulſations in a given ſpace of time varies infinitely in healthy perſons. Age is the chief cauſe of theſe varieties: but other circumſtances, which conſtitute the peculiar ſtate of health of each individual, have conſiderable effect; ſo that no ſtandard can be ſettled which ſhall prove generally correct. The following numbers afford, we believe, as near an approximation as can be expected amidſt ſo much uncertainty; they will ſerve at leaſt as a comparative view in ſubjects of different ages.

The heart of an infant, ſleeping tranquilly, performs, in the firſt days of exiſtence, about 140 pulſations in a minute. At the end of the firſt year the pulſations are in the ſame ſpace of time about 124:

At the end of the ſecond year	110
——— third and following years	96
——— ſeventh and following	86
——— time of puberty	80
——— age of manhood	75
——— ſixtieth year	65

beyond which time the variations are very great.

The female ſex are obſerved, *cæteris paribus*, to have a more frequent pulſe than the male; and ſhort perſons exceed tall ones in this reſpect. It is alſo remarked, that the inhabitants of cold climates have ſlow pulſes. It is moſt familiarly known that the pulſe is accelerated by taking a meal, by the act of coition, by exerciſe of the body, or affections of the mind. The latter cauſes, indeed, if carried to a conſiderable extent, produce moſt vehement palpitations of the heart. In ſaying thus much of the pulſe, we have thought it more natural to refer it to the heart, which is its ſource, than to the arteries, in which it is commonly examined.

It has been queſtioned, whether the heart expels the whole of the contained blood in its ſyſtole. It ſeems probable that this is the caſe in a healthy animal; although it has been denied on the faith of experiments. We muſt be cautious in applying inferences, drawn from the interrupted and diſordered action of the heart of an animal, expiring under the torture of an experiment, to the living functions of the viſcus. If any blood remains in the ventricle, it excites a conſtant contraction of the cavity. In ſome cold-blooded animals, and in the incubated chick, the heart is obſerved to become completely pale in its ſyſtole, which proves an entire evacuation of the ventricles.

The pulſations of the heart proceed in a regular and continued ſucceſſion to the laſt period of life: and then all its parts do not ceaſe to act at once. But the right auricle and ventricle ſurvive the oppoſite cavities for ſome little time; ſo that the former part has been called the *ultimum moriens*. The blood which returns by the venæ cavæ, after the laſt expiration, no longer finds the uſual paſſage through the lungs, which are contracted, but it is ſtill urged on from behind by that which the aorta has recently propelled. Hence, it is forced into the right auricle, and excites contraction in that part by the ſtimulus of its preſence, ſome time after the left ſide has been at reſt. This congeſtion on the right ſide of the heart in the laſt agony, explains the empty ſtate of the arteries, particularly the larger ones, after death. Sabatier has aſcribed to the ſame cauſe, the greater relative capacity of the right ventricle and auricle of the adult heart. (See Mémoire ſur l'inégale capacité des cavités du cœur, et des vaiſſeaux pulmonaires, in his Traité complet d'Anatomie, tom. iii.) The appearance, which we are now alluding to, does not admit of explanation from any circumſtances connected with the healthy functions of the heart and lungs; yet Sabatier's ſtatement can hardly be received as completely ſatisfactory. For, not to mention that we ſeldom find theſe cavities actually diſtended, this explanation ſuppoſes the veins to pour the blood into the heart, with greater force than the ventricle can exert in reacting; which does not appear probable from comparing the ſtructure of the two parts. The facts, however, contained in the memoir above-mentioned deſerve attention: it is ſtated that, by opening the venæ cavæ, and tying the aorta, which prevents accumulation of blood on the right, and cauſes it on the left ſide of the heart, the left cavities will be found after death to exceed the capacity of the right. This experiment would have been more convincing, had the difference been aſcertained with certainty and correctneſs, inſtead of reſting on the inaccurate ground of a mere inſpection.

The longer duration of action in the right, than in the left cavities of the heart, is to be aſcribed ſolely to the circumſtance of the former parts continuing to receive blood, after the latter are completely evacuated. Hence, if an experiment be inſtituted, in which theſe conditions ſhall be reverſed; the prerogative of *ultimum moriens* will be transferred to the left cavities. Haller has produced this effect: he opened the venæ cavæ, preſſed out the blood from the right cavities, and tied thoſe veins. He made a large aperture in the pulmonary artery, in order to evacuate more completely the right ventricle. The pulmonary veins were left untouched; but the aorta was tied. Thus the right auricle and ventricle were evacuated, while the blood was received and retained in the oppoſite cavities. By this means the right auricle and ventricle remained in action, long after all contraction of the left cavities had ceaſed. See Elementa Phyſiologiæ, lib. iv. ſect. 5. § 14.

It is hardly poſſible to determine the velocity of the blood's motion in the healthy ſtate; for individuals differ from each other in this reſpect; and conſiderable variety probably takes place in different parts of the body. It is generally

generally ſuppoſed, that the blood flows in a more gentle ſtream through the ſmall arteries than in the arterial trunks; and that the velocity of its current is ſomewhat leſs in the veins, than in the arteries of the body. Theſe differences have, however, been exaggerated by former phyſiologiſts. The mean velocity of the blood in the aorta is calculated at eight inches for each pulſation; which gives about 50 feet in a minute. If we reflect that the ſyſtole of the ventricle, which gives this whole impulſe to the blood, occupies only one third of the whole pulſe, the velocity of the blood's motion muſt be trebled in that diviſion of the time. It is ſaid that this velocity, which we have aſſigned to the blood's motion at its departure from the heart, becomes ſpeedily diminiſhed in its further progreſs; and the diminution has been deduced from various cauſes. The firſt and moſt powerful of theſe is the conſtantly increaſing area of the branches, when compared with the trunk of an artery. See Artery.

It is a well known law in hydraulics, that the velocity of a fluid paſſing through an inverted cone conſtantly decreaſes, and that the diminution of velocity is in the ratio of the increaſe of area. The mathematical phyſiologiſts have alſo noticed the effects of friction; deducing theſe from a compariſon with the courſe of fluids in dead tubes. Other cauſes have been deduced from the ſame ſource; hence the ſerpentine courſe of ſome arteries, the unfavourable angles by which they ſometimes ariſe, and their communications with each other are enumerated among the circumſtances, which retard the courſe of the arterial blood. But it muſt be remembered, that in viewing theſe retarding cauſes, we are conſidering their action on the blood, as if this fluid were contained in inanimate tubes; and influenced merely by the contraction of the heart; without taking into account any acceſſory impulſe, which may be, and moſt probably is, derived from the arteries. This retardation has been variouſly eſtimated by different calculators; who have all made it very conſiderable. Hales ſuppoſes the blood to flow through the capillary arteries of a frog, at the rate of two-thirds of an inch in a minute; which will be about 650 times ſlower than in the human aorta. ("Statical Eſſays," vol. ii. p. 66.) Robinſon and Whytt have gone ſtill farther; the former ſtating that the velocity of the blood's motion in the aorta, is to that in the ſmalleſt veſſels, as 1100 to 1. ("Diſſertation on the Food and Diſcharges of Human Bodies.") We mention theſe calculations to ſhew what abſurdities have been committed by men of the greateſt abilities, when they have applied the laws which regulate the properties of dead matter to the living functions of the animal machine. Haller's "Obſervations on the Circulation in living Animals," entirely overthrow theſe calculations. ("Elementa Phyſiologiæ," lib. 6. ſect. i. § 30.) He found by his microſcopical experiments, that the blood flowed generally as rapidly through the ſmall as through the larger veſſels. He ſtates alſo, that in living animals it is poured out as far from a ſmall as from a large artery. The numerous and diverſified experiments of Spallanzani, afford additional evidence of the ſame truth, and throw conſiderable light on the whole ſubject. The reſults of his experiments are ſo concluſive, that we preſent them to the reader in his own words: "I did not find that the blood, in paſſing out of the middle-ſized arteries into their branches, experienced the leaſt retardation from any difference in the capacity of theſe veſſels, or the numerous angles which they formed with one another; neither did the mode of the circulation, whether languid or ſtrong, oſcillatory or intermittent, appear to be at all affected by the multiplicity of natural and artificial curvatures, or the flexures and convolutions made by the different ramifications. When the ſtrength of the animal was not impaired, the blood in the ſmall arteries moved very rapidly, and with nearly an equal velocity; but when, on the contrary, it had been exhauſted, or in an unhealthy ſtate, the circulation was carried on with the ſame celerity in the middle ſized arteries; whilſt it began to abate in the ſmall arterial ramifications, and ſtopped ſooner or later in proportion to their diſtance from the heart. The united reſults of theſe experiments diſplay, in a ſtriking point of view, the true motion of the blood from the origin to the termination of the arteries, which was hitherto only conjectural, and ſubject to frequent diſputes, from the want of a ſufficient number of experiments. Theſe facts, beſides, confirm the ſage maxim of Haller, reſpecting the caution with which we ought to apply mechanical principles to the animated ſyſtem; for, in fact, if the animal machine be ſtrictly ſubject to hydraulic laws, why do they not produce the ſame effects in the vaſcular ſyſtem, as in common tubes? Whilſt, however, we acknowledge that theſe laws muſt exert an influence upon the phenomena of the circulation, we contend that their power is counterbalanced by oppoſite cauſes, inherent in the ſanguiferous ſyſtem." ("Experiments upon the Circulation of the Blood throughout the Vaſcular Syſtem, by the Abbé Spallanzani," p. 259.)

We have ſtated, that the blood is thrown into the arteries, by ſeparate contractions of the heart; yet theſe veſſels are conſtantly full, as may be proved by opening them during the heart's diaſtole. For the blood flows on in ſuch a way, that the ſubſequent quantity diſcharged from the right ventricle, overtakes that which is before, and thus cauſes the pulſation of the arteries. The exceſs of velocity in the blood, coming from the heart, over that contained in the arteries, becomes conſtantly leſs; and at a certain point ceaſes altogether. Here the pulſe ceaſes alſo. Hence in microſcopical obſervations on the courſe of the blood in ſmall veſſels, its ſtream appears to be uniform: and it is commonly ſtated, that the pulſation ceaſes in veſſels of about one-ſixth of a line in diameter.

The motion of the blood in the minute veins, ſeems to be equal in velocity to its courſe in the ſmall arteries; this velocity increaſes in the larger trunks; and there is a conſtant acceleration in the blood's courſe until it arrives at the heart. This fluid is paſſing through tubes which conſtantly decreaſe in area; and it follows of neceſſity, that by diminiſhing the channel of a fluid, its courſe muſt be accelerated. Hence the trunks of the venæ cavæ return to the heart, within a given time, as much blood, as the aorta carried out of this viſcus.

The motion of the blood along the veins muſt be derived from the impulſe, which it receives from the heart, and from the action (if there be any) of the arteries. Its circulation in theſe veſſels is aided by the contraction of the muſcles, which muſt urge on the contained fluid towards the heart; ſince their valves prevent any retrograde motion.

The return of the venous blood is affected by reſpiration. It appears in living animals, that the large veins become turgid during expiration; either from the obſtruction of the blood's courſe through the lungs, or in conſequence of its reflux from the heart; they are evacuated in inſpiration. In this latter ſtate the depletion of the veins cauſes the brain to ſubſide; whereas in expiration the retention of the blood produces diſtention and ſwelling of the viſcus.

As the motion of the blood in the veins is not derived from any immediate force, it is conſiderably affected by gravity; in ſpite of the valves, which counteract this influence conſiderably. The experiments of Haller and Spallanzani have ſhewn this fact in cold-blooded animals. It is evinced alſo

also by various phenomena in the human subject; viz. varices of the legs, swelling of the feet after the erect position has been long preserved, &c.

Some very curious and interesting phenomena have been observed in experiments on living animals, and referred to a general principle termed derivation; in conformity with which it appears that the blood flows rapidly towards any quarter, from which the usual pressure is removed. The experiments of Haller and Spallanzani have much illustrated this subject, which is of the greatest importance in a practical view. (See Haller's "Elementa Physiologiæ," lib. 6. sect. 1. § 40. Spallanzani's "Experiments on the Circulation, &c." p. 386, et seq.) The blood rushes from all quarters towards an incision in a vein or artery; it forsakes the neighbouring trunks and branches; it is discharged both in the direction of the circulation, and in a retrograde course; it moves against the force of gravity, as well as contrary to its usual current. When the blood stagnates in an animal submitted to experiment, it flows again through an opening made in an artery or vein. The blood in the artery, corresponding to the vein that is opened, recovers or accelerates its course according to the stagnation or velocity which it possessed before the operation. An incision into the heart has the same effect; the blood flows out at the opening both from the arteries and veins. The swelling of a part under a cupping glass is probably derived from the principle which we have now described.

When the circulation ceases before death, it appears to stop first in the small vessels; and this stagnation is propagated towards the heart. "The arterial blood," says Spallanzani, in speaking of the phenomena of languid circulation, "which at first had an uniform course, lost more or less quickly its equilibrium, and abated in velocity at each diastole of the heart; to this abatement soon succeeded a complete stagnation, except during the systole, when the blood preserved some remains of motion, which however disappeared by degrees. Thus the circulation ceased in the arteries by a successive and gradual diminution of momentum, without any flux or reflux, intermittent or vibratory motion. The motion of the blood in the veins, ceased in the same gradual manner; and these different phenomena were alike evident in the arterial and venous fluid of cold and warm-blooded animals." P. 383.

It has been stated that the globules of the blood pass more in the axis of the vessel than the other parts of this fluid. This circumstance has been deduced from an absurd application of the laws of hydraulics to the circulation, and is not founded on any actual observation in living animals.

It appears also, from experimental inquiries on the subject, that we are not warranted in assigning to the blood any intestinal motion, in addition to the regular and uniform progression, which we have been now describing. Yet it is not unlikely, that the various directions, divisions, and anastomoses of the blood-vessels may have some influence on the elements of the blood.

We proceed to consider the powers, which animate the organs of circulation, and enable these parts to execute their several functions. Those of the heart, as being the greatest and most important, will claim our first attention; but there are secondary and auxiliary forces, which probably have considerable share in aiding the actions of this viscus.

We shall readily perceive, that no certain calculation can be formed of the powers of the heart, when we consider that neither the quantity of blood expelled at one pulsation, nor the distance through which it passes in a given time; nor the velocity of its course, can be defined with any certainty; much less can we form any accurate estimate of the obstacles which occur to the blood's motion; which must considerably affect such a calculation. We may however approach in some degree to the truth, by collecting and comparing the results of probable conjecture. If we calculate the blood contained in the body at thirty pounds, the number of pulsations in one minute at 75, and the quantity expelled from the left ventricle at each pulsation at $2\frac{1}{2}$ ounces, the whole quantity will pass through the heart about twenty-three times in the course of an hour; it will perform the circulation once in less than three minutes. The velocity with which this blood is propelled by the systole of the left ventricle may be collected from the violence with which it is ejected from a wounded artery; and the altitude to which it ascends. Blumenbach has seen it projected more than five feet from the carotid of an adult during the first contractions of the heart. Our countryman Hales calculated from his experiments, in which he measured the height of the blood's ascent in a glass tube, inserted into a large artery, that it would be thrown $7\frac{1}{2}$ feet from the human carotid: he estimates the surface of the ventricle at fifteen square inches; and thus finds that 1350 cubic inches, or about 51lbs. weight, press upon the left ventricle, and must be overcome by its systole. Many other calculations of the powers of the heart have been formed upon mathematical principles: but different persons have been led to such opposite results, that we are warranted from this circumstance in disregarding them altogether. Borelli makes the powers of the heart equal to 180,000lbs.; Keill to eight ounces. Senac observes, that if a weight of 50lbs. be attached to the foot, with the knee of that side placed on the opposite one; the weight will be elevated at each pulsation: this weight is placed at a considerable distance from the centre of motion; and, allowing for this circumstance, he estimates the moving power at 400lbs.

This power of the heart, so wonderful both in extent and duration, must be referred to the irritability of the organ; in which point of view it seems far to exceed all other muscular parts of the body. That the immediate cause of contraction in this viscus arises from the presence of blood in its cavities, is shewn by the celebrated experiment of Haller; in which the longer duration of action in the right or left cavities was varied by influencing the supply of blood.

In the action of those muscles, which depend on the will; a supply of nerves, and a distribution of blood to the moving fibres, seem to be essential conditions. It has been disputed whether or not these circumstances are necessary in the heart; and what share they may contribute to the heart's action. We may observe, in the first place, that the actions of the heart are completely involuntary; that no exertion of the will can produce the smallest effect in accelerating, retarding, or otherwise affecting the actions of this part. Yet, various arguments prove that the nerves exert an influence over this organ. Not to mention the peculiar arrangement of the cardiac nerves; the sympathy between the heart's action, and nearly every other function, even of the most different classes, suffices to demonstrate the connection. The vehement disturbance of the heart from the passions of the mind must be familiar to every person from his own experience: its action is also strongly influenced by various states and affections of the alimentary canal. That its irritability must be influenced by different states of the vascular system is rendered probable by the remarkable and copious apparatus of blood-vessels, which are distributed to it.

The action of the heart is intimately connected with the changes which the blood undergoes in its passage through the

the lungs. For when refpiration is obftructed, the heart's action ceafes; and it may be recalled by again introducing air into the lungs. Hence arifes the importance of inflating the lungs, in inftances of apparent death from drowning, &c. in order to excite the heart to action.

There is a mechanical power derived from the ftructure of the heart, which is faid to affift in the function of circulation. The blood being expelled by the fyftole of its cavities, they are in an empty and contracted ftate; a tendency to the formation of a vacuum now arifes, in confequence of which, the blood arriving by the veins immediately rufhes into the vacant fpace.

The other organs of circulation, befides the heart, are endowed with powers by which they contribute to the performance of this function. The arteries probably contribute effentially to the circulation, although the degree of their affiftance, and their mode of action, are not yet fatisfactorily explained. By their elaftic power, thefe veffels recover their original fize, after being diftended by the heart's action; and they muft of courfe urge on the blood proportionally. It is a fact moft familiarly known, that the arteries pulfate; and that they pulfate powerfully, fo that the courfe of the blood through the popliteal artery is fufficient, when we place one knee on the other, to elevate the whole leg and foot, even with the addition of a confiderable weight. Phyfiologifts have been long accuftomed to afcribe to thefe veffels a ftate of fyftole, or contraction, as well as a ftate of diaftole, or dilatation; which are confidered as alternating with the fimilar ftates of the heart; and the latter of which is referred to a mufcular power, or irritability, refiding in the arterial coats. It feems certain that the effect, which we call the pulfe, cannot be afcribed originally to any property of the veffel in which it occurs; but that its origin muft be derived from the contraction of the heart, and the confequent diftention of the arterial tube by the blood, which is then expelled from the left ventricle. We admit, therefore, a diaftole of the arteries, arifing from the lateral preffure of the blood, forcibly projected into thefe canals. That this pulfation is produced by the heart's action, is proved by aneurifms, and by the effect of ligatures on an arterial trunk; for thefe deftroy the pulfe in the arteries, beyond the part. We are not equally warranted in afcribing a true fyftole to the arteries; or a contraction of thefe veffels by mufcular power, to a fmaller area than that to which they are reduced by their elafticity. Nay, fome phyfiologifts have proceeded fo far, as to deny altogether the exiftence of irritability in the arteries; or at leaft to affirm, that the action of the heart alone fuffices to carry on the circulation. The following arguments feem to prove the exiftence of mufcular powers in the arteries, and their actual exertion in the living body. We have already fhewn that the caufes which would retard the blood's motion in dead tubes, do not feem to operate in the arteries of the body: this can only be explained, by fuppofing them to be overbalanced by fome powers refiding in thefe veffels. If we divide an artery in a living animal, the orifice clofes; if we divide it for fome extent, it contracts gradually, fo as to become nearly fhut (Hunter on the Blood, p. 114.). The arteries of an animal bled to death are contracted to a fmaller area than their elafticity would bring them to; they may at leaft be diftended confiderably, and will not by their elafticity recover their former contracted ftate (Ibid.). The functions of the arteries argue the poffeffion of living powers: by thefe the growth and formation of the various parts of the body is affected; they perform the different fecretions: thefe phenomena, as well as thofe of blufhing and palenefs, cannot be accounted for, if we confider the arteries merely as dead tubes. The great fupply of nerves which thefe veffels poffefs in many parts of the body, *viz.* the branches of the carotid, the arteries of the neck, and thofe of the cheft and abdomen, is a prefumptive proof to the fame effect. In fome rare inftances the heart has been wanting in fœtufes, otherwife well formed: we muft fuppofe that there was a circulation which muft, under thefe circumftances, have been carried on by the veffels only. It has been ftated, in oppofition to the irritable power of the arteries, and to their fyftole as aiding the circulation, that ftimuli which affect other mufcles caufe no figns of irritability in thefe tubes. That an artery, laid bare in the living fubject, cannot be feen to contract; that if divided, its diameter is not leffened in the fuppofed ftate of fyftole; that the blood flows in a continuous ftream, excepting as far as it is affected by the heart's action. (Kirkland on the prefent ftate of medical furgery, vol. 1. p. 306. et feq.) Hence Blumenbach ftates it as his opinion, that the arteries do not contract in the healthy ftate, or as long as the heart is adequate to the natural performance of its functions; but if thefe veffels are affected by preternatural ftimuli, or if the heart's action, from whatever caufe, become deficient, then the vital powers of the arteries will ferve as an auxiliary force for keeping up the circulation. Blumenbach Inftit. Phyfiol. fect. 7. § 130. Laftly, all obfervers agree in ftating that the blood flows with an uniform current through the fmaller ramifications; and it has been generally allowed, that this is the cafe in all arteries of lefs than one-fixth of a line in diameter. Now we fhould infer from reafoning *à priori*, as Mr. Hunter has actually affirmed, that the mufcular force of an artery would increafe in a direct ratio with the diminution of its fize, (On the Blood, p. 122,) for the auxiliary power muft be the more required, in proportion as we recede from the fource of motion. But if either thefe fmall arteries, or the larger ramifications which immediately precede them, contribute to the circulation by any actual contraction, the blood's motion could not appear regular and uninterrupted. Thefe, which appear to be the principal arguments on both fides of the queftion, are left to the confideration of the reader. Further proofs and illuftrations, derived from accurate obfervation in living animals, and from a comparative view of the organs of circulation in the different orders of animals, feem to be required, before a decided and fatisfactory opinion can be formed on the fubject.

Some phyfiologifts, being of opinion that the action of the heart could not reach to the fmalleft order of fanguiferous veffels, have afcribed the paffage of the blood in the minute arteries, and thence into the veins, to an ofcillatory motion of thefe parts, and have employed this explanation in the doctrine of inflammation. Microfcopical obfervation, however, detects nothing but an uniform progreffive motion in the fmall veffels.

There is little to be faid refpecting the powers which belong to the veins, fince thefe veffels obvioufly take a lefs active fhare in the circulation than the other parts of the fyftem. The return of the blood through the veins is only effected by the preffure from behind of the arterial blood, affifted by the valves, which prevent any retrograde motion.

Circulation of the Blood in the Fœtus.

The defcription which we have juft given, applies to the circulation as it is performed in the adult fubject; this function differs confiderably in the fœtal ftate; and the difference is caufed from fome variations in the ftructure of the heart, and adjacent veffels, which arife from the connection eftablifhed between the mother and the child, through the medium of the placenta, and from the want of refpiration. See Heart and Placenta.

The

The ſituation of the child in utero precludes the acceſs of atmoſpheric air to its lungs; theſe organs are conſequently ſmall and collapſed; and the leſſer circulation of the blood cannot be ſaid to take place in the fœtal ſtate. Although its circulation might be conſidered in this reſpect as more ſimple than that of the adult, this function becomes conſiderably complicated by the connection with the placenta. A portion only of the child's blood circulates through this part; and it is no doubt ſo altered or modified by this paſſage through the veſſels of the placenta, as to be rendered more fit for the growth and nouriſhment of the child. No ſuch alteration or modification has however been actually demonſtrated in the fœtal blood. Phyſiologiſts have diſcovered no difference in this fluid in the various veſſels of the fœtus. It is of the ſame dark colour in the arteries and veins. The interruption of the communication with the placenta, before reſpiration has commenced, is however ſuddenly fatal. Our ignorance of the functions of the placenta, and of the liver, which is of immenſe ſize in the fœtus; as well as of the changes which the fetal blood probably undergoes in the complicated ſyſtem of organs, which are connected with its circulation in this ſtate of exiſtence, leaves many parts of the ſubject in doubt and obſcurity.

The blood, which has paſſed through the placenta, is returned to the ſyſtem of the child by the umbilical vein; it is chiefly diſtributed through the liver, and is ſent in a ſmaller quantity by the ductus venoſus directly into the trunk of the inferior cava. This veſſel, paſſing in an oblique aſcent from the right towards the left ſide, ſends its blood into the left auricle through the foramen ovale; the Euſtachian valve preventing it from paſſing towards the right ventricle. The valve of the foramen ovale guards againſt the poſſibility of its return to the right ſide of the heart. The ſuperior vena cava pours its blood into the right auricle and ventricle, as it paſſes obliquely into the former cavity, in a direction from before backwards, and from the right towards the left ſide. The thick ſuperior margin of the foramen ovale concurs with this direction in preventing any paſſage towards the left auricle. The continuation of the trunk of the pulmonary artery, under the name of ductus arterioſus, into the aorta, conveys this blood into the poſterior part of the arch of the latter veſſel, and it is hence tranſmitted in great meaſure by the umbilical arteries to the placenta. It appears, therefore, that the blood of the inferior vena cava, including that which has recently circulated through the placenta, is ſent entirely to the head and upper extremities, through the branches of the aortal arch; while that portion of this fluid, which returns to the heart through the ſuperior cava, is ſent to the deſcending portion of the aorta, and therefore in great part to the placenta. Hence Sabatier has obſerved, that the courſe of the blood in the fœtus may be compared to the figure 8, the point of decuſſation being in the heart. This fluid is tranſmitted through the umbilical vein, the inferior cava, and the foramen ovale, into the left auricle and ventricle; from which the three large branches of the arch of the aorta conduct it to the head and upper extremities. The ſuperior cava returns it to the heart; it goes through the right auricle and ventricle, the ductus arterioſus, and the aorta, to the umbilical arteries, which return it to the placenta. By this arrangement, the blood, which has gone through the placenta, is not returned to that part, until it has circulated through the whole ſyſtem of the child; whereas, by the opinion, which ſuppoſes a mixture of the blood of the two venæ cavæ in the right auricle, it follows, that a portion of the placental blood would return to that part, without circulating in the ſyſtem of the child; and the blood, which had already gone through the proper veſſels of the fœtus, would recommence its courſe in theſe ſame veſſels, without receiving the ſalutary influence, which is probably exerted on it by the placenta. Sabatier derives from this expoſition of the courſe of the blood, an explanation of the relatively diminutive ſize of the lower parts of the body, when compared with the head and upper extremities of the fœtus. The former parts, ſays he, are ſupplied with a leſs pure blood. We cannot, however, admit this phyſiology. The phenomenon in queſtion ariſes out of the future ſtate of the human embryo, and muſt be conſidered in connection with the long ſtate of helpleſs infancy, to which the individuals of the human ſpecies are excluſively devoted in the early periods of their exiſtence. In quadrupeds, which are obliged to go alone almoſt from the moment of their birth, theſe proportions are not found; although their veſſels are diſtributed in the ſame manner as in the human fœtus. The embryos of the quadrumana, and of the ſquirrel, the foal, &c. are examples of this fact.

The differences in the ſtructure of the heart and circulating veſſels in the fœtus, are ſuch that they are readily and eaſily changed after birth, ſo as to become accommodated to the alterations which take place in the new mode of exiſtence. Two ſtriking and eſſential changes in the animal economy are co-eval with birth, *viz.* the obſtruction of the placental circulation, and the commencement of reſpiration. The former of theſe diminiſhes the quantity of blood conveyed to the right auricle by the inferior cava; the latter cauſes a developement of the ſtructure of the lungs, and a conſiderable enlargement of the pulmonary veſſels; ſo that the left auricle receives more and more blood from the pulmonary veins. Hence the quantity of blood contained in the two auricles becomes equal; and the foramen ovale is cloſed by its valve growing to the margin of the apertures. The ductus arterioſus now contracts; ſo that the whole blood of the pulmonary artery muſt circulate through the lungs in its courſe from the right to the left ſide of the heart. The Euſtachian valve gradually diminiſhes as its function has ceaſed; the umbilical arteries and vein cloſe. Thus the heart and veſſels become adapted to the double circulation, which belongs to the perfect animal. Theſe changes take place gradually, and not abruptly; it is many months, nay even one or two years, before the foramen ovale is cloſed. The ductus arterioſus contracts much more rapidly; indeed this veſſel, as well as the umbilical arteries and vein, are impervious within a very ſhort period after birth.

We refer the reader, on the ſubjects of this article, to the 3d, 4th, and 6th books of Haller's "Elementa Phyſiologiæ." Senac, "Traité de la Structure du Cœur, de ſon Action, et de ſes Maladies." Hales's "Statical Eſſays," vol. ii. Blumenbach "Inſtitutiones Phyſiologiæ," ſect. 7. Spallanzani's "Experiments on the Circulation of the Blood." Sabatier "Sur les Organes de la Circulation du Sang du Fœtus," in his "Traité Complet d'Anatomie," tom. iii.

Circulation, *diſcovery of.* The vaſt importance of this diſcovery to the whole ſcience of phyſiology; the influence which it neceſſarily exerted on the doctrines of pathology; and the general revolution which aroſe from this ſource throughout the whole circle of medical knowledge, will juſtify us in giving a ſlight hiſtorical ſketch of the ſubject, and in pointing out the opinions held by thoſe anatomiſts and phyſiologiſts who preceded our immortal countryman Harvey. To him, indeed, the glory of this greateſt of all phyſiological diſcoveries has been aſſigned by the almoſt unanimous concurrence of his ſucceſſors. Some, however, have endeavoured to deprive him of his well-earned fame, by aſcribing a knowledge of the circulation to various preceding writers. Mr. Dutens, in the ſecond volume of his "Recherches sur l'Origine des Decouvertes attribueés aux Modernes," has brought forwards paſſages from Hippocrates, Plato, Ariſtotle, Julius Pollux, Apuleius, and others, in order to prove that they knew the courſe of the blood. After the poſitive dogmatical aſſertions with which the author ſets out, we are ſurpriſed by the weakneſs and inadequacy of his proofs, and can only account for the inconſiſtency by ſuppoſing him to have been utterly ignorant of the ſubject. He quotes a few iſolated paſſages which cannot, by the moſt favourable interpretation, be conſtrued into the ſemblance of a proof, that the writers in queſtion knew the circulation of the blood. Thus he adduces the following paſſage from Hippocrates: "Venæ per corpus diffuſæ, ſpiritum, et fluxum, ac motum exhibent, ab unâ multæ germinantes; atque hæc una unde oriatur, et ubi deſinat, non ſcio: circulo enim facto, principium non invenitur." Another equally unſatisfactory follows from Plato: "Cor vero venarum originem, fontemque ſanguinis per omne corpus impetu quodam *manantis*," the Greek word is περιφερομενα. Theſe are really the ſtrongeſt quotations which Mr. Dutens has furniſhed on the ſubject, ſo that nothing more would be required in order to diſprove his opinion, than to examine the very paſſages which he adduces in ſupport of it.

Let us further remark, on the ſame point, that this ſpecies of argument, derived from the conſideration of ſingle words and paſſages, is by no means a ſatisfactory one. A ſentence or term employed accidentally and undeſignedly, may ſuggeſt to the mind of a perſon acquainted with all the details of a ſubject, various notions that were not in the contemplation of the writer, and may very probably have been unknown to him; while they would be paſſed over without attention by a perſon not poſſeſſing this previous knowledge. The only fair and unexceptionable method of determining whether any individual was acquainted with a particular fact, is to conſider all that he has ſaid on the ſubject, and to draw our inferences from the reſult of this general examination. Such an inquiry will prove moſt clearly, that a knowledge of the circulation, ſuch as we poſſeſs at preſent, can be aſcribed to no one before Harvey; although a part of the ſubject, viz. the paſſage of the blood through the lungs, had been deſcribed by ſeveral perſons before the time of that illuſtrious character.

That the blood moves, has been univerſally known and admitted, ſince the ſcience of medicine has aſſumed a diſtinct form: how much of its courſe, and of the laws that regulate its motion, has been aſcertained at any given period, is another queſtion. The circulation is ſo generally known in the preſent day, and the proofs on which it reſts are ſo obvious and familiar to every tyro in the profeſſion, that we feel ſurpriſed how they ſhould ſo long have eſcaped the obſervation of the numerous ingenious and learned characters, whoſe names adorn the annals of anatomy. We muſt remember that the courſe of the blood, taken altogether, forms a ſubject of conſiderable intricacy; that the purſuit of anatomy was attended in the early periods of the ſcience with conſiderable difficulty and danger; and that the unlimited ſway which the authority of Galen held over the minds of men for ſome centuries, precluded all attempts at further inveſtigation. We may alſo account for the ignorance of the ancients on this ſubject, by remembering the juſt diſtinction which Haller has drawn, between the kind of information which may be reaſonably expected from them and that which cannot be looked for in this ſource, "Faciles ab antiquitate ſperamus, quæcunque ex ingenio ſolo naſci poſſunt; id enim, ſub felici cælo hominibus vitæ negotiis minus implicitis, ſummum fuit. Quæ verò multiplici, neque a caſu ſperabili, ſed imperato ad ſuos fines experimento nituntur, ea ab eâ ætate non ſperes." Bibl. Anat. tom. i. p. 9.

Hippocrates ſtates that the blood meets with obſtacles in its courſe, which retard or entirely arreſt its progreſs; that it goes from the internal parts towards the ſurface: and *vice-verſâ*, that the blood muſt flow forwards from the heart, ſince the valves hinder its return, and that the arteries are diſtended, when their blood is ſtopped. In ſpeaking of the blood's motion he compares it to the courſe of rivers, to the ebbing and flowing of the ſea, and even to the revolutions of the planets. He aſſigns the origin of the arteries to the heart, and that of the veins to the liver, and ſuppoſes that there are two oppoſite motions in the temporal arteries, by which their pulſations are produced. He ſpeaks of four fluids in the body, the blood, water, mucus, and bile, which come from the heart, head, ſpleen, and liver; all thoſe parts are, however, ſupplied from one principal ſource, the ſtomach.

Can we diſcover any traces of a knowledge of the circulation in this confuſion of ideas? and may we not be juſtly ſurpriſed, to find that enlightened men ſhould be ſo led away by their prejudices, as to allow to Hippocrates the knowledge of a diſcovery, which no one had perceived in his writings for nearly three thouſand years? The obſervations of the founder of medicine had led aſtray all who followed him to the time of Harvey; but when the reſearches of that great man had unfolded the myſtery of the circulation, his enemies dared to affirm, that the writings of Hippocrates had furniſhed the lights which guided him in the path of diſcovery.

The philoſophers who joined the ſtudy of medicine to that of the other ſciences, ſeem to have been equally ignorant of the laws which regulate the blood's motion. A paſſage has been already quoted from Plato on this ſubject; but it would be a moſt remarkable inſtance of liberality to allow him, on the credit of the vague and indefinite expreſſion, which he there employs, the honour of an admirable diſcovery, which he would have explained more clearly if he had known, or even ſuſpected it. In the ſequel to this paſſage, he employs various allegories, in which the heart is a ſentinel or officer to receive the orders of the ſoul, and convey them to all parts. Ariſtotle expreſsly ſtates that the blood never returns to the heart.

The Alexandrian anatomiſts maintained that the arteries held no blood, but were filled with air; from which circumſtance they gave them the name, which they have conſtantly retained, from αηρ, air, and τηρεω, to hold. To explain the occurrence of blood in theſe veſſels after death, they ſuppoſed the exiſtence of ſubtle communications with the veins.

The genius of Galen diſdained to follow blindly the ſteps of his predeceſſors; and he endeavoured at leaſt to diſcover the truth by experiments, and obſervations on the ſtructure of the body. By theſe means he aſcertained ſome facts, although he could not ſucceed in piercing the veil which concealed the ſecret of the circulation. He ſeems to have recognized the uſe of the valves at the two orifices of the ventricles. He proved, by tying an artery with two ligatures, that theſe veſſels contain blood during life; and ſtates that they are filled by the contraction of the heart, in conſequence of which they pulſate. Theſe circumſtances ſeem to indicate a conſiderable advancement in the knowledge of the circulation; but we muſt mention, in the ſame ſpirit of impartiality, the contradictions and uncertainty which prevail in the works of Galen on this ſubject, and the limits which his labours could not exceed. He ſtill referred, with Hippocrates, the origin of the veins to the liver, and ſuppoſed a paſ-

ſage

fage of the blood through the feptum of the ventricles, while a fmall portion entered the pulmonary artery to nourifh the lungs: he imagined laftly, that it might pafs reciprocally between the pulmonary artery and veins.

There could be little reafon to expect, that in the troubled and barbarous times, which followed the age in which Galen flourifhed, the fecret of the circulation fhould be difcovered; ftill lefs that it fhould be explained to phyficians by men, whofe purfuits were foreign to the fcience of medicine. Yet it has been boldly afferted that Nemefius, bifhop of Emefa, knew the courfe of the blood, as it has been afcertained by the fubfequent labours of Harvey. The editor of the Oxford edition of his works, has imbibed the true fpirit of a commentator; who difcovers in the writings of the ancients, meanings which never were in the contemplation of the authors; and abufes the moderns as plagiarifts, for decorating themfelves with the difcoveries of antiquity.

But on what grounds does Nemefius claim the honour of a difcovery, denied to fo many great geniufes? Becaufe, according to Freind, the bifhop ftates, that the blood paffes from the arteries into the veins during fleep. This reftriction immediately overturns the claim; which would indeed be deftroyed by the kind of motion that he fuppofes to take place, *viz.* a reciprocal alternation of undulations, like that of the Euripus. In another paffage cited by Dutens, he fpeaks of the arteries in their dilatation attracting the blood from the veins; which fufficiently proves that he knew nothing of the matter; and exemplifies ftill further the abfurdity of a perfon's attempting to dogmatize as Dutens has done, on fubjects of which, as being foreign to his profeffion, and difficult of inveftigation, he cannot reafonably be expected to be a competent judge. "Thus," to ufe the words of Senac, "a theologian writes on the nature of man; a fubject which does not very properly belong to fuch a writer: on no other teftimony, than fome vague and ridiculous expreffions, he gains the credit of knowing the circulation, of which the greateft phyficians and anatomifts had been hitherto completely ignorant. Thus it is, that interpreters and commentators are mifled by a blind zeal for antiquity, and difcover hidden meanings in the moft fimple expreffions. How would their boldnefs and affurance have been augmented, if Nemefius had expreffed himfelf as clearly, as an ancient fcholiaft of Euripides has done, where he fays, "that the blood flows through the veins, and that thefe veffels receive it from the arteries." Should we, however, on this infulated and cafual expreffion, be juftified in beftowing on a weigher of words, and meafurer of phrafes, the honour of a difcovery, which had eluded the refearches of the greateft philofophers?

The ftate of darknefs and ignorance, in which the human mind languifhed during the fucceeding ages, does not allow us to expect that any writer of that period can difpute with Harvey the honour of the great difcovery. About the fixteenth century the curiofity of mankind was again excited to the inveftigation of this interefting fubject. Reafon, which had hitherto fubmitted to the yoke of authority, began to affert her rights; and feveral phyficians were bold enough to examine fubjects, which Hippocrates and Galen had not been able to develope.

The firft ray of light was thrown on the circulation, by a man, whofe name cannot be mentioned without exciting feelings of compaffion for his unmerited and barbarous treatment, and of indignation at the unrelenting bigotry of his cruel perfecutor, and implacable judge. Gifted with an ardent and penetrating genius, Servetus made a rapid progrefs, at a very early age, in the fciences of natural philofophy and divinity. By applying the rigorous, and exact kind of proof required in fubjects of the former kind, to the latter fcience, he refufed to affent to propofitions, which he could not comprehend; and openly declared his difbelief of the facred myftery of the Trinity. This compelled him to leave Spain his native country; from which he paffed into France, and ftudied medicine at Paris, under Winter d'Andernach, who was profeffor in the college lately founded by Francis I. He vifited different parts of France and Germany, and after various perfecutions on account of his religious opinions, fettled in Dauphiny. But the reformer of Geneva, either being too narrow-minded to grant to a rival, that freedom of thought, and liberty of confcience, which he had fo fuccefsfully exerted in his own perfon; or fearing that his fchemes of aggrandizement would be interrupted by the fuperior talents of Servetus; had him feized and condemned to the flames. Thus, fays Portal, one heretic deftroyed another; but the difference was, that an ambitious and defigning knave pronounced the condemnation, and one of the fineft and moft enlightened geniufes of Europe was the lamented victim of this iniquitous fentence.

The paffage, which proves Servetus to have been acquainted with the pulmonary circulation, occurs in his work de Reftitutione Chriftianifmi; which having been carefully deftroyed on account of the herefy which it contains, is now extremely fcarce; fo that two or three copies only are fuppofed to exift, and the duke de la Valiere gave the fum of 132*l.* for one. Blumenbach Introd. in Medic. Literar. p. 125.

He ftates that the vital fpirit is compofed of the moft fubtile parts of the blood, and of the air, which infinuates itfelf into the lungs; and that the fource of this blood is in the right ventricle. "But the communication, that is to fay, the paffage of the blood from the right to the left ventricle, does not take place acrofs the middle feptum, as perfons have generally imagined; it depends on a more fingular ftructure. In the long windings of the lung, this fubtile blood is agitated, and prepared by the action of the vifcus, and gains a yellow colour. From the *vena arteriofa*, (pulmonary artery), it paffes into the *arteriæ venofæ*, (pulmonary veins), where it becomes mingled with the air that has entered the lungs, and lofes its fuliginous excrements. Laftly it enters the left ventricle, which attracts it in its diaftole. Such is the preparation of the blood, from which the vital fpirit is formed; this preparation, and this paffage from the arterial vein into the venous artery, are evidently proved by the fize of the veffels; which would not be fo large, nor poffefs fo many branches; nor carry to the lung fo great a volume of blood, if it were deftined to the nourifhment only of the vifcus." He adds that the vital fpirit is fent from the left ventricle into all the arteries of the body.

This reprefentation proves inconteftably that Servetus knew the minor circulation. He laid the foundation of a building, which had baffled all the efforts of the great geniufes of antiquity. In order to perfect this defign it was only neceffary to extend the ideas of the firft architect. He indicated the route, through which the blood paffes from the right to the left ventricle; it remained to be proved that all the blood takes this paffage, and that it returns again to the heart from the arteries through the veins.

The obfcure fketch of the circulation, which was furnifhed by Servetus, appears in a more finifhed and luminous form in the works of Realdus Columbus. He defcribes the entrance of the blood into the heart from the vena cava, and its fubfequent paffage through the lungs into the left ventricle

tricle and aorta. He advanced a ſtep farther than Servetus; for he ſtates that the whole blood paſſes through the lungs, and not the vital ſpirit only. But he falls into the ſame error with preceding anatomiſts on the ſubject of the liver; ſuppoſing that gland to be the ſource of the blood which nouriſhes the ſtomach, ſpleen, &c.

Arantius and Cæſalpinus deſcribed more perfectly and clearly than Columbus, the paſſage of the blood through the lungs; which they confirmed by ſeveral arguments drawn from the ſtructure of the parts, and particularly from the poſition and mechaniſm of the valves. The latter indeed approached very nearly to the grand deſideratum, the paſſage of the blood from the arteries through the veins to the heart. He obſerves that a vein ſwells below the ligature; but he did not follow this up to prove the circulation. He ſays that the blood returns to the heart through the veins during ſleep; but he ſuppoſed it to move backwards and forwards in the ſame veſſels, like the Euripus. He was miſled alſo in the labyrinth of the liver, where ſo many phyſiologiſts have loſt themſelves. The arrangement of the arteries and veins in this organ preſents ſuch an intricate combination that we need not wonder at its proving, for ſo long a time, a ſource of miſtake and illuſion.

Paul Sarpi, the learned hiſtorian of the council of Trent, is one of thoſe to whom the circulation is ſaid to have been known; but the want of all arguments that bear the leaſt conviction on the ſubject, will juſtify us in declining any particular conſideration of his claim, as well as thoſe of Fabri, a Jeſuit, of Helvicus Dietericus and others.

Notwithſtanding the labours and writings of the anatomiſts, whoſe opinions we have thus curſorily examined, the minds of men were ſtill enſlaved by thoſe errors, which, having prevailed for ſo many centuries, had acquired the ſanction which time and authority beſtow on any opinions, however abſurd. The moſt enlightened phyſicians were ſatisfied with the labours of their predeceſſors: and Harvey alone had ſufficient courage and information to canvaſs theſe inveterate prejudices, which length of time had conſecrated as infallible truths. He obſerved and deſcribed the true courſe of the blood with a wonderful ſagacity and clearneſs. None of the arguments, which prove the circulation, eſcaped the reſearches of this acute obſerver; ſo that a modern phyſiologiſt, in recounting the proofs of this phyſiological fact, could add little, if any thing, to what is accumulated in the original work of Harvey. He was not contented with demonſtrating the circulation in ſome parts only; but followed up the ſubject in all the viſcera of the body. He traced the courſe of the blood through the liver, where every preceding anatomiſt had diſcovered nothing but perplexity and confuſion. The work of Harvey is, in ſhort, one of thoſe rare and precious productions which embrace a ſubject in its whole extent, and preſent it to the mind in ſo perfect and finiſhed a form, as ſcarcely to admit a ſingle addition or improvement.

The merits of our countryman, whoſe fame can never periſh, while medical ſcience continues to be cultivated, will be exalted to a ſtill higher pitch, when we conſider the ſtate of medical knowledge in England at that time. While anatomical ſchools had been long eſtabliſhed in Italy, France, and Germany, and ſeveral teachers had rendered their names illuſtrious by the ſucceſsful purſuit of the ſcience, anatomy was ſtill unknown in England, where diſſection had hitherto hardly begun. Yet, at this inauſpicious period, did Harvey make the diſcovery, which may be conſidered as a ſecond and more perfect foundation of the ſcience of medicine; and which amply juſtifies Haller in ranking him as ſecond to Hippocrates only.

Harvey ſtudied anatomy at Padua under Hieronymus Fabricius; who had inveſtigated more minutely, and deſcribed more accurately the valves of the veins firſt diſcovered by Cannanus. Returning to his own country, he commenced a ſeries of experiments on living animals; and taught the circulation in his lectures about the year 1616. But he did not publicly promulgate his grand diſcovery till 1628, when his "Exercitatio anatomica de Motu Cordis et Sanguinis in Animalibus" appeared at Frankfort: and this is the only edition, which bears the ſtamp of Harvey's own authority. This treatiſe, which Haller has moſt appropriately ſtyled "aureum opuſculum," is conſtructed entirely upon the reſult of experiment, and contains an excellent arrangement of the ſubject. The author was now created phyſician to king Charles I. and demonſtrated the circulation before him in a living animal.

The publication of this grand diſcovery rouſed the attention of all Europe. The old profeſſors, accuſtomed to pay a blind and implicit deference to the authority of Galen, which was now utterly ſubverted, and, aſhamed of confeſſing that their whole life had been ſpent in teaching the groſſeſt errors, took up their pens in oppoſition to the author of theſe innovations. One party aſſerted that the diſcovery was not a new one: that it had been known to ſeveral perſons, and, indeed, to all antiquity. Such were the aſſertions of Nardi, Vander Linden, Hartmann, Almeloveen, Barra, Drelincourt, Patin, Falconet, Heiſter, Regnault, &c. A ſufficient refutation of theſe ſtatements will be found in the hiſtorical ſketch, which we have already exhibited. Other adverſaries of Harvey proceeded in a more rational manner; and attempted to diſprove his ſtatements by experiment and reaſoning. Primeroſe led the way in this attack, and he was followed by Emilius Pariſanus, Joh. Riolan, Caſp. Hoffmann, and others. If men of ſuch acknowledged erudition as Riolan and Hoffmann were ſo utterly unacquainted with the circulation, as to deny it altogether, may we not ſafely conclude that the ſubject is not deſcribed in any of the writers, who preceded Harvey? Out of all his numerous opponents, this illuſtrious man anſwered Riolan only; in his "Secunda et tertia exercitatio de circulatione ſanguinis." The reply was rather extorted by the rank, fame, and learning of Riolan, than by the ſtrength of his arguments. If we ſeek to define exactly the preciſe ſhare of merit which Harvey may claim in the diſcovery of the circulation, it will be neceſſary to hold a middle courſe between the groſs and palpable abſurdity of thoſe who diſcover a knowledge of the circulation in the writings of Solomon, Hippocrates, Plato, Ariſtotle, &c., and the too great partiality of ſuch as would deny all knowledge of the ſubject to every anatomiſt who preceded Harvey. It ſeldom happens, that ſo extenſive and intricate a ſubject as that which we are now conſidering, is ſurveyed and brought to light in all its branches by the labour of an individual; nor has it happened in the preſent inſtance. For Servetus, Columbus, Arantius, and Cæſalpinus, were acquainted with the courſe of the blood through the lungs; and the latter writer has even an obſcure hint towards the greater circulation. But no one attempted to prove the latter point by arguments and experiment before the time of Harvey: the expreſſions of Cæſalpinus, which are by no means clear or ſatisfactory, had been before the public for half a century without exciting the leaſt inveſtigation, and without ſuggeſting to Fabricius the true office of the valves in the veins. The entire merit of the greater circulation may, therefore, be aſcribed to our illuſtrious countryman; and if we compare the luminous method, and irrefragable proofs which are found

found in his expofition of the other part of the fubject, with the partial and confufed ftatements of preceding authors, his merit will here be only fecond in degree to that of actual difcovery.

The doctrine of the circulation met with fome fupporters on its firft promulgation. Walæus of Leyden exerted himfelf ftrenuoufly on this fide, and defended the propofitions of Harvey in two excellent letters addreffed to Bartholin. Des Cartes alfo, whofe authority at that time carried vaft weight with it, took a decided part in the controverfy in favour of Harvey, from its commencement. The doctrine was pretty generally admitted throughout Europe before the deceafe of its propofer.

The nature of the communication between the arteries and veins was left undetermined by Harvey, who decided no point which he could not make the fubject of experiment. The art of injecting the veffels of the dead body, which has been difcovered and carried to great perfection fince his time, has fhewn a continuation of canal joining the two fyftems of blood-veffels: and the employment of the microfcope has completed the proof, by demonftrating the circulation in the tranfparent parts of frogs, &c. during life. The transfufion of the blood of one animal into the veffels of another, which has been performed with fuccefs in many inftances, has added another ftrong proof to the demonftration of the circulation. See the "Hiftoire de l'Anatomie, et de la Chirurgie" of Portal, and the "Bibliotheca Anatomica" of Haller, in the articles concerning the writers, whofe names are mentioned in this account; "Elementa Phyfiologiæ," tom. i. fect. 3. Senac "Traité du Cœur," livre 3. Dutens "Recherches fur les Decouvertes attribuées aux Modernes."

Circulation *of the Sap*, in *Vegetable Phyfiology*, is a fubject which has been long involved in the utmoft obfcurity. After the difcovery of the circulation of the blood in animals, feveral diftinguifhed philofophers, who beftowed attention upon the anatomy and phyfiology of plants, expected to difcover fomething equivalent in their conftitution. The flighteft obfervation was fufficient to determine that the juices of the earth were abforbed by the roots of plants, and pervading their fubftance, fupplied them with nourifhment, thus contributing effentially to their health and increafe. This regular propulfion of fluids through the vegetable body is evinced by taking an entire plant with its root, or even a branch cut from its parent ftem, and after it has begun to droop, placing its lower extremity in water. By the abforption of the water through its veffels, the plant or branch will foon revive, and continue in vigour for a longer or fhorter period, according as the circumftances in which it is placed may be more or lefs favourable. It was alfo very foon difcovered that an extraordinary motion of the fap took place at a certain time of the year. If a vine, for inftance, be wounded in the fpring, juft before its leaf-buds open, it *bleeds*, as the gardeners exprefs it, that is, the fap runs out very abundantly, infomuch that if the wound be not ftopped, the experiment is fatal to the branch on which it is made. The fame thing was obferved in the birch, whofe fap fo procured is, in fome countries, manufactured into wine, as that of the American fugar-maple, *acer faccharinum*, is made to yield fugar. This bleeding does not take place if the vine be cut after the leaves begin to expand; but in autumn, after a flight froft, not during the froft, the fap runs in a fimilar manner from a wound, though in a far lefs degree. This is called technically the *flowing of the fap*. An ordinary branch of a vine will yield about a pint in 24 hours. The liquor thus obtained is clear and colourlefs, with little fmell or tafte, and feems fcarcely different from common water, yet it foon undergoes chemical changes, which fhew it to be fomething more. The peculiar fecretions of the vine, which are very acid, alfo come along with it, and ftill more thofe of the birch and fugar-maple; fo that the perfectly pure fap, or nutritious fluid of any plant, is fcarcely to be obtained unmixed with adventitious matter.

When this flowing of the fap began to be ftudied by phyfiologifts, their fanguine hopes of detecting the vegetable circulation by its means were not at all anfwered. In vain were ligatures tried to difcover its courfe, as had been practifed with fo much fuccefs on the veins and arteries of animals. Nothing like a fwelling from a ftoppage of the fap in its paffage, by ligatures, and confequent accumulation in the veffels, has ever been perceived in vegetables. It was obferved to flow equally from both fides of a tranfverfe wound, and in as great quantity from the portion of the ftem or branch above the wound as below it, at leaft till the upper portion, not being fupplied from the root, was exhaufted. It was alfo feen to proceed always from the wood, not from the bark. Some authors having thought they obferved the fap to flow more abundantly from the lower fide of an incifion during the heat of the day, and from the upper in the cool of the evening, have afferted that it mounts during the former period, and defcends at the latter. But the moft furprizing circumftancee of all was, that after the leaves were expanded, when it was known that a great perfpiration was going on through thofe organs, and that there confequently muft be as great and conftant a propulfion of the fap at leaft as took place before, no fuch violent movement in that fluid could be perceived; for during the greater part of the year only a flight effufion of fap happens from a wound. Dr. Smith, taking all thefe phenomena into confideration, has fuggefted that probably this great motion in the fap, which has been univerfally believed to exift in trees for a fhort period before their buds open, is altogether imaginary. He is perfuaded the fap is at that period, as well as through the winter, (in deciduous trees at leaft,) quiefcent, and that it has in fpring merely an extraordinary propenfity to run, caufed by the reviving warmth of that feafon, and the accumulated irritability of the vegetable conftitution during winter. For this reafon the fap flows in fome degree in a warm autumnal day after a froft, the cold having increafed the fenfibility of the plant to the warmth which follows, and thus what happens in winter and fpring is acted for a fhort period on a fmall fcale. This flowing of the fap, or fpeaking more correctly, this facility of the fap to run, is therefore the firft ftep towards the revival of vegetation in the fpring, and its exciting caufe is heat, doubtlefs by ftimulating the vital principle, and not by any mechanical action. The effect of heat in this refpect is in proportion to the degree of cold to which the plant has previoufly been expofed. In forced plants the irritability is exhaufted, according to the remark of Mr. Knight in the "Philofophical Tranfactions for 1801," which is ftrikingly to our prefent purpofe.

"It is well known," fays that gentleman, p. 342, "that the degree of heat required to put the fap into motion, in the vine, is not definite, but depends on that to which the plant has been previoufly accuftomed. Thus, a vine which has grown all the fummer in the heat of a ftove, will not be made to vegetate during the winter by the heat of that ftove; but, if another plant of the fame variety, which has grown in the open air, be at any time introduced, after it has dropped its leaves in the autumn, it will inftantly vegetate. This effect appears to me to arife from the latter plant's poffeffing a degree of irritability, which has been exhaufted exhausted in the former by the heat of the stove, but which it will acquire again during the winter, or by being drawn out and exposed for a short time to the autumnal frost.

For the same reason, all vegetation goes on better in the increasing heat of spring, than in the decreasing heat of autumn, and some plants, even of the most hardy kind, as radishes, which grow so freely at the former season, can by no art be made to vegetate at all in the decline of the year. An attention to this law of nature will enable us to procure flowers from many plants that do not readily blossom under ordinary management. The Cape jasmine, *Gardenia florida*, is best kept in a common greenhouse, secured from frost, till about April, when if exposed to the strongest heat of a bark bed it is made to flower in the greatest luxuriance.

The propulsion of the sap, in one direction at least, from the root upwards, being established, the next subject of inquiry is the system of vessels in which it runs. Malpighi and Grew, the leaders in this branch of philosophy, and all their followers, even the intelligent Du Hamel among others, were convinced of the existence of three kinds of longitudinal vessels in the vegetable body, sap vessels, air vessels, and vessels denominated *vasa propria*, containing secreted fluids. The last are obvious to the most careless observer, filled with the resin of the fir, the milk of the fig, celandine, &c. Air-vessels are found in most parts of a plant, of a roundish or oval form, intermixed with the *parenchyma* or pulp. So far is unquestionable; but the above ingenious observers thought they had also discovered longitudinal air-vessels. When a young branch of elder, the stem of a lily, and many other stems, branches, or leaf stalks, are partly cut through, and their two portions gently drawn asunder, a set of white spiral threads, of considerable strength, are unrolled in the substance of the young wood, not in the bark. Each of these threads forms the spiral coat of a vessel, the thread itself not being, as some persons have supposed, pervious. Such vessels are of sufficient diameter to be easily visible under an ordinary microscope, and when investigated with high magnifying powers, their structure is readily seen. They are always found nearly, if not quite, empty of moisture, and filled with air, and were therefore, by a similar mistake to what was formerly made concerning animal arteries, determined to be air-vessels, though no communication could be traced between them and the above-mentioned round or oval air-cells. The sap-vessels only remained to be ascertained. These, it was thought, could exist only in the woody fibres, which make so considerable a part of the bulk of a tree or shrub, and are abundant even in herbaceous plants. But philosophers sought in vain for any cavity in those fibres. They are divisible without end, nor can any perforation be detected. Still it was argued that as the *vasa propria* were always found full of secreted fluids, different in different plants, but all quite distinct from that universal lymph or sap, which is nearly uniform in all; and as the spiral-coated vessels were always full of air only; the sap could have no other course but along the woody fibres. It was even presumed that although these fibres were imperforate, the sap might ascend along them by capillary attraction, as through a spongy or cottony substance. This was Tournefort's opinion, and others have adopted it. Grew imagined that the nutritious fluids were absorbed by plants in a highly rarified form, and in that state pervaded their substance with the more readiness and force. Du Hamel guessed that the passage of air out of the air-vessels parallel to the woody fibres, causing the former to contract, must produce a power of suction in the latter, and so promote the conveyance of the sap, as well as its absorption from the earth. De la Hire went so far as to suppose, not only vessels, whose cavities he could not discover, in the woody fibres, but valves in those vessels, some having them placed so as to allow the sap to ascend, others in a contrary position. This imaginary structure, combined with fine theories of rarefaction and condensation, explained every thing that was wanted. "But unhappily," says the more faithful and more philosophical Du Hamel, "these valves, so commodious for all the above explanations, are a mere supposition. I have sought them in some plants of the reed kind, and have ardently wished to find them. I shall however relate plainly what I have been able to discover. After having succeeded in introducing coloured liquors in the longitudinal vessels of the plants in question, I thought I perceived in the centre of each vessel a firm longitudinal thread pervading its cavity throughout, which was rough, or clothed with a very fine pubescence. Such a structure is very similar to what M. Mariotte has discovered in the *vasa propria* of plants. Those who are so inclined may, if they please, suppose that this downy substance, being bent one way or the other, may perform the functions of valves, but after all, the whole will be but a supposition, to which some degree of probability only can be granted."

We have given the above passage from Du Hamel to shew, that nothing was really known in his time, concerning the true sap-vessels of plants.

Nor are the *reducent* vessels, confidently described by some recent writers as lodged near the pith, and which are supposed to return the sap towards the root, with more certainty to be demonstrated, at least as far as their functions are concerned, than the valves of De la Hire, whatever may be the case with the *adducent* vessels of the same authors, whose existence we are not disposed to deny.

But it is time to quit the regions of hypothesis, and to recur to facts and practical observations.

Dr. Darwin and Mr. Knight have shewn by clear experiments that the real sap-vessels are what had hitherto been considered as air-vessels, and which longitudinally pervade the *alburnum* or layer of new unhardened wood. Some of them have a spiral coat, others not, and these last probably are the adducent vessels of the authors above alluded to, who retain the old opinion that the others are air-vessels.

Young twigs of horse-chesnut, apple-tree, fig-tree, &c. whose lower ends are immersed in water stained with madder, log-wood, or the skins of very black grapes, imbibe such coloured fluids by their spiral-coated tubes. We have even found common ink to be absorbed by the *Hydrangea hortensis*, a shrub whose vascular system is large and easily discernible. But the fig perhaps is preferable to most other things for such experiments, as its white secreted juices, lodged in their appropriate vessels, are so strikingly contrasted with any coloured liquor which their sap-vessels may take up, and thus the course of the latter can be the more readily traced. Dr. Darwin pursued his observations to no great extent, but Mr. Knight, whose experiments are recorded in the "Philosophical Transactions for 1801," has traced the coloured fluids, not only along the main tubes of the branch, but has discovered how they are conveyed, by an appropriate set of vessels in every case, along the leaf-stalks into the substance of the leaves. The same most acute and ingenious philosopher has moreover discovered a set of returning vessels, commencing in the leaf, and conveying fluids to the young layer of bark. The fluids so conveyed are quite different from the sap of which we have hitherto been speaking. They possess the peculiar flavour of the plant whatever it may be, and are truly secreted fluid. Here then is a new and most satisfactory theory of vegetation

vegetation offered to our contemplation. The nutritious fluids, imbibed from the foil by the radical fibres, after, poffibly, undergoing fome change equivalent to digeftion, in the body of the root or bafe of the ftem, are conveyed in the ftate of fap along the laft-mentioned organ into the leaves. The fap therefore is the blood of a vegetable, and like that of animals, is nearly fimilar in all. In the leaf it is expofed to the action of light, heat and air, three powerful agents, fufficient to account for the changes it there undergoes. Much of the watery part of its compofition evaporates by perfpiration from the leaf, nor is the main body of the fap returned to the part, whence it was propelled, like blood to the heart, fo that in this fenfe vegetables cannot be ftrictly faid to have a circulation of their fap. That portion of the fap which returns from the leaf, is impregnated with carbon from the atmofphere, fo as to be capable of furnifhing matter of increafe through the bark to the body of the plant, according to the experiments of Du Hamel, Hope and others, and wood is moft plentifully fecreted under the infertion of each leaf, as is apparent from the fwelling obfervable in moft trees thereabouts. Indeed Dr. Hales had fhewn long ago that the bark, when cut afunder, extended itfelf from below a leaf or leaf-bud, and not above it, fee his "Vegetable Staticks," tab. 13.; and every body knows that all the part of a branch above a leaf dies in confequence of being cut.

Nor does the fap acquire in the leaves matter of increafe only. All the peculiar fecretions, by which one plant differs in tafte, fmell, and medical qualities, from another, are firft evolved in thofe organs, though probably perfected in the bark and wood. There originate the acid or alkaline, mucilaginous or refinous, acrid or aromatic, faccharine or bitter principles. How exquifite, then, is the chemiftry of nature, and how fine the ftructure of the vegetable frame, to elaborate and to preferve, in fo fmall a compafs, fuch different and difcordant fecretions! That portion of the fap which is carried to the flower and fruit, undergoes no lefs remarkable changes, for purpofes deftined to be accomplifhed there; nor is it returned from thence, as from the leaves, in order to anfwer any further end. Hence thofe parts, called the organs of fructification, have their own appropriate internal ftructure, as well as external configuration. Their fecretions of colour, fcent and flavour, are generally very diftinct from thofe of the leaves, and even more remarkable.

Now the real fap veffels are known, it feems no longer very difficult to account for the propulfion of fluids along them. The ftimulating effect of thofe fluids, as well as of external heat, upon the living principle of the veffels in queftion, their fpiral ftructure, the agitation of the whole vegetable frame, particularly the leaves, by wind, the great perfpiration of the latter, and confequent fuction of fluids from the veffels that enter their fubftance, are all furely fufficient caufes. Thofe who have hitherto treated the fubject of vegetable phyfiology, have confined their ideas too much either to mechanical or to chemical principles, without taking into confideration the living power by which alone the vegetable, as well as animal functions, can be in any adequate degree explained; and, after all, it muft be confeffed that this vital principle, whofe agency we cannot deny, proves in many inftances rather a refuge for our ignorance, than a fource of information.

One farther obfervation remains to be made, relative to the circulation or propulfion of the fap, that the vafcular fyftem of plants is ftrictly annual, not only in thofe herbs whofe whole exiftence is confined to one fummer, but even in trees and fhrubs. The layer of alburnum, along which the fap runs in the prefent fpring and fummer, is in autumn added to the wood, and foon affimilated to it, while the innermoft layer of bark, along which the returning fap, or rather fecretions, were conveyed, is in like manner added to the bark of preceding feafons, after fecreting materials for a new layer of bark and of alburnum. Thefe in their turn are laid afide; and though they may reafonably be fuppofed to be ftill employed in perfecting the fecretions lodged in their cells, they are out of the main courfe of circulation. The fame thing takes place in the perennial roots of many plants, whofe ftems and leaves are altogether annual. Such roots have many layers, more or lefs diftinctly marked, of wood and bark, and the fecretions which thofe parts contain are often very highly elaborated, as is the cafe with rhubarb, jalap, gentian, bryony, and many others. S.

Circulation *of the fpirits*, or *nervous juice*. That the fpirits circulate is evinced in the fame manner as fome authors choofe to prove the circulation of the blood, *viz.* that as the heart drives out every hour three or four thoufand ounces of blood, whereas ordinarily there are not above two thoufand in the whole body, there is a neceffity for the blood driven out to return to the heart, in order to fupply a fund to be expelled.

In like manner it is fhewn, that there is formed each hour a large quantity of fpirits, which are nothing but the more fubtile parts of this blood driven out from the heart; whence it is inferred that thefe two muft circulate.

The courfe they are fuppofed to take is this. The moft fubtile parts of the arterial blood being carried from the heart to the brain by the carotid arteries, are thrown violently into the fine net-work wherewith the bottom of the ventricles of the brain is lined; whence the more delicate parts are driven into the mouths of the choroid arteries, where they continue their rapid motion, and difcharge themfelves at the pores where thofe veffels terminate around the pineal gland.

Hence they enter that gland, and there form a conftant fpring of fpirits, which, being here purified, enter the cavities of the brain, and infinuating into the pores of its fubftance, flow into the lymphatics, whence they are carried to the heart by two ways; thofe from the upper parts by the fubclavian veins, and the adjacent veffels; thofe from the lower, being difcharged into Pecquet's refervoir, proceed by the thoracic duct, and at laft, by the defcending veins, to the heart, whence they begin their courfe afrefh. See Animal *Spirits*.

Circulation, *fubterranean*. Dr. Plott is one of the many authors who have argued for a fubterranean circulation of water, by means of which many fprings and rivers are fupplied with that water which they give again to the fea. It is probable, indeed, that many of the fmaller fprings are fupplied by rains, only where the country and fituation are favourable; but the larger rivers, and the fprings which fupply them, muft have their origin from fuch a fubterranean circulation, fince all the water that falls in a year in the whole earth, is not one five hundredth part the quantity of that difcharged into the fea at the mouths of rivers, as appears by careful and moderate calculations. There are fome fprings which ebb and flow with the fea; thefe cannot be doubted as to their origin, which is evidently from that body of water whofe motions they are influenced by. Nor is the cafe much lefs clear in regard to thofe lakes which have falt water and fea-fifh in them, and yet have no communication with any fea by any known cut or paffage.

The number of fhell-fifh and parts of fea-animals dug up in feveral places, at great depths within land, are alfo urged by fome as proofs of fuch fubterranean paffages of the fea-water; but thefe are too univerfally diftributed through

through the ſtrata of the earth to have been brought in this manner, and are therefore rather ſuppoſed to be owing to the great change made in the earth by the flood in the days of Noah. See VAPOUR, &c.

CIRCULATION, in *Chemiſtry*, is an operation whereby the ſame vapour, raiſed by fire, falls back, to be returned and diſtilled ſeveral times, and thus reduced into its moſt ſubtile parts.

Circulation is performed by diſpoſing the liquor in a ſingle veſſel, ſtopped at top, called a *pelican;* or in a double veſſel conſiſting of two pieces, luted on each other; the lower to contain the liquor and its vapours.

It is performed either by the heat of a lamp or that of aſhes, or of ſand moderately hot, or in dung, or by the ſun. It uſually demands a continued heat of ſeveral days, ſometimes of ſeveral weeks, or even ſeveral months. By circulation, the fineſt part of the fluid mounts to the top of the veſſel, and finding no iſſue there, falls back again, and rejoins the matter left behind at the bottom, whence it aroſe; and thus by continuing to riſe and fall alternately in the veſſel, there is effected a kind of circulation or remixtion of the ſpirituous parts with the groſs ones, whereby the former is rendered finer and more ſubtile, and are better diſpoſed to exert their activity when ſeparated from the latter.

CIRCULATION, in *Commerce*, denotes that reciprocal interchange of goods, money, or paper, by which the political and trading intereſts of a country are conducted and promoted.

Accordingly, ſome writers have repreſented it as the grand baſis on which the whole edifice of modern political economy reſts; as that which characterizes and diſtinguiſhes this ſyſtem of political economy from all others; and as that which determines and meaſures the population, the riches, the credit, the proſperity, and the power of nations; inſomuch that the degree of and facility of circulation being given, the degree of population, of riches, of credit, of proſperity, and of power, are neceſſarily given at the ſame time.

Dr. Smith, in his "Nature and Cauſes of the Wealth of Nations" (vol. i p. 485), obſerves, that the circulation of every country may be conſidered as divided into two branches: the circulation of the dealers with one another, and the circulation between the dealers and the conſumers. Although the ſame pieces of money, whether paper or metal, may be employed ſometimes in the one circulation, and ſometimes in the other, yet as both are conſtantly going on at the ſame time, each requires a certain ſtock of money of one kind or another to carry it on. The value of the goods circulated between the different dealers, never can exceed the value of thoſe circulated between the dealers and the conſumers: whatever is bought by the dealers being ultimately deſtined to be ſold to the conſumers. The circulation between the dealers, as it is carried on by wholeſale, requires generally a pretty large ſum for every particular tranſaction. That between the dealers and the conſumers, on the contrary, as it is generally carried on by retail, frequently requires but very ſmall ones; a ſhilling, or even a halfpenny, being often ſufficient. But ſmall ſums circulate much faſter than large ones. A ſhilling changes maſters more frequently than a guinea, and a halfpenny more frequently than a ſhilling. Conſequently, though the annual purchaſes of all the conſumers are at leaſt equal to thoſe of all the dealers, they can generally be tranſacted with a much ſmaller quantity of money; the ſame pieces, by a more rapid circulation, ſerving as the inſtrument of many more purchaſes of the one kind than of the other. Paper-money may be ſo regulated, as either to confine itſelf very much to the circulation between the different dealers, or to extend itſelf likewiſe to a great part of that between the dealers and the conſumers. When bank-notes are iſſued of a conſiderable value, *e. g.* of 10*l.*, paper-money confines itſelf very much to the circulation between the dealers. The conſumer is obliged to change it in the purchaſe of a ſmall quantity of goods, *e. g.* the worth of 5*s.* It often returns into the hands of a dealer before the conſumer hath ſpent the fortieth part of the money. But where bank-notes are iſſued for ſo ſmall ſums as 20*s.*, paper-money extends itſelf to a great part of the circulation between dealers and conſumers. By the mode of iſſuing for the purpoſe of circulation, bank-notes for very ſmall ſums, people of little real property are enabled and encouraged to become bankers: and the frequent bankruptcies to which ſuch mean bankers are liable, may occaſion a very conſiderable inconvenience, and ſometimes even a very great calamity to many poor people who had received their notes in payment. Dr. Smith ſuggeſts, that it might be better if no bank-notes were iſſued in any part of the kingdom for a ſmaller ſum than five pounds. Paper-money, he ſays, would then confine itſelf in every part of the kingdom to the circulation between the different dealers; and when this is the caſe, there will be always plenty of gold and ſilver. But when it extends itſelf to a conſiderable part of the circulation between dealers and conſumers, it baniſhes gold and ſilver almoſt entirely from the country; almoſt all the ordinary tranſactions of its interior commerce being then carried on by paper. Neverthelefs, though paper-money ſhould be pretty much confined to the circulation between dealers and dealers, yet bankers might ſtill be able to give nearly the ſame aſſiſtance to the induſtry and commerce of the country, as they would do if paper-money filled almoſt the whole circulation. The ready money which a dealer is obliged to keep by him for anſwering occaſional demands, is deſtined altogether for the circulation between himſelf and other dealers of whom he buys goods. He has no occaſion to keep any by him for the circulation between himſelf and the conſumers, who are his cuſtomers, and who bring ready-money to him, inſtead of taking any from him. Though no paper-money, therefore, was allowed to be iſſued but for ſuch ſums as would confine it pretty much to the circulation between dealers and dealers, yet, partly by diſcounting real bills of exchange, and partly by lending upon caſh accounts, banks and bankers might ſtill be able to relieve the greater part of theſe dealers from the neceſſity of keeping any conſiderable part of their ſtock by them unemployed, and in ready money, for anſwering occaſional demands. They might ſtill be able to give the utmoſt aſſiſtance which banks and bankers can with propriety give to traders of every kind. See BANK, COMMERCE, CREDIT, MONEY, and PAPER-MONEY.

CIRCULATORY, CIRCULATORIUM, in *Chemiſtry*, the veſſel wherein a fluid is put to undergo the proceſs of CIRCULATION.

There are two kinds of *circulatories;* the *diota*, or DOUBLE *veſſel;* and the PELICAN.

CIRCULUS, in *Geometry*, *Logic*, &c. See CIRCLE.

CIRCULUS, among *Chemiſts*, is a round iron inſtrument, uſed in cutting off the necks of glaſs veſſels; which they effect thus: The inſtrument, being heated, is applied to the glaſs veſſel, and there kept till the latter grows hot; then, by a few drops of cold water, or a cold blaſt thereon, it flies even and regularly off. Thus they cut off the necks of retorts, or cucurbits.

There is another method of doing the ſame; *viz.* by tying a thread, firſt dipped in oil of turpentine, round the place where the ſection is to be; and then ſetting fire to the thread. This done, ſome cold water being ſprinkled on the

the place, the glafs will be cracked through that part precifely where the thread was tied.

CIRCUMAGENTES *mufculi*, in *Anatomy*. See OBLIQUUS.

CIRCUMAMBIENT, an epithet denoting a thing to inveft, or incompafs another round. Thus, we fay, the ambient, or circumambient air, &c.

CIRCUMCELLIONES, in *Church Hiftory*, a fet of illiterate favage peafants, and defperate ruffians, who adhered to the party of the DONATISTS towards the end of the fourth century. They affumed the title of vindicators of juftice, and protectors of the oppreffed, and maintained their caufe by force of arms, and filled the whole province of Africa with flaughter and rapine. Conftantine the Great, in order to quiet the tumults which they occafioned, abolifhed the laws that had been enacted againft the Donatifts; however, after his death, their affaffinations and maffacres were renewed, till they were defeated by Macarius at the battle of Bagnia. Many of this frantic mob were afterwards treated with great feverity, and the Donatifts fhared their fufferings.

CIRCUMCISION, the act of cutting off the prepuce; or a ceremony, in the Jewifh and Mahometan religions, wherein they cut away the forefkin of the males who are to profefs the one or the other law.

Circumcifion commenced in the time of Abraham; and was, as it were, the feal of a covenant ftipulated between God and him: it was in the year of the world 2107, of the Julian period 2817, B.C. 1897, that Abraham, by divine appointment, circumcifed himfelf, and all the males of his family; from which time it became an hereditary practice among his defcendants.

This appointment (fee Gen. xvii. 9, &c.) was accompanied with a further injunction, that for the future all males born of him, or in his family, whether bond or free, fhould be circumcifed on the 8th day after the birth, and alfo a declaration, that if any male remained uncircumcifed, that perfon fhould be cut off, as a defpifer of God's covenant, from having any fhare in the promifed land defigned for him and his pofterity.

This ceremony, however, was not confined to the Jews: Herodotus and Philo Judæus have obferved, that it obtained alfo among the Egyptians and Ethiopians. Herodotus fays, (lib. ii. c. 91.) that the cuftom was very ancient among each people; fo that there was no determining which of them borrowed it from the other. Among the Egyptians, he fays, it was inftituted ἀπ' ἀρχῆς, from the beginning; by which expreffion, as Shuckford intimates (Conn. vol. i. p. 324.) he could not mean, from the firft rife or original of that nation, but that it was fo early among them, that the Heathen writers had no account of the original of it. When any thing appeared to them to be thus ancient, they pronounced it to be ἀπ' ἀρχῆς. That Herodotus himfelf meant no more than this by the expreffion is evident from his own words. For we find him querying, whether the Egyptians learnt circumcifion from the Ethiopians, or the Ethiopians from the Egyptians, and he leaves the queftion undecided, merely concluding that it was a very ancient rite, (lib. ii. c. 104.) There had been no room for this hefitation and indecifion, if he had before meant, that it was an original rite of the Egyptians when he faid it was ufed by them "from the beginning." But among the Heathen writers, to fay a thing was ἀπ' ἀρχῆς, "from the beginning," or that it was "very anciently" practifed, are terms perfectly fynonymous, and mean the fame thing.

The fame hiftorian relates, that the inhabitants of Colchis alfo ufed circumcifion; whence he concludes, that they were originally Egyptians. He adds, that the Phœnicians and Syrians, who lived in Paleftine (*i. e.* as Jofephus rightly corrects him, (Cont. Apion.) the Jews) were likewife circumcifed; but that they borrowed the practice from the Egyptians. And, laftly, that a little before the time when he wrote, circumcifion had paffed from Colchis, to the people inhabiting near Thermodoon and Parthenius.

Diodorus Siculus (lib. i.) thought the Colchians and the Jews to be derived from the Egyptians, becaufe they ufed circumcifion. And again he fays (lib. iii.), fpeaking of fome other nations, that they were circumcifed, after the manner of the Egyptians. Sir John Marfham is of opinion, that the Hebrews borrowed circumcifion from the Egyptians; and that God was not the firft author thereof; citing Diodorus Siculus, and Herodotus, as evidences on his fide. This latter propofition feems directly contrary to the teftimony of Mofes, who affures us, (Gen. xvii.) that Abraham, though ninety-nine years of age, was not circumcifed till he had the exprefs command of God for it.

Celfus and Julian, as we learn from Origen and Cyril, adopted the opinion, avowed by Marfham; and lord Shaftefbury in his "Characteriftics," (vol. iii. p. 52.) has alfo expreffed his fentiments to the fame purpofe. As to the teftimonies of Herodotus and Diodorus, they cannot be held in very high eftimation, if we confider, that the Heathen writers in general were very imperfectly and partially acquainted with the Jewifh hiftory. In the books of Jofephus (Cont. Apion) we have many inftances of their errors and mifreprefentations with regard to the hiftory of the Jews; and the account which Juftin, the epitomizer of Trogus Pompeius, gives of their original, (Juftin. lib. xxxvi. c. 2.) evidently fhews, that they were but very fuperficially acquainted with Jewifh affairs. Accordingly, Origen might juftly blame Celfus for adhering to the Heathen accounts of circumcifion in preference to that of Mofes; for Mofes has given a clear and full account of the original of the inftitution, whilft they only afford us imperfect hints and conjectures. Befides, we have (fays Shuckford) the teftimony of an Heathen writer unqueftionably confirming Mofes's account of Abraham's circumcifion. We read in Philo Biblius's extracts from Sanchoniathon (apud Eufeb. Præp. Evang. lib. i. c. 10.) of a record in the Phœnician antiquities, that Ilus, who was alfo called Chronus, circumcifed himfelf, and compelled his companions to do the fame. This Ilus, or Chronus, according to fir John Marfham, was Noah, or at leaft, as other writers fuggeft, he was a perfon much more ancient than the times of Abraham; and therefore they infer from this paffage, that circumcifion was practifed before the time of Abraham. To this argument, however, it may be replied, that the fame author who gives us this account of Ilus, or Chronus, fufficiently informs us who he was, by telling us that he facrificed his only fon; and we are further informed, with refpect to this Chronus, from the Egyptian records, that the Phœnicians called him Ifrael. Chronus, therefore, or Ifrael, who was reported to have facrificed his only fon, can be no other perfon than Abraham, who is reprefented by the Heathen writers as having facrificed his only fon Ifaac. Jacob was, indeed, the perfon who was called Ifrael; but the Heathen accounts afcribe to him 10 fons; and here we have only a trivial miftake compared with many others which occur in the Heathen hiftories; or that of applying the name Ifrael to the perfon, who, as they fay, facrificed his only fon, when the name really belonged to his grandfon. From this paffage, therefore, it appears, not as fome writers would infer from it, that circumcifion was ufed in Heathen nations for ages before Abraham, but that Abraham and his family were circumcifed;

cumcifed; and, therefore, unlefs they can produce a teftimony of fome other perfons being circumcifed, cotemporary with, or prior to, Abraham, we have their own confeffion that Abraham was circumcifed at an earlier period than that in which they can produce an inftance of any other perfon's being circumcifed in the world. Moreover, it has been alleged, that the Philiftines, who were originally Egyptians, and gave name to the country, were circumcifed: and if we may be allowed to refer to the rabbinical commentators on this fubject, they pretend that one of the three proofs, which Jofeph gave to the patriarchs of his being their brother (fee Gen. xlv. 12.), was the token of circumcifion, which, as they fay, was peculiar at that time to the family of Abraham. This he is fuppofed to have difcovered, by unfolding his garment, when they ftood near him, and bidding them regard it. Jofeph's "caufing every man to go out (v. 1.) and praying his brethren to come near him," (v. 4.) feems to intimate, that he had fome important fecret to impart to them, a fecret which was not to be expofed to the ridicule or wanton curiofity of the uncircumcifed Egyptians. Otherwife there appears to be nothing, in this whole narration, which is told with fo much elegance and fimplicity, that could in any manner offend, or which, indeed, would not rather have afforded the greateft pleafure and fatisfaction to the Egyptians. (See Shaw's Travels, p. 390.) It feems alfo to be implied (Jerem. ix. 25, 26.) that the Egyptians were not circumcifed at the time when that prophet lived, *viz.* about 627 years before Chrift, which was not 200 years before Herodotus flourifhed and wrote his hiftory.

Dr. Spencer, in his learned work "De Legibus Hebræorum, &c." (lib. i. c. 5.) diftinguifhes between patriarchal and Mofaic circumcifion: the former was in ufe before the law, and fealed the covenant between God and Abraham, as well as his pofterity: the latter derived a kind of new fanction from the Mofaic law, and was deemed a primary ceremony of the Jewifh religion. He confiders the defign and ufe of this inftitution, partly as a *fign*, and partly as a *feal*. As a *fign*, it ferved to diftinguifh and difcriminate the people of God, and particularly the pofterity of Abraham, from whofe line the Meffiah was to proceed, from other nations; it was alfo a memorial of the covenant between God and Abraham; it figuratively denoted the purity and fanctity which pertained to the character of thofe who fuftained a relation to God; it was alfo a token of initiation, by which perfons were introduced into the Jewifh church, and devoted themfelves to the worfhip of Jehovah; it was a kind of prophylactic, or prefervative fign, which intimated the providential protection in which the Jews were peculiarly interefted; and it was a political fign, by which profelytes were admitted into the commonwealth of Ifrael, and a participation of the external privileges and honours pertaining to the Jewifh people. Circumcifion, as a *feal*, ferved to indicate and to ratify the covenant fubfifting, under the patriarchal difpenfation, between God and the defcendants of Abraham, and, under the Mofaic economy, between God and the Jewifh people. On the part of God, it betokened and enfured the grant of peculiar bleffings, and on the part of men, abftinence from idolatry, and a ftedfaft adherence to the worfhip and fervice of Jehovah. This learned writer proceeds to enumerate a variety of reafons, natural, moral, and ceremonial, for the particular mode in which this rite was performed, and he intimates that at the time of its performance it was ufual to give a name to thofe who were the fubjects of it. In an elaborate inquiry concerning the origin and antiquity of this rite, he ftates the arguments for and againft its derivation from the Egyptians; and without abfolutely determining the queftion, he feems to incline to the opinion adopted by fir John Marfham and others. The evidence, however, as we have already obferved, feems to preponderate on the other fide; and it is generally allowed that the practice of circumcifion, among the Hebrews, differed very confiderably from that of the Egyptians. Among the firft it was a ceremony of religion, and was performed on the eighth day after the birth of the child: among the latter, it was a point of mere decency and cleanlinefs; and, as fome will have it, of phyfical neceffity; and was not performed till the thirteenth year; and then on girls as well as boys.

Among the Jews, circumcifion was performed with a knife made of fome kind of ftone, as being thought lefs dangerous than other inftruments of iron or fteel. But nothing is ordained, in the original inftitution of this rite, with refpect to the perfon by whom, or with what inftrument, or in what manner the ceremony was to be performed; only that the forefkin fhould be cut off on the eighth day; fo that it was left to the option of the parent, either to perform it himfelf, or to employ fome other perfon, either a prieft, a furgeon, or a friend. In this laft capacity, it was confidered as a high compliment to be chofen to that office. The ceremony, the mode of performing which it is needlefs minutely to defcribe, was ufually accompanied with great rejoicing and feafting; and it was at that time, as we have already obferved, that the child was to be named by the parents, in the prefence of the company. Thefe names were generally fignificant of fomething relating to the parents or the child, or to fome other circumftances of time or place. The Ifraelites fet afide the practice of circumcifion, during the forty years of their paffage through the wildernefs; becaufe, as fome have argued, circumcifion being intended as a mark of diftinction between the Jews and the Gentiles, it was not neceffary to make any mark at all, in a place wherein there was nobody to mix with them. Other reafons, however, have been affigned for the difcontinuance and revival of this rite, of which it will be proper to give fome account. After the Ifraelites had paffed the river Jordan, Jofhua encamped at Gilgal, on the eaft fide of Jericho, and here God directed him to revive the right of circumcifion; for the Ifraelites had circumcifed none of their children that were born, after the exit from Egypt, until this time. In order to account for this neglect, it has been alleged, that the covenant which the Ifraelites made with God at Horeb was to do and obferve all the things which the Lord fhould command them (fee Exod. xix. 8. xxiv. 3. 7. Deut. v. 27. xxvi. 17.); and they were to avoid the introduction of any religious rite, without a divine command: and, therefore, though God had ordered Abraham to circumcife himfelf and children, and to enjoin the ufe of this rite on his pofterity; yet, when God was giving to the Ifraelites a new law by the inftrumentality of Mofes, they could not warrantably affume any rite, however ancient or cuftomary, as a part of it, unlefs God himfelf gave them a command for it. God, indeed, had given them a command for circumcifion. We find it among the laws given after the death of Nadab and Abihu, the fons of Aaron (Lev. xii. 3.), who were killed by fire from the Lord, for offering incenfe in a manner which he did not command (Lev. x. 1.); and this incident muft ferve as admonition to the people not to mingle any of their own fancies in the performance of any divine inftitutions, and rendered them particularly cautious in every matter of this kind. Although the paffover was a feaft which they were commanded to obferve throughout their generations by a perpetual ordinance (Exod. xii. 14.); yet we find that they

they did not attempt a second celebration of it, without an express command from God for the purpose (Numb. ix. 1, 2, 3. 7.); nor did they venture to proceed in a case of doubt, which occurred in relation to the men, who were defiled by a dead body, but waited till Moses heard what the Lord would command concerning them. (Numb. ix. 6, 7, 8.) Thus also, as the law for circumcision required the males to be circumcised at the age of eight days (Lev. xii. 3.), and was not given till within the second year of the Exodus, when there must have been in the camp a great number of children uncircumcised, who were past the day of age at which this rite was to be performed, a doubt would arise, when or how these were to be put "under the law;" and as the Israelites did not receive directions from God how to act, they might reasonably hesitate in proceeding without special instruction. The reader, who consults Poli Synops. Critic. in loc. will find various reasons assigned by critics and commentators for the omission of circumcision during the period already noticed. But Shuckford, (see his Conn. of Sacred and Prophane Hist. vol. ii. p. 156.) thinks they have not succeeded in assigning the true one. We find (he says) no fault imputed to the Israelites for their neglect of it, and God himself now "rolled away the reproach of Egypt from off them," (Josh. v. 9.); so that the Israelites had long esteemed it a reproach to them, that they did not practise this rite; but it had been their misfortune, that God had not yet given them orders how or when to begin it, and, therefore, they were under a necessity of living in the omission of it. Shuckford suggests that the expression here used has been misunderstood. A state of circumcision is called the "reproach of Egypt," that is, as some say, the Egyptians thought it a reproach to them who lived in it: and, indeed, it is necessary to take the words in this sense, if we would infer from them that circumcision was originally an Egyptian rite, and that the Hebrews learned from them the use of it. But the writer, whose observations are now cited, is of opinion, that the true meaning of the expression "the reproach of Egypt," is directly contrary to the sense which these writers would give to it. "My reproach," "my shame," "my dishonour," (see Gen. xxx. 23. 2 Sam. xiii. 13. Ps. lxix. 19.) do all signify, not what I may have to impute to others, but what others may object to me; and, in like manner, "reproach of Egypt," or "Egyptian reproach," signifies not what the Egyptians might think a disrepute to others, but what other nations esteemed a blemish and defect in them. We find an expression of like import thus used by one of the most elegant classics. (See Hor. Carm. l. iv. od. 12.) The swallow is said to be

> "—— Cecropiæ domûs
> Æternum opprobrium,"

the "everlasting reproach of the house of Cecrops," not as hinting any thing, for which the descendants of Cecrops might reproach others; but upon account of facts that were a lasting dishonour to this family. Thus also, they were not the Egyptians at this time, but the Israelites, who thought uncircumcision a disreputable thing, and accounted all nations profane, that did not use this institution; and the Egyptians at this time, not observing this rite, this, in the judgment of the Israelites, was their reproach, a thing opprobrious or disgraceful to them: and, therefore, when God here appointed the Israelites to be circumcised, he "rolled away the reproach of Egypt from off" them; he removed from them that state of uncircumcision, which they thought an infamous defect in the Egyptians. With regard to the revival of circumcision by Joshua, our author makes the two following observations; the first is, that the Israelites must hence derive full conviction that all their fathers were dead, against whom God had denounced, that their carcases should fall in the wilderness (Numb. xiv.); for, upon this renewal of circumcision, none having been circumcised from the time of the Exodus till now (Josh. v. 5.), it became evident how many of the camp had been in Egypt; and, by computing the age of those who had been there, it would appear, that no persons were then alive except Caleb and Joshua, who were twenty years old, when the poll was taken in the year after the Exodus. (Numb. xxvi. 64, 65.) Secondly, as the Israelites were now in an enemy's country, in the neighbourhood of a powerful and populous city, and could not be secure for one day, that the Canaanites might not attempt to march against them, Joshua, without an express order from God, could never have thought this a proper time to disable any part of the camp by circumcising them; and, therefore, he must certainly have had a command from God to this purpose.

M. Fleury observes, that the Jews were not unanimous as to the necessity of circumcision; some holding it an essential, others only as a circumstance.

Among the Jews, the father is obliged to have his son circumcised on the eighth day; it may not be sooner: but the child's weakness may allow of its being deferred longer. There is a god-father to hold the child, and a god-mother to carry it from the house to the synagogue, and to present it there. He who circumcises is called in Hebrew *Mohel;* any person is chosen for the purpose indifferently, provided he be but capable of the function, which, among the Jews, is a title of great merit. The manner of the ceremony, as related by Leo de Modena, is as follows.—Two seats are prepared in the morning with silken cushions, one for the god-father, who holds the child, the other, as they say, for the prophet Elias, whom they suppose to assist invisibly. The person who is to circumcise brings the necessary utensils; the razor, styptic, linen, fillet, and oil of roses; to which some add a shell full of sand, to put the preputium in. A psalm is sung till the god-mother brings the child, attended with a crowd of women, and delivers it to the god-father, none of them entering the door: the god-father, being seated, sets the child on his lap; then the circumciser, taking the razor, and preparing the child for the operation, says, "Blessed be thou, O Lord, who hast injoined us circumcision," and in so saying cuts off the thick skin of the preputium, and with his finger-nails tears off another finer skin remaining, sucking the blood two or three times, as it breaks out, and spitting it out into a glass full of wine; then he lays dragon's blood on the wound, with powder of coral, and other things, to staunch the blood; and lastly, a compress of oil of roses; and thus binds up the whole: this done, he takes a glass of wine, and, blessing it, adds another benediction for the child, and imposes the name.

Circumcision, though it be not so much as once mentioned in the Koran, is yet held by the Mahometans to be an ancient divine institution, confirmed by the religion of Islam, and though not so absolutely necessary but that it may be dispensed with in some cases, yet highly proper and expedient. The Arabs used this rite for many ages before Mahomet, having probably learned it from Ismael, though not only his descendants, but the Hamyarites, and other tribes, practised the same. The Ismaelites, we are told (Joseph. Ant. b. i. c. 23.), used to circumcise their children, not on the 8th day, according to the custom of the Jews, but when about twelve or thirteen years old, at which age their father underwent that operation (Gen. xvii. 25.): and the Mahometans imitate them so far as not to circumcise children before they be able,

 at

at leaſt, diſtinctly to pronounce that profeſſion of their faith, "There is no God, but God, Mahomet is the apoſtle of God;" but they fix on what age they pleaſe for the purpoſe between ſix and ſixteen. Although the Moſlem doctors are generally of opinion, conformably to the Scripture, that this precept was originally given to Abraham, yet ſome have imagined that Adam was taught it by the angel Gabriel, to ſatisfy an oath he had made to cut off that fleſh, which, after his fall, had rebelled againſt his ſpirit; whence an odd argument has been drawn for the univerſal obligation of circumciſion (See the apocryphal Goſpel of Barnabas, c. 23.). It cannot be ſaid, indeed, that the Jews took the lead of the Mahometans in this way, yet they ſeem ſo unwilling to believe any of the principal patriarchs or prophets before Abraham were really uncircumciſed, that they even pretend ſeveral of them, as well as ſome holy men who lived after his time, were born in a circumciſed ſtate, or without a foreſkin; and that Adam, in particular, was ſo created; whence the Mahometans affirm the ſame thing of their prophet; but as the practice was in uſe among the Arabs long before, the prophet muſt have been circumciſed many years prior to his pretended miſſion. See "Pocock, Spec." and "Abulfed. Vit. Mahom." cited by Sale in the Preliminary Diſcourſe to the Koran. Among the Mahometans they have a tradition, that their prophet declared circumciſion to be a neceſſary rite for men, and for women honourable. This tradition makes the prophet declare it to be "Sonna," which Pocock renders a neceſſary rite, though Sonna, according to the explanation of Reland, does not comprehend things abſolutely neceſſary, but ſuch as, though the obſervance of them be meritorious, the neglect is not liable to puniſhment. Aſſemani aſſerts, that the Turkiſh children receive their name at the inſtant of circumciſion, as the children of Chriſtians do at baptiſm: and with reſpect to the circumciſion of Chriſtian proſelytes, that they are previouſly obliged to trample and ſpit three times on a croſs preſented to them for that purpoſe, and then three arrows being ſhot off into the air by three of the attendants, the name of the new convert is pronounced before the arrows fall to the ground. "The two laſt circumſtances," ſays Dr. Ruſſell (Hiſt. of Aleppo, vol. i. p. 407.), are unknown at Aleppo; and the firſt is certainly a miſtake; for the child is named almoſt as ſoon as it comes into the world; and at Conſtantinople alſo, the naming of the child is not deferred till the time of circumciſion. The circumciſion of females is not known at Aleppo; and Dr. Ruſſell is of opinion, that circumciſion is not abſolutely neceſſary in that climate on a phyſical account; nor does it appear to prevent any inconveniences which might not be obviated by leſs violent means. At Aleppo the boys are circumciſed between the age of ſix and ten, ſometimes later, but very ſeldom earlier. From that period their heads are ſhaved, and they aſſume the turban, inſtead of the handkerchief, which they wore during infancy. The ceremony is performed at the father's houſe, where noiſy rejoicings are made for ſeveral days. The boy receives preſents from his kindred, as well as from others who have been invited to the feaſt. He is dreſſed in new clothes, his turban is decked with flowers and tinſel, and for five or ſix days he wears a kind of large ſilk apron faſtened upon one ſhoulder, as a badge of the operation he has undergone. In this dreſs he is led on horſeback, in proceſſion through the ſtreets, preceded by the caſtle-muſic and ſeveral men armed with ſcymitars and ſhields. A number of female relations cloſe the proceſſion, and, after every ſtop made for the mock champions to combat, the women ſhout in their uſual manner while the men huzza. It is cuſtomary for people of condition to have two or three of their dependants' children circumciſed at the ſame time, which adds to the pomp of the cavalcade. Sonnini (ſee his "Travels in Upper and Lower Egypt," p. 337), deſcribes proceſſions on a ſimilar occaſion, which he frequently witneſſed in the ſtreets of Siout.

The Turks, before the operation of circumciſion, ſqueeze the ſkin with little pincers, to deaden the ſenſation; they then cut it off with a razor, and apply a certain powder which heals the wound and takes off the pain. They never circumciſe till the ſeventh or eighth year, and ſometimes the eleventh or twelfth, as having no notion of its being neceſſary to ſalvation.

The manner of circumciſing among the Turks differs from that of the Jews; for the former, after they have cut off the ſkin, meddle no farther; but the laſt tear off the edge of the remaining ſkin in ſeveral places with their thumb-nails, which is the reaſon why the circumciſed Jews are cured much ſooner than the Turks.

Thoſe among the Jews who perform the operation of circumciſion are diſtinguiſhed by the length of their thumb-nails.

The Perſians circumciſe their children ſometimes within ten days after their birth, and ſometimes at ten years of age: that of girls is unknown: the wound is healed with cauſtic or aſtringent powders; and burnt paper is very generally uſed, which, according to Chardin, is the beſt remedy. This author tells us, "that the operation, when performed on grown perſons, is attended with conſiderable pain; that they are obliged to confine themſelves to the houſe for three or four weeks, and that death is ſometimes the conſequence."

Thoſe of Madagaſcar cut off the fleſh at three ſeveral times, and the moſt zealous of the relations preſent catches hold of the preputium and ſwallows it.

In the Maldivia iſlands, children are circumciſed at the age of ſeven years. In order to render the ſkin ſoft, the children are bathed in the ſea ſix or ſeven hours before the operation.

Herrera tells us, there is a kind of circumciſion among the Mexicans, though they are very far both from Judaiſm and Mahometaniſm; they cut off the foreſkin of the virile member, and the ears, as ſoon as the child is born, with great ceremony.

Among all the nations ſeated on the genuine Maranon in America, circumciſion is practiſed among the men, and exciſion among the women. Among the latter it is uſed at the age of ſeven, eight, or nine years, as in Arabia.

There is a kind of circumciſion practiſed at Otaheite, one of the newly diſcovered iſlands in the South Seas. The operation is performed by a prieſt, and conſiſts in ſlitting the prepuce through the upper part, to prevent its contracting over the glans. The practice ſeems to have taken its riſe from motives of cleanlineſs. Hawkeſworth's Voyages, vol. ii. p. 241.

Circumciſion is very generally practiſed in Abyſſinia, (ſee Abyssinia.) The Abyſſinians have a tradition among them, which merits ſome conſideration in the inquiry into the origin of this rite; *viz.* that they were, in the earlieſt time, circumciſed, before they left their native country and ſettled in Tigré. On this point Mr. Bruce obſerves, that if circumciſion was originally a Jewiſh invention, it ſeems very extraordinary, that all thoſe nations to the ſouth ſhould be ignorant of it, while others towards the north were ſo early acquainted with it: for none of thoſe nations up the Nile (except the ſhepherds) either know or practiſe it to this day; though, ever ſince the 1400th year before Chriſt, they have been in the cloſeſt connection with the Jews. Hence this writer infers, that the rite of circumciſion migrated northward from the plain of Mamre, for it certainly

made

made no progrefs fouthward from Egypt. As many nations contiguous to Egypt never received circumcifion from it, it feems, fays Mr. Bruce, an invincible argument, that this was no endemial rite or cuftom among the Egyptians; and it was of no ufe to this nation, as the reafons mentioned by Philo and others, of cleanlinefs and climate, are abfolute dreams, and are now exploded; and that they are fo is plain, becaufe otherwife, the nations more to the fouthward would have adopted it, as they have univerfally done the cuftom of female circumcifion, which Mr. Bruce calls "excifion." Circumcifion then, fays this author, (Travels, vol. iii. p. 346.) having no natural caufe or advantage, being in itfelf repugnant to man's nature, and extremely painful, if not dangerous, could never originate in man's mind wantonly and out of free-will. It might have done fo indeed from imitation, but with Abraham it had a caufe, as God was to make his private family in a few years numerous, like the fands of the fea. This mark, which feparated them from all the world, was an eafy mode of fhewing whether the promife was fulfilled or not. They were going to take poffeffion of a land where circumcifion was not known, and this fhewed them their enemy diftinct from their own people. And it would be the groffeft abfurdity to bind Sampfon to bring, as tokens of the flain, fo many forefkins or prepuces of the Philiftines, if, as Herodotus fays, the Philiftines had cut off their prepuces a thoufand years before.

Circumcifion among the ancient Egyptians was confidered as indifpenfable. Whether it was really fo in their climate, Sonnini (Travels in Upper and Lower Egypt, p. 263.) does not undertake to refolve; although he thinks, that if it be not altogether neceffary, it is at leaft of very great utility among a rude and flovenly people. It is likewife in ufe among the Copts, who, not thinking themfelves fufficiently fure of admittance into paradife by virtue of the baptifm they receive as Chriftians, reckon it alfo neceffary to fubmit to circumcifion, following, in this refpect, as well as in feveral others, the precepts of the religion of the Mahometans, among whom they live.

In Egypt circumcifion is not peculiar to the men; but the women alfo undergo one of a fomewhat fimilar nature. This fort of circumcifion, called indeed by Bruce "excifion," as we are informed by Strabo (lib. xvii.), was practifed by the people of ancient Egypt. He fays, the Egyptians circumcifed both men and women "like the Jews." It does not appear that any fuch operation ever obtained among the Jewifh women; nor is it any where pretended to have been a religious rite, but to be introduced from neceffity, in order to avoid a deformity to which nature has fubjected particular perfons, in particular climates and countries. All the Egyptians, as Mr. Bruce informs us, the Arabians, and nations to the fouth of Africa, the Abyffinians, Gallas, Agows, Gafats, and Gongas, make their children undergo this operation, at no fixed time, indeed, but always before they are marriageable. Belon fays the practice prevailed among the Coptæ; and P. Jovius and Munfter fay the fame of the fubjects of Prefter John.

The greater number of thofe who have written on the practice of female circumcifion, have confidered it as the retrenchment of a portion of the nymphæ, which are faid to grow, in the countries where the practice obtains, to an extraordinary fize. Others have imagined that it was nothing lefs than the amputation of the clitoris, the elongation of which is faid to be a difgufting deformity, and to be attended with other inconveniences, which rendered the operation neceffary.

Sonnini fays, that before he had an opportunity of afcertaining the nature of the circumcifion of the Egyptian women, he imagined it confifted in the amputation of the excrefcence of the nymphæ or of the clitoris, according to circumftances, and according as thefe parts were more or lefs elongated. He adds, that it is even very probable, that thefe operations take place not only in Egypt, but likewife in feveral countries of the Eaft, where the heat of the climate, and other caufes, may produce too great an increafe of thefe parts. This author, fufpecting that there muft be fomething more than an excefs in thofe parts, an inconvenience, which, far from being met with in all women, could alone have given rife to an ancient and general practice, determined to fubmit the matter to the teft of experience. Having examined a young girl of Egyptian origin, about 8 years old, he found a thick, flabby, and flefhy excrefcence, covered with fkin, which grew from above the commiffure of the labia and hung down it about half an inch. In fize and fhape it refembled the caruncle pendent from the bill of a turkey-cock. This fingular excrefcence was cut off by a female operator, without giving much pain to the patient, and without touching either the nympha or the clitoris, which parts were not vifible. The only topical application was a pinch of afhes, although the wound difcharged a confiderable quantity of blood. This operation feems to be neceffary, as this fort of elongated caruncle increafes in proportion to a girl's age, and if fuffered to remain, would entirely cover the os externum. The excrefcence now defcribed is peculiar to women of Egyptian origin, all others, according to Sonnini, being exempt from it, though belonging to nations that are fettled in the country, and in a manner naturalized. The operation is commonly performed on the Egyptian girls at the age of 7 or 8 years. The women of the Saïd are thofe who are accuftomed to perform the operation; and they go about the towns and villages, crying in the ftreet, "circumcifor! who wants a circumcifor?" A fuperftitious tradition has fixed the period in which circumcifion is to be practifed, at the commencement of the increafe of the Nile. In this excrefcence, which is a diftinguifhing characteriftic of the women indigenous in Egypt, we may difcover fome refemblance of that which is peculiar to the inhabitants of the other extremity of Africa. Indeed there is reafon for believing, that this appendage is not reftricted to the Egyptian women only, but extends from their country as far as the Cape of Good Hope, by a line which includes merely the tawny women, and not the female negroes, who have no fuch characteriftic.

Circumcision, in *Surgery*, is an operation to which practitioners have recourfe on feveral emergencies, *viz.* when the prepuce is fo much elongated as to become inconvenient;—when it is clofely contracted, fo as not to admit a free difcharge of the urine;—when there is an ulcer or excoriation under the prepuce, requiring the ufe of fome medicated application, and which cannot be done without removing the forefkin;—when warty excrefcences are formed in a confiderable quantity around the glans penis;—or, when the prepuce itfelf becomes fo altered in its ftructure as to threaten more ferious confequences than would arife from its excifion.

In females, efpecially thofe refiding in hot countries, the preputium clitoridis is often fo much enlarged as to need a fimilar operation; and this fact is mentioned both by the Arabian and Greek phyficians, particularly by Paulus Œgineta, Œtius, Avicenna, Albucafis, &c.

This operation requires but little fkill in the performance, except in guarding againft any accident to the glans, and in taking care to divide the inner as well as the outer fold of the prepuce. The ftate of the difeafed parts may occafion fome diverfity in the mode of circumcifing, but, in general, one of thefe two methods is expedient:

1. *Firft*,

First, to draw forward the prepuce, and hold it between a pair of forceps; then to cut off the projecting portion of skin with one stroke of the scalpel: or, *Secondly*, to introduce a narrow bistory, concealed within a deep director, until it reaches the top of the corona glandis; next, after pushing the bistory through the upper part of the foreskin, and bringing it along to the extremity, cut around the whole prepuce nearly in a circular direction, till the superfluous portion is removed. But in making this latter incision, it is necessary to avoid touching the frænum and glans, lest the patient should suffer unnecessary pain and subsequent injury from the surgeon's carelessness in operating.

The first method of circumcising is not eligible, if it be designed to expose the whole surface of the glans, although we may sometimes be required to take away only a small part of the prepuce, or even to lay it open without removing any. The after-treatment is very simple, provided the parts are not diseased. The softest and least irritating dressings are most proper. The patient should keep in bed, or recline on a couch, for a few days, and shun all causes of inflammation. See PHYMOSIS, WARTS, LUES VENEREA, and SYPHILIS.

CIRCUMCISION is also the name of a feast celebrated on the first of January, in commemoration of the circumcision of our Saviour. This day was anciently kept a fast, in opposition to the Pagan superstitions, who feasted on it in honour of the god Janus.

CIRCUMFERENCE, formed from *circum*, *about*, and *fero*, *I carry*, in *Geometry*, the curve line that incloses a circle, or circular space; called also the periphery.

All lines drawn from the centre of a circle to the circumference, called *radii*, are equal.

Any part of the circumference is called an *arc;* and a right line drawn from one extreme of the arc to the other, a *chord*. See ARC and CHORD.

The circumference of every circle is supposed to be divided into 360 equal parts, which are called *degrees*. See DEGREE.

The angle at the circumference is double that at the centre. See CIRCLE.

The circumferences of circles are to each other as their radii. See CIRCLE.

And, since the circumference of one circle is to its radius, as that of any other circle to its radius; the ratio of the circumference to the radius is the same in all circles. For the method of estimating the proportion of the diameter to the circumference, see DIAMETER, RECTIFICATION, and QUADRATURE.

CIRCUMFERENTOR, a mathematical instrument used by land-surveyors, for taking angles by the magnetic needle. It is an instrument (where great accuracy is not desired) much used in surveying, in and about woodlands, commons, harbours, sea-coasts, in the working of coal mines, &c. &c. where a permanent direction of the needle is of the most material consequence in surveying.

In *Plate* II. of *Surveying*, *fig.* 1. represents the general form of the modern circumferentor. It is made of brass, and, in its most simple state, consists of the following parts. A, a brass compass box, about five inches diameter, or more. On the plate of the box, are engraved and lettered the principal points of the compass, divided into four quarters of 90 degrees each, two of the quarters being figured from the south point, and terminated by 90 degrees at the east and west; and the other two quarters from the north point, terminating also at the east and west. On the circumference of the plate, is fixed a ring, divided into 360 degrees, numbered from 0 to 360; the observer may therefore take his angles, as bearing from the north and south towards the east and west; or, by that which is the most usual method, the whole circumference of a circle of 360 degrees, commencing from the north point. A magnetic needle of the usual kind turns upon an iron point, fixed in the centre of the compass plate. A stop and trigger wire is applied to the compass box, to throw the needle off its centre when not in use, in order to preserve the fineness of the centre point. A glass and brass spring ring covers the needle and closes the box. To the under side of the compass box, at the N. and S. points, is connected the bar B B, about 15 inches long from end to end, to each end of which is fixed a perpendicular brass sight C C, about five inches long, each sight containing a long slit or perforation, and a sight line, so that the observer may take his line of sight, or observation of the line, upon the station mark, at which end of the bar he pleases. A brass socket is fixed at the centre under the compass box, which is fitted to and turns upon the brass ball and socket of the parallel plates D *d*. The under part of the plate D is screwed to the centre of the brass plate of the folding staves E. This screw makes fast the plates D *d* to the staves E, and a similar screw makes fast the socket of the circumferentor above, to the other plate, *d*. The instrument is levelled by turning the 4 screws *a a*, &c. between the plates D D, and kept fast. The instrument in the figure is represented as placed up in the field ready for use; when done with, the sights C C may be taken off the bar B B; the parallel plates by unscrewing the two screws above mentioned, are separated both from the staves and circumferentor, and thus the instrument is packed into a portable case, and the staves folded together in a small space. Improvements applied to this instrument, to render it more portable and increase its uses, will be hereafter mentioned.

To observe an Angle by the Circumferentor.

Suppose the angular distance of two objects, or marks A B, *fig.* 2, be required, as seen by an observer at C. Place the instrument at the station point C, and, looking through the sight at the north point of the compass box, direct the line in the opposite sight to cut the centre of the object at A, by means of the tangent screw *m*. Notice the degree, and part of the degree, that the point of that end of the needle marked south points to, in the divisions of the circle of 360 degrees, which suppose to be $157\frac{1}{2}$ degrees, or 157° 30′, then turn the instrument on its centre, by the screw *m*, till you observe the centre point of the object B, and note the degree pointed to, which suppose to be 199° 40′. Subtracting the preceding less number from this greater, gives 42° 10′, the angle required. In turning from a degree between 180 and 360, to another on the commencement of the graduations, the remainder may exceed 180 degrees, if so that quantity taken from 360 degrees, the remainder will be the just angle. In this manner, any number of the interior angles of a field may be expeditiously taken.

To take the Plot of a Wood, Park, &c. by observing the Bearings of certain Station-lines encompassing that Wood, by the Circumferentor, fig. 3.

The instrument is to be placed at the first convenient station (a), with the north point of the compass turned from you, or, which is the same thing, your eye placed at the sight aperture over the south point. Direct the line of sight to the mark placed at the station b, and note the degree of the circle, that the north point of the needle points to, which suppose to be 260° 30′. Enter this in your field book, as the bearing of the line a b. Measure onward the length of your station line a b, noting the offsets for the irregular boundary. Move the instrument to the station b,

 keeping

keeping the north point of the compass still from you. Observe the mark at the third station c, and the degree that the same end of the needle before used points to, suppose $292^\circ\ 12'$ (the $12'$ being by estimation). This note also in your field book, for the bearing of the line $b\,c$; and in proceeding on to the station c, measure the length of the line $b\,c$, noting the offsets. In this manner the bearings and lengths of the other station lines may be taken.

If the circumferentor is placed at every other station, half the trouble of setting it on the ground will be saved; but in this case the back as well as fore observations of the marks must be taken. Thus, if the instrument had been placed at b, the north point or sight must be towards you, when you look back at the first station (a), and the same point from you, as before, when you look towards the station c, to make the bearings the same as if taken by the preceding method. Yet as the length of all the station lines must be measured with the chain, no trouble relative to them can be avoided; and, in general, it may prove the best way, to set the instrument down at every station, which will afford you the better opportunity of detecting an error in the just direction of the needle, or in observation, as in the following manner. Suppose the instrument fixed at a, the sight directed to b, the north point of the compass from you, and the north point of the needle was observed to point to $260^\circ\ 30'$ the instrument afterwards being moved to b, and the north point of the compass *towards* you, direct the sight back to a; if the north point of the needle point to the same $260^\circ\ 30'$, as before, when at a, there is no error either of needle or observation; but if it do not, the cause of the error must be ascertained. The perfection or correct traversing of the needle is easily discovered by the following observation. When the needle is in a quiescent state, observe the particular degree that one of its ends exactly points to, then with the approach of the blade of a pen-knife, a key, or other piece of iron, attract one of its ends 40 or 50 degrees from its position, leave the needle then to vibrate and settle, and if it rest, pointing precisely to the same degree as before, the error is not that of the needle's imperfection, but either in some extraneous body secretly influencing its direction, or in the observation itself. A blunt centre-point on which the needle turns, imperfect centre-cap of the needle, or iron particles in the cast brass of the compass-box, are causes which sometimes prevent the just action of the needle and constitute a bad circumferentor. The best and most perfect sort of needles have a small polished agate stone fixed in their centre.

In surveying by the circumferentor, the lengths of the offsets from the station lines to the irregular boundaries are to be measured and entered in the field book as usual in the other methods of surveying.

To protract the above-mentioned Survey as taken by the Circumferentor.

Suppose the bearings and lengths to be as follow:

St.	L.	Bearings.		Lengths.
a	b	260°	30	1242
b	c	292	12	1012
c	d	331	45	1050
d	e	59	00	1428
e	f	112	15	645
f	a	151	30	1806

The surveyor must provide himself with a brass protractor about 6 or 7 inches in diameter, either of the circular, or semi-circular form, divided into degrees and half degrees. The circular form is mostly used, as saving time and causing less chance of error, in protracting expeditiously. The order of the numbering of the 360° should be in the contrary way to that of the circumferentor, but most protractors have a double row of figures, commencing in order from the opposite ends of the diameter.

Draw several lines over the intended draught, *fig.* 3, at a distance from each other not greater than the diameter of the protractor, marking their extremities with the letters N. and S. for the north and south points. Consider in which direction the plot will extend. Assign a point in one of the parallel lines to represent the first station a; to which point lay the centre of the protractor with the diametrical or fiducial edge to coincide with that line. Look into the field book for the bearing of the first station-line, $a\,b$, $260^\circ\ 30'$, at that number on the limb of the protractor, make a point or mark, and through that mark from the assigned point a, draw the line $a\,b$, on which line by your plotting scale of equal parts set off $12^{c}\ 42^{lks}$ as noted in the field book; hence will the line $a\,b$ on the paper have a similar bearing to that of the same station-line taken in the field. The offsets are next to be made, and the true boundary of that side of the wood will be given.

If the protractor be a semicircle, it should be numbered first on the outer edge on to 180°, and then on the inner circle, with numbers increasing the same way to 360°. These inner numbers are for bearings greater than 180°, and the 0 of the numbers must be laid northward or southward, as the degrees of bearing are less or more than 180°.

Next lay the centre of the protractor on the point b, with its diameter upon a parallel with the north and south line, and mark off on its limb $292^\circ\ 12'$, through which from b draw the line bc, mark its length 1010^{lks}, or 10 chains 10 links. Set off the offsets, and thus will that side of the wood be determined. Proceed on in the same manner for the other lines $c\,d$, $d\,e$, &c. and the last line $f\,a$ will terminate exactly or very nearly so at the point a, if the observations have been correctly made.

Of the Improved Circumferentor.

From what has been observed, the reader will understand, that by the circumferentor, as originally constructed, the angles can be taken but by the needle only, and which from the uncertainty of the accurate position of the needle, is not sufficient for some surveys where the accuracy of an angle is of great importance. Several years back Mr. Wm. Jones, optician, of Holborn, published a contrivance of an improvement on the circumferentor, whereby it might serve the purpose of a common theodolite, as well as a circumferentor, that is, to take the angles by a moveable nonius turning against the divided circle of degrees, independent of the needle, and like a common theodolite, serving as an occasional check upon the position of the needle. It was rendered useful also as a spirit-level, and to give angles of altitude and depression, with other advantages, as will be seen by the following description. *Fig.* 1 contains the representation of the improvements. The outside brass rim A, of the compass-box, is fixed to a circular plate placed under that of the compass, but moving independent of it, to which the bases of the sights B B are screwed. Within side of the rim, under the glass, is screwed a small brass nonius scale-piece, g, on which is divided a nonius scale adapted to the divisions of the circle of 360°, and subdividing it into 5 or 3 minutes of a degree, as may at first be desired. The centre of this scale is placed exactly in the line of sight. When the instrument is to be used as a circumferentor only, the under moving-plate and the compass-plate

plate are kept together with a brafs pin, and turning upon the ball and focket within the parallel plates D*d* as before defcribed. When the angle is to be taken in degrees and minutes, independent of the needle, as in a theodolite, this pin is taken out, and the fights with the nonius-fcale moved round the compafs-circle in the fame manner as the index limb of a theodolite, and the angle in degrees and minutes read off by this nonius. The directions for taking a furvey by this inftrument are the fame as are given under the article [illegible].

To ufe this inftrument as a level, an opening is cut in the fide of the focket to admit of the pin of the ball, when the compafs box A is turned into a vertical pofition. The [illegible] on of the fight hole is made, by turning the whole [illegible] ent vertically on the centre of the ball, by the fcrews *aa*, &c. till the air bubble of the fpirit level F, fcrewed to and adjufted under the compafs box, reft exactly in the middle. If angles of altitude or depreffion are to be taken, the centre of the compafs is to be fcrewed faft to the ball, then the pin con[illegible] g the two plates being taken out, the fights and no[illegible] may be moved either above or below the horizon[illegible] on, till the object be feen through the little fight [illegible], and the angle in degrees and minutes read off by [illegible] ion of the nonius fcale at the circumference of the [illegible] For a more accurate motion of the plate and index *B B*, the edge of the compafs plate is in fome inftruments cut with teeth, and a pinion, adapted to thefe teeth, is fixed to the under moveable plate, fo, that by turning the pinion, the fights may be carried round to the mark in the moft fteady and accurate manner. To render the inftrument more portable, the fights, with their bafes *B B*, are kept to the plate under the compafs box, when in ufe, by two finger fcrews, one of which is fhewn at G, and when not in ufe, taken away by unfcrewing the fame fcrews, fo as to admit the whole inftrument with its ball and focket without the ftaves, to pack into a cafe but feven inches fquare, and three inches deep.

For a more extenfive application of circumferentors in land-furveying, particularly in a method ufed by Mr. Gale, we refer the reader to Mr. William Jones's edition of the late Mr. George Adams's Geometrical and Graphical Effays, 1803, page 290, *et feq.*

CIRCUMFLEX, in *Grammar*, an accent, ferving to note or diftinguifh a fyllable of an intermediate found between acute and grave; and generally fomewhat long. See Accent.

It is feldom ufed among the moderns, unlefs to fhew the omiffion of a letter which made the fyllable long and open; a thing much more frequent in the French, than among us: they write *pâte*, for *pafte*; *tête* for *tefte*; *fûmes* for *fufmes*, &c. They alfo ufe the circumflex in the participles; fome of their authors write *conneu. peu*; others *connû, pû*, &c. Father Buffier is at a lofs for the reafon of the circumflex on this occafion.

The form of the Greek circumflex was anciently the fame with that of ours, viz. ^; being a compofition of the other two accents ʌ in one.—But the copyifts changed the form of the characters, and introducing the running hand, changed alfo the form of the circumflex accent, and inftead of making a juft angle, rounded it off, adding a dafh, through too much hafte; and thus formed an *s*, laid horizontally, which produced this figure , inftead of this ^.

CIRCUMFLEXA *femoris externa*, and *interna*, in *Angeiology*, two branches of the arteria profunda femoris. See Artery.

Circumflexa *humeri*, *anterior*, and *pofterior*, two branches of the axillary artery. See Artery.

CIRCUMFLEXUS *palati mollis*, one of the mufcles belonging to the foft palate. See Deglutition.

CIRCUMGYRATION, the wheeling motion of any body round a centre.

CIRCUMINCESSION, in *Theology*, a term whereby the fchoolmen ufe to exprefs the exiftence of three divine perfons in one another, in the myftery of the Trinity. See Person.

The fchool divines are not the firft authors of this term: Damafcenus, in the eighth century, having ufed the word περιχώρησις, which fignifies the fame thing, in his explication of that text, *I am in my Father, and my Father is in me.*

CIRCUMLOCUTION, from *circumloquor*, *I fpeak about*, in *Oratory*, denotes a circuit, or compafs of words; ufed either when a proper term for expreffing any fubject naturally and immediately does not occur, or when a perfon wifhes to avoid fomething difagreeable, inconvenient, or improper to be expreffed in direct terms, and conveys the fame fenfe in a kind of paraphrafe, fo formed as to foften or break the force of the fubject.

Thus Cicero, unable to deny that Clodius was flain by Milo, owns it with this circumlocution, "Milo's fervants being prevented from affifting their mafter, who was reported to be killed by Clodius; they, in his abfence, and without his privity, or confent, did what every body would expect from their own fervants on fuch an occafion."

CIRCUM-POLAR *Stars*, are fuch ftars as, being pretty near our north-pole, move round it; and in our latitude, never fet, or go below the horizon.

CIRCUMPOTATIO, in *Antiquity*, a funeral feaft, provided in honour of the dead.

This was very frequent among the ancient Romans, as well as among the Athenians. Solon, at Athens, and the decemviri at Rome, endeavoured to reform this cuftom, thinking it abfurd that mirth and drunkennefs fhould mingle with forrow and grief.

CIRCUMSCRIBED *figure*, in *Geometry*. See Circumscribing.

Circumscribed *hyperbola*, one of the fecond order, according to Sir Ifaac Newton, which cuts its afymptotes, and contains the parts cut off within its own fpace. See Hyperbola.

CIRCUMSCRIBING, in *Geometry*, denotes the defcribing of a polygonous figure about a circle, in fuch manner as that all its fides are tangents to the circumference.

The term is fometimes alfo ufed for the defcribing of the circle about a polygon; fo as that each fide is a chord. But in this cafe, we more ufually fay, the polygon is infcribed, than the circle circumfcribed. See Polygon and Circle.

The fide of a hexagon is equal to the radius of a circumfcribed circle. See Hexagon. For the method of circumfcribing a circle about any given regular polygon: See Polygon. For the method of circumfcribing a fquare or any regular polygon about a circle: See Square and Polygon. See alfo Quadrilateral, Pentagon, Hexagon, Dodecagon, &c.

CIRCUMSPECTE' *agatis*, the title of a ftatute made ann. 13 Edw. I. relating to prohibitions, prefcribing certain cafes to the judges, wherein the king's prohibition lies not.

CIRCUMSTANCES, the incidents of an event, or the particularities that accompany an action.

The circumftances of the actions of men, are expreffed in this Latin verfe:

Quis, quid, ubi, quibus auxiliis, cur, quomodo, quando.

Quis, who, denotes the quality, ftate, age, &c. of the perfon.

fon. *Quid*, what, the greatnefs, fmallnefs, multitude, fewnefs, &c. of the thing. *Ubi*, where, the place. *Quibus auxiliis*, with what affiftances, the inftruments, means, &c. *Cur*, why, on what account, with what view. *Quomodo*, how, the quality of the action, as to intention or remiffnefs, defignednefs or cafualty, fecrecy or opennefs. *Quando*, when, the time; as on a holiday, at the hour of prayer, &c.

CIRCUMSTANTIAL *evidence*, in *Law*, or the *doctrine of prefumption*, takes place next to pofitive proof: circumftances which either neceffarily or ufually attend facts of a particular nature, that cannot be demonftratively evinced, are called prefumptions, and are only to be relied on till the contrary be actually proved. See EVIDENCE and PRESUMPTION.

CIRCUMSTANTIBUS, in *Law*, is ufed for the fupplying, and making up the number of jurors (in cafe any impannelled appear not; or appearing, be challenged by either party), by adding to them fo many of the perfons prefent, or ftanding by, as will ferve the turn. Stat. 35 Hen. VIII. c. 6; and Stat. 5 Eliz. c. 25, for Wales.

CIRCUMVALLATION, in *Fortification*. A line of circumvallation is a work confifting of a ditch and parapet, with redans, or baftions, from diftance to diftance, with their faliant angles towards the country or the field thrown up by the befiegers of a place, againft any attempts of the enemy from without. It differs from a line of contravallation, or countervallation, in this refpect, that the latter is thrown up between the befieger's camp and the place befieged, to prevent any attempts of the befieged from within, and is feldom made quite fo ftrong as the line of circumvallation.

The refolving upon fieges, or the coming to a determination to befiege places, which is an affair of the cabinet, unlefs the general who commands the operating army has fo far the confidence of his fovereign and his minifters, as to be at liberty to act as he thinks, or according to his own difcretion, is the natural confequence of that fuperiority which we fuppofe ourfelves to poffefs over our enemies. But the carrying of them fuccefsfully into execution, if the places be bravely and ably defended, is an undertaking that may juftly be regarded as one of the moft ferious, important, and difficult parts of war, and therefore requires much precaution, preparation, prudence, and circumfpection. Their fuccefs depends on the obfervance of various meafures; of which the following may be confidered as the principal.

1ft. Secrecy, without which it is very difficult to fucceed.

2dly, A fufficient number of forces for attacking your enemy's places, and for defending your own.

3dly. A knowledge of the difpofitions of the enemy. For if they are re-united, and in as great force as yourfelves, they can prevent you from undertaking any fieges.

4thly. That the magazines neareft to the places you mean to inveft, are abundantly fupplied, and in a favourable condition for your purpofe.

5thly, To feize on the moft favourable times and feafons for carrying on your operations; for all times are not proper for fieges, nothing being more ruinous to an army than thofe that are carried on in winter. That feafon ought, therefore, to be avoided as much as poffible.

Laftly, An eftimate and knowledge of the expence that will attend them; for money being the finew of war, no military operations of confequence can be carried on without it.

Thefe are the principal objects of confideration beforehand, and for which the neceffary meafures fhould be taken at leifure. And after all, when we fuppofe them to be well taken, it frequently happens that the whole fails; for the enemy, who feldom or ever takes the fame view of things that we do, may interrupt us, by being, in the firft place, as ftrong as we are, and obferving our motions and proceedings in due feafon; or, fecondly, by forming the defign of undertaking fome enterprife againft places which it is of more confequence to us to preferve, than the conqueft of thofe we intend to attack; or, thirdly, by being in a condition to over-run our country, or part of it, and carry defolation into the fame, whilft we are occupied with the fiege of fome place, the capture of which, that may be doubtful or uncertain, would not by any means compenfate for the lofs we fhould thereby fuftain; or, laftly, by having it in his power to give us battle before we can eftablifh ourfelves before the place we wifh to attack.

All thefe confiderations ought to be well weighed before we undertake the fiege of a place; and the time for the fame fhould be fo judicioufly chofen, that the enemy cannot fall upon us fuddenly, before we eftablifh ourfelves in the enterprife, by fecuring our befieging army with a line of circumvallation, or even countervallation. The beft plan is to have a fuperior force to that of the enemy, and to have two armies when it is practicable, viz. one to befiege the place, and the other to watch and obferve. The befieging army confines itfelf within its lines, whilft the army of obfervation only moves about, keeps a look-out, and occupies the avenues, or approaches, by which the enemy can approach or prefent himfelf; or takes pofts, and there retrenches himfelf; or if the enemy moves to a little diftance, follows him, keeping always in fight of him, but conftantly pofting itfelf between him and the befieging army fo advantageoufly as not to be under the neceffity of fighting, contrary to his wifh or inclination. If we can only gain a few days' time at the commencement of a fiege, it is of very great advantage.

Thefe two armies, viz. the befieging army and the army of obfervation, ought always to keep themfelves within reach of each other, particularly during the commencement of a fiege, in order to be able to fuccour or fupport each other, and keep the enemy at a diftance, who on his part ought to be apprehenfive of approaching too near to the place, for fear the two joining together, if they be ftronger than he is, falling upon him and attacking him with advantage.

The army of obfervation is, befides, of great advantage to that which carries on the fiege, as it watches for its fafety, and favours its operations by efcorting its convoys, furnifhnifhing it with fafcines, and performing other neceffary duties and fervices. And the befieging army can reciprocally, in cafe of need, reinforce the army of obfervation after the firft fix or feven days of opening the trenches, when it has well taken its advantages and precautions againft the place invefted.

It is alfo a very favourable circumftance to be able to attack before the enemy is in a condition to take the field with all his forces, or in the fall, when part of his troops are retired or withdrawn, and he is no longer in fufficient force to oppofe our enterprifes.

To take advantage of the firft of thefe circumftances, it is neceffary to have large magazines of forage within reach of the places you wifh to inveft, and always to have an army of obfervation, if poffible.

We have already obferved, that it is neceffary to have magazines near to and within reach of the places we defign to inveft, and particularly of forage, if we mean to attack them before the enemy can take the field with all his forces. But we have not attempted to mention the number, or defcribe the natures of the different magazines, or the quantity of each fpecies species of stores, they ought to contain. For to ascertain this is difficult, and in attempting to do so one can only be regulated by a reference to the relative degrees of strength, importance, &c. of the places to be attacked. If the place be considerable and of consequence, one should reckon on a siege sufficiently long for one month at least of open trenches. For it rarely happens that a place cannot hold out that time if it be tolerably well garrisoned, and be defended by intelligent officers, who wish to do their duty. A surplus of ammunition and stores at command, occasions no loss or inconvenience, but a deficiency may make the enterprise miscarry.

Besides having from 8 to 900,000 weight of powder, according as the place is more or less strong, there should be from 40 to 60,000 large bullets; from 16 to 20,000 smaller ones; from 12 to 16,000 shells; from 30 to 40,000 grenades; from 8 to 10,000 matches; from 150 to 180,000 weight of lead; 100,000 musquet flints, strong and well chosen; 50,000 sacks of earth; 30.000 small charges of powder ready made up; spare timber for bridges of communication, and other purposes; a sufficient number of horses for the artillery; cannon or guns of various sizes, for the defence of the lines, and other services; mortars for throwing shells and stones; shot, shells, grenades, leaden bullets, matches, flints; platforms complete for guns and mortars; spare carriages for guns; spare beds for mortars; spare sponges, rammers, and ladles; intrenching tools; carpenters' ditto; sling carts and carriages of different descriptions, &c. &c.

When all the necessary preparations are made, and the measures well taken, when the siege of a place is resolved on, and the armies in short are in the field, and in a condition for acting, the general should, by his movements, do his utmost to remove the suspicions which the enemy may entertain of his designs, and to direct them towards other objects as much as he is able. Sometimes this consideration will carry him so far as to invest a place which he has no wish to attack, in order to make the enemy change his notions and measures, and thereby lead him to weaken the garrison of the place he really means to besiege. It was in this manner that the allies, in 1710, appearing to menace Ipres, occasioned the best part of the garrison of Tournay to be withdrawn from it, which being itself invested next morning, was not of consequence in a condition to make the resistance that might have been expected from it, though it was at that time one of the strongest places in the Low Countries. Sometimes they press on the enemy during several days to drive him to a distance from the place intended to be attacked; after which, and when matters are brought to the point desired, the first thing they ought to do is to invest the place, which is commonly done by a detachment of 4 or 5000 cavalry, more or less, according to the strength of the garrison, commanded by a lieutenant-general and two or three major-generals. These troops should march day and night, till they come within a league or two of the place, where halting they regulate their particular arrangement, and the dispositions of the investiture, in such a manner, that they may all of them be able to arrive at the same hour to nearly the distance of cannon shot from the place.

These occupy and command all the avenues favourable for throwing succours into the place, and shut it up as closely as possible, by seizing on posts all around it, pushing on detachments to the very gates to carry off men, cattle, and whatsoever else they can find without the works, that may be serviceable to the garrison. During the day, they keep themselves out of the reach of the cannon of the place; but at night they approach to the distance of about musquet shot from the works, in order to be able to form round it a circle, so furnished with troops, as to leave no, or but small intervals, or empty spaces between them. In this situation they turn their backs on the place, and post small guards both in front and rear of them to prevent surprise. They dispose of themselves, in short, in such a manner, as to be ready to make head against the enemy, on whatever side he may present himself, keeping always half the cavalry appointed to support them mounted, whilst the other half of them is dismounted to give both the men and horses some repose. In the morning they retire by degrees towards the dawn of day, frequently halting as they retire till sun rise, when they return to their quarters or former posts, placing the ordinary guards towards the place and stronger ones in the avenues on the side of succours; after which the squadrons who are not on guard, retire to the camp to repose themselves, without taking off either their own cloaths or the saddles of their horses, but merely for the short time necessary for dressing them, that they may be in readiness to mount at a moment's notice.

During this time he, who commands, sends parties to learn intelligence of the enemy; he continues to make his arrangements, and to reconnoitre the situation the most convenient for placing the camps, and fixing the directions of the lines, as soon as the artillery shall arrive. This is a point to which the engineers, who should be on the spot as soon as the investing detachment, ought particularly to direct their attention. When those, who form the investiture, have some troops of infantry with them, they dispose of them in small guards on the principal avenues of the place, supported by larger ones posted behind them. And when infantry is wanting, they employ dragoons instead of them.

Whilst these dispositions are making, the army makes forced marches, and commonly arrives before the place the second, third, fourth, or at most the fifth day after the investiture. The lieutenant-general, who has formed advances from his troops to the distance of half a league or thereabout, is to meet the general, and render him an account of his diligence, expedition, and preparations; and the general on his report makes his final arrangement for the encampment of the army round the place.

Next morning he rectifies it if necessary, and in company with the other general officers and principal engineers, makes the circuit of the place, reconnoitring the ground for the purpose of finally determining its line of circumvallation. After having agreed on the figure and circuit of the lines, which ought always to regulate the encampment, the general distributes all the troops, according to the quarters destined for them, and assigns to each general officer his own.

The line of circumvallation is the first work of any magnitude, that is thrown up after the investiture of a place, and is intended not only for shutting it up so completely, as to prevent any supplies of men, ammunition, cannon, military stores, or provisions from being thrown into it, but also for securing the camp of the besieging army against insult or attack from without, or from the side of the country. As this line is calculated for protecting the besieging army and its camp against any attemps of the enemy from the field: so the line of countervailation, which is formed in a similar manner, and is made between the camp and the place, when the garrison is strong, is intended for securing it against any attacks from the besieged. The saliant angles of the line of circumvallation look externally towards the country, whereas those of the line of countervallation look inwards towards the place invested.

In tracing both these lines, care should be taken to occupy the

the most advantageous ground in the neighbourhood of the place, without being over scrupulous about its being a little too near to, or a little too far off from the same.

As to the camp of the besieging army, it ought to be placed, or pitched in such a manner, that the rear of it may not be within reach of the cannon-shot of the place. On the other hand, it should not be advanced too far from the same into the field, but ought to occupy precisely, if possible, ground at the distance necessary for its security.

Particular attention ought also to be paid to the avoiding of all eminences or high situations, that may command any part of the camp, and when this is impracticable, to take them within the line, if it should not be thereby rendered too extensive; but if it should, to occupy them with redoubts or other closed outworks.

Advantage should be taken, both in forming and securing this line, of all favourable circumstances, furnished by the nature of the ground and the *environs* of the place; such as precipices, morasses, rivers, rivulets, pools, hedges, lanes, thickets, woods fit for making *abattis*, &c.

The justly celebrated Vauban generally made his lines of circumvallation with *redans*, and ravelins, opposite to the gates or sally ports, taking care to place the said works, for the flanking defences, on the higher parts of the ground, if possible, without minding whether the distance between the saliant angle of one *redan*, and that of the next was the customary length of 120 toises or fathoms, or from 10 to 20, more or less, if the ground required it. The openings or gorges of the *redans* were each of them about 30 toises or fathoms, and the capital or depth of each about 20. The gorges of the ravelins, which covered the gates or sally ports, were commonly each of them about 30 toises or fathoms, and the capital of each about 20. Sometimes bastions were employed as well as redans, particularly at the saliant angles of the line of circumvallation, or at the angles formed by the different directions of its component parts.

That famous general and engineer has given six different profiles for lines of circumvallation, in order to make them suit all sorts of them. These are the following:

First Profile. See Section 1st.

	Ft.	inch.
Width of the ditch at the opening or top,	18	—
Width or breadth of the same at the bottom,	6	—
Its depth,	7	6
Solid content of its excavation in *toises courantes*,	15	—
Solid content in cubic toises,	$2\frac{1}{2}$	—
Thickness of the parapet at top,	8	—
Height of ditto within,	$7\frac{1}{2}$	—
Height of ditto without,	6	—

Second Profile. See Section 2d.

	Ft.	inch.
Width of the ditch at the opening or top,	16	—
Width of the same at the bottom,	5	4
Depth of the same,	7	—
Solid content of its excavation in *toises courantes*,	$12\frac{4}{9}$	—
Solid content in cubic toises,	$2\frac{2}{27}$	—
Thickness of the parapet at top,	7	—
Height of ditto within,	$7\frac{1}{2}$	—
Height of ditto without,	6	—

Third Profile. See Section 3d.

	Ft.	inch.
Width of the ditch at the opening or top,	14	—
Width of the same at the bottom,	4	8
Depth of the same,	6	6
Solid content of its excavation in *toises courantes*,	$10\frac{7}{24}$	—
Solid content in cubic toises	$1\frac{103}{144}$	—
Thickness of the parapet at top,	6	—
Height of ditto within,	$7\frac{1}{2}$	—
Height of ditto without,	6	—

Fourth Profile. See Section 4th.

	Ft.	inch.
Width of the ditch at the opening or top,	12	—
Width of the same at the bottom,	4	—
Depth of the same,	6	—
Solid content of the excavation *par toises courantes*,	8	—
Solid content *par toises cubes*,	$1\frac{1}{3}$	—
Thickness of the parapet at top,	6	—

Fifth Profile. See Section 5th.

	Ft.	inch.
Width of the ditch at the opening or top,	10	—
Width of the same at the bottom,	3	4
Depth of the same,	5	6
Solid content of its excavation *par toises courantes*	$6\frac{13}{72}$	—
Solid content *par toises cubes*,	$1\frac{13}{72}$	—
Thickness of the parapet at top,	6	—

Sixth Profile. See Section 6th.

	Ft.	inch.
Width of the ditch at the opening or top,	8	—
Width of the same at the bottom,	2	8
Depth of the same,	5	—
Solid content of its excavation *par toises courantes*	$4\frac{4}{9}$	—
Solid content *par toises cubes*,	$\frac{20}{27}$	—
Thickness of the parapet at top,	4	—
Height of ditto within,	$7\frac{1}{2}$	—
Height of ditto without,	6	—

Vauban considers these profiles as sufficient for all the different sorts of lines, of which one may have occasion to make use. They ought to be regulated according to circumstances and necessity. For instance, if you are resolved to wait the enemy within your lines, they should be made good and substantial, according to the first profile. But if you have taken the resolution of meeting him, you may make them as you think proper. It is, however, always safest to make them good and strong.

The first and second profiles are good, the third and fourth middling, and the fifth and sixth are calculated for the lines of small sieges, where you do not however cease to be under the necessity of taking precautions.

As to lines of countervallation, they are of the same nature, fashion, and form as those of circumvallation, except in this circumstance, that they are not so large or strong. They ought not to be neglected, particularly at the sieges of places, which have strong garrisons, whilst the besieging armies are not very numerous. The circuit of the countervallation should be carried in rear of the camps, at double the distance nearly from the same of the line of circumvallation from the heads or fronts of them. The camps or quarters then of the different parts of a besieging army lie between the lines of circumvallation and countervallation, but about twice as distant from the latter as from the former. The besiegers by the line of countervallation shut up the place as closely and as near to it as they can, without exposing themselves to the fire of its artillery. They should avail themselves of every favourable situation of ground that presents itself. In this line they commonly have passages formed with barriers of the same fashion with that of the line itself. But it is not necessary either to have many of these, or to cover them with outworks.

The depth of the camp is generally about 30 fathoms, and its distance from the line of circumvallation about 120.

 The

The diſtance therefore between the line of circumvallation and that of countervallation is commonly about 390 or 400 fathoms.

It has been generally alleged and ſuppoſed, that if the camp of the beſieging army be about 1200 toiſes or fathoms from the covert-way of the place beſieged, it will be without the reach of cannon-ſhot fired from the ſame. This ſuppoſition however will not always hold good. For guns may be caſt of ſuch calibres as to throw both ſhot and ſhells to a much greater diſtance. Let d then repreſent the greateſt diſtance in fathoms to which the beſieged can throw either a ſhot or ſhell from the covert-way; ſuppoſe the rear of the beſiegers' camp to be 200 fathoms farther from the ſame, its depth to be equal to 30 fathoms, and the diſtance of its front from the line of circumvallation to be 120 fathoms. Then the diſtance from the covert-way to this line will be equal to $\overline{d + 350}$ fathoms. Now if, for the ſake of example, we ſuppoſe the place attacked to be a regular octagon, fortified according to Vauban's firſt method, the diſtance from its centre to the covert-way will be about 250 fathoms, which being added to $\overline{d + 350}$ gives us $\overline{d + 600}$ fathoms for the diſtance from the centre of the place to the line of circumvallation. The circumference correſponding to this radius is nearly equal to $\overline{d + 600} \times \frac{710}{113}$ fathoms. But the perimeter of the line of circumvallation, which is ſometimes made with *redans* and ſometimes with *baſtions*, will exceed this circumference by about one-third, and will of courſe be equal to about $\overline{d + 600} \times \frac{710}{113} + \frac{710}{339}$ or $\overline{d + 600} \times \frac{2840}{339}$ fathoms. See Line of Circumvallation, with camp within it, and figures repreſenting parts of the lines of circumvallation at Philipſbourg and Arras, with their ſections.

As there are no obſervations in this work under the article *Attack* that furniſh any information reſpecting the reconnoiſſance of places attacked, or their ſituations, which are inſeparably connected with the modes of attacking, and the fixing of the lines both of circumvallation and countervallation, it is perhaps the more neceſſary to make ſome here on theſe points. But before we proceed to make them, it will not be improper briefly to obſerve, that the parts of the line of circumvallation moſt expoſed to an attack by the enemy from without, ought to be well palliſaded, and even ſometimes to have outworks or a ſecond ditch, or both, and in thoſe places in front of it, where cavalry can act to advantage, to have *trous-de-loup*, or pits placed chequerwiſe 5 or 6 feet deep, and about 8 feet wide at top, with ſtakes planted in the middle of them, projecting about a foot or fifteen inches above the ſurface of the ground. And it is a maxim, which ought not to be loſt ſight of, when ſome parts of the line are naturally by the circumſtances of ground ſtronger than others, to make the reſt by art as nearly as poſſible equally ſtrong.

As to the *reconnoiſſance* of places, there are few of them at preſent in Europe of which we have not plans, that are even printed. Although ſeveral of theſe are not very exact or correct, ſome information, aſſiſtance, and lights may be drawn from them that are far from being uſeleſs. They ought not therefore to be neglected or unattended to any more than charts of the environs of places.

One finds ſometimes the means of learning ſeveral circumſtances reſpecting the condition and ſituation of places by the peaſantry, or people of the country, particularly by workmen ſomewhat intelligent, as maſons, ſtone-cutters, preparers of ſtones, terrace-makers, undertakers, and contractors. You may alſo contrive to get ſome perſon introduced into a place, who, after remaining in it for ſome time, brings you intelligence of what you wiſh to know.

In addition to all that you can learn in this way, on which much reliance ought not always to be placed, you ſhould add what you can diſcover by yourſelf. You ſhould therefore reconnoitre places and their environs in perſon, or cauſe the reconnoiſſance to be made by people truſty and intelligent, which ought to be done with but little noiſe both by day and by night.

By day you cannot approach very near, unleſs you do ſo almoſt alone, becauſe the advanced guards of the place and the cannon diſturb and moleſt you when you are accompanied by others, and prevent your approaching it.

The beſt method you can adopt is to have ſmall advanced guards behind you, concealed in fences, or in ſome ditch ſupported by others a little farther from you, by means of which you advance alone, or with very few attendants. This practice for the moſt part ſucceeds. Theſe are things, for which every favourable moment or opportunity ought to be ſeized; and the inſpection or examination ſhould be ſeveral times renewed. Such methods however of reconnoitring furniſh no inſtruction or information, but in regard to the mode of commencing and conducting the attacks, the number and ſize of the baſtions, of the cavaliers, ravelins, crown-works, redans, the covert way, &c. which to be informed of, is always to know a good deal. But if there be pits or hollows near the place, or other ſpots of cover and concealment, that can be uſeful for any purpoſe of attack, they ſhould be carefully examined. Theſe, however, as well as the dormant and running waters near the place, are in general but very imperfectly reconnoitred.

The better to diſcover and explore all theſe, you ſhould reconnoitre them by night well attended, in order to be able to approach them and touch them, as the ſaying is, with the ends of your fingers, which is not done without danger, even in the night, when your view of things is not very good or diſtinct. But towards morning, in retiring by little and little, or gradually as the light increaſes and the day advances, you diſcover, what you wiſhed to ſee, in a manner more complete. This is a matter in which nothing ought to be neglected. For great advantages are to be derived from a perfect reconnoiſſance of a place.

Beſides it is not a thing always very eaſy to diſcover the ſtrong and weak parts of a place. For reconnoitre it as much as you chooſe, both day and night, you will not be able to know what is within it, unleſs you learn this from others. Wherefore no channel or means of information ought to be overlooked or neglected.

There is hardly any place that has not its weak and ſtrong parts, unleſs it be of a regular conſtruction, of which the parts of the ſame deſcription are all equal among themſelves, and ſituated in the middle of an open level plain, which affords no advantage to one part more than another. Such is New Briſac. When this is the caſe, you may ſay the place is equally ſtrong and weak throughout. The only conſideration, then, is to determine on the attacks with a view to convenience; that is to ſay, to make them on the ſide moſt within reach of head quarters, the park of artillery, and thoſe places from which you can procure ſupplies of faſcines and gabions, and with which you can have the eaſieſt communications. But as places are ſeldom to be met with that are fortified in this manner, and as they are almoſt always regular in ſome parts, and irregular in others, as to their fortifications being generally compoſed of old and new works,

works, they have almost all of them some defect or advantage, either in point of situation, greater on one side than on another, or with respect to the ground of the environs, which occasions a diversity that requires different observations. To develope this as well as possible, is of consequence, and is a matter entitled to the maturest deliberation.

If the fortification of a place have a side situated upon a rock from 25, 30, 40, 50, 60, or 70 feet high, and if the rock be sound and steep, we may pronounce the place inaccessible on that side. If the foot of this rock is close by a river of smooth or rapid water, it will be still worse. If any side on the level ground borders on a river that is not fordable, that cannot be turned out of its natural course, and is bordered on the side of the place with a good fortification, capable of defending the passage of it, we may say the place cannot be attacked on that side. If the course of this river is accompanied by meadows, low and marshy at all seasons, it must appear still more difficult to be attacked on that side.

If the place is surrounded partly with water, and partly with morasses, but accessible at the same by spots of dry ground that border these morasses; if these accessible avenues are well fortified; if there are works in the morasses which are not approachable, and can see in reverse the attacks making on the firm ground adjoining them, such a situation cannot be favourable or advantageous for the attacks, on account of these inaccessible works, and because it is necessary to be able to embrace what is attacked.

If the place be high, surrounded with low lands and marshes, as is frequently the case in the Low Countries, and is not accessible but by causeways, it ought to be considered.

1st, If it is not possible to dry up the morasses; if they commonly become dry of themselves, during any time of the year, and at what season; in short, if they can be drained and rendered dry.

2dly, If the causeways are straight or winding, enfiladed by the place in whole or in part; of what extent is the part that is not, and at what distance it is from the place; what its width or breadth is, and whether it is possible to traverse it and advance along it with trenches, without being exposed to an *enfilade* from the enemy.

3dly, If it be possible to place batteries below or near it, on some spot or spots higher than the rest of the ground round it, that may furnish a cross fire on those parts of the place that are attacked.

4thly, Whether the causeways be so strongly enfiladed, that there are no considerable crossing or transverse parts, that front the place, sufficiently near to it, and whether there is any part that might furnish a considerable cover against its fire, by raising one part of the thickness of the causeways upon another, and at what distance from the place all this is found.

5thly, If the causeways near to one another, which terminate at the place, meet or join in any particular spot, and if, when occupied by the attacks, they can mutually succour and support one another, by the bearings of cannon firing cross ways, or in reverse, on the works attacked.

6thly, What is the nature of the rampart of the place, and its outworks; if it has covert ways; if the causeways, as they approach these, meet or join; and whether there is any advanced ditch, full of either running or dormant water, that separates them.

From all these considerations one ought to conclude, that a place should never be attacked on a side, where there are so many obstacles and difficulties to be encountered, if there be the least prospect of being able to approach it on some other side, because you are always enfiladed and raked by the cannon, without having it in your power to defend yourself against them, or to render yourself master of them, or to embrace the parts of the place that are attacked.

With regard to works on plain or level ground, it is proper to examine, in the first place, on what sides you can embrace the fronts of the attack, because these are always to be preferred to others.

2dly, The number and quantity of the works to be taken before you can reach the body of the place; their natures, and those of the ground on which they are situated.

3dly, If the place is bastioned and reveted.

4thly, If its fortification is regular, or nearly so.

5thly, If it is covered by a quantity of outworks, of what descriptions they are, and how many.

6thly, If the covert ways are well made, countermined, and pallisaded; if their glacis are steep and uneven, and not commanded by the higher works of the place.

7thly, If there are advanced ditches, and of what nature they are.

8thly, If the ditches are reveted and deep; dry, or full of water; of what depth; if the water is stagnant or running; if there are sluices in them, and what descent the running water has in them from its entering into them to its issuing out of them.

9thly, If they are dry, what is their depth; and whether the sides of them are low and not reveted.

Finally, Attention should be paid to this circumstance, that the worst of all are those that are full of standing water.

Ditches that are dry, deep, and reveted, are good. But the best of all are those that are dry, but may be easily filed at pleasure, with a large body of either running or dormant water; because they can, in the first place, be defended dry, and afterwards be inundated, and have strong currents or torrents excited in them, which will render the passage impracticable. Such are the ditches at Valenciennes, on the side of Quesnoy, which are dry, but can be filled by the garrison at any time, either with standing or running water, without the besiegers having it in their power to hinder them. Such are also the ditches of Landau.

Places which have such ditches, with reservoirs of water that cannot be diverted from them, and which they cannot be prevented from using, are very difficult to be forced when those who defend them know how to make a proper use of their advantage.

Reveted ditches, as soon as they have a depth of 10, 12, 15, 20, or 25 feet, are also very good, because neither mortars nor cannon can much injure these revetements, and the enemy cannot enter them but by descents, that is to say, in defiling one by one, or two by two at most, which is subject to many inconveniences. For the besieged can practise various sallies or sorties, against the besieger's passage, and the lodgments of his miners, which occasion much retardation and loss. Besides, when an attack is made or determined on, it cannot be supported but feebly, as all those employed on it must go through one or two passages, and always by defiling, with much inconvenience.

Care should also be taken to examine if the ditches are cut in a rock, and if the rock is hard and continuous. For, if it is hard and difficult to be worked, the besiegers will be obliged to fill the ditches quite up to the level of the covert way, in order to make their passage, which is a tedious and difficult operation, especially if the ditch is deep. For these manœuvres require much arrangement and time, and the besieged, who so much as seriously think of defending themselves, make the besiegers suffer much by their attempts and contrivances, by turning aside their materials, snatching away their

their fafcines, fetting fire to them, and conftantly annoying them with fallies, and the fire of their cannon, mortars, and mufquetry; againft all which the befiegers are obliged to take every precaution, as a heavy fire from a fhort diftance is very dangerous, and reduces them to the neceffity of filencing it by one ftill greater, well difpofed.

After you are well informed in regard to the nature of the fortifications of the place you wifh to attack, you fhould fee if there are any eminences, cover, hollow way, or inequality of ground, that will favour your approaches, and fave you the trouble of opening part of one end of the trenches; and if there is no commanding fituation, from which you can derive advantage, you fhould examine if the ground through which you muft conduct your approaches is foft and eafily turned up, or if it is hard and mixed with ftones, flints, fhells, and bare rocks, into which you cannot fink a trench at all, or to but a fmall depth at moft.

All thefe differences are confiderable. For if the ground is eafily wrought, it will not be difficult to open good trenches in it, without much rifk and in but little time; whereas if it be mixed with ftones or flints, the opening of them will be much more difficult and dangerous, as cannon fhot fired through or along fuch foil are apt to do much mifchief.

If it is a hard and naked rock, in which you cannot open a trench, you muft lay your account with bringing to the fpot all the earth and other materials, of which you may ftand in need; and you will be obliged to make three-fourths of the trench with fafcines and gabions, and even with bales of hair and wool; which will be attended with much lofs of time and fatigue, without making your approaches proof againft cannon or even mufquet fhot. Such labour and attacks fhould therefore be avoided as much as poffible. See Marfhal Vauban's "Attack and Defence of Places."

CIRCUS, in *Antiquity*, an edifice in ufe among the Romans for the exhibition of chariot races, and other games. The circenfian games appear to have been adopted by the Romans from the Etrufcans in the earlieft ages. Romulus eftablifhed the games at the circus almoft as foon as his power, and the rape of the Sabines, which took place at the firft exhibition of thefe games, probably led him to dedicate them to Confus, the giver of good counfels. The circus at firft was a wooden enclofure, in which the fpectators ftood, a few feats being placed for the moft diftinguifhed perfons. It is faid, that in the earlieft periods of thefe exhibitions, the goals or terms, round which the chariots were obliged to turn, were armed with feveral fwords, prefenting their points towards the horfes, thus increafing the intereft of the conteft by the dangers to which it was expofed. This circumftance has given rife to a fingular etymology, adopted by Caffiodorus and Ifidorus, *ludi circenfes quafi circum enfes*.

The firft permanent circus at Rome was built by Tarquinius Prifcus in the valley Murcia, between the Aventine and the Palatine hills. This edifice which obtained the appellation of *Circus Maximus* from its great fuperiority in fize to thofe of a later date, was for a length of time the only circus in Rome; fome have fuggefted that it derived its name from its being appropriated to the celebration of the greater games; and others feek the origin of the appellation in its having been confecrated to the great gods, *viz.* to Vertumnus, Neptune, Jupiter, Juno, Minerva, and the Dii Penates of Rome. It was enlarged by Julius Cæfar, and rebuilt and richly ornamented by Auguftus. At this period it is defcribed by Dionyfius of Halicarnaffus as furrounded by a portico, and having numerous ftaircafes, fo well diftributed as to avoid any confufion of the fpectators in entering or returning; and he adds, that it was $3\frac{1}{2}$ ftadia in length, and 4 jugera broad; which according to the meafure given by Pliny of the Roman ftadium, 625 feet, will give for the length 2187 Roman feet, or fomewhat more than three Englifh furlongs, and its breadth, allowing for each of the jugera 240 Roman feet, will be 960 feet; and it contained 150,000 perfons. This great magnificence, however, was not fufficient for the fucceffors of Auguftus, fince Tiberius, Caligula, Claudius, and Nero, all made additions to it. In the time of the elder Pliny, the Circus Maximus had been fo much enlarged as to be capable of containing 260,000 fpectators; and Trajan fo much increafed its dimenfions, that an infcription placed over the great gate, of which Dion Caffius has given a tranflation in Greek, expreffed that this emperor had rendered it capable of containing the Roman people. Conftantine alfo added new porticoes, and his fon Conftans ornamented it with the great obelifk, at prefent at the Lateran. Of this fuperb edifice there only remain fome indeterminate veftiges on a level with the ground. Tradition has preferved its remembrance, for at Rome the place is ftill called *Cerchi*, which marks the fite of this enormous pile at prefent occupied by gardens and the cemetery of the Jews.

The other circufes at Rome are the following.—

The *Flaminian* circus, which muft have been a confiderable edifice, as it is fo often mentioned by ancient authors. According to Livy, it was founded by Flaminius, the unfortunate antagonift of Hannibal. Dion Caffius relates that Auguftus exhibited in this circus a chace of crocodiles, in which there were thirty-fix killed. Under ground, and among the ruins of vaft arcades, there is ftill a confiderable ftream of water which fupplied this circus. Its only remains are ruins hid beneath the prefent pavement of the city, which is confiderably raifed in that part; and the church and convent of Santa Caterina de Funari, the two palaces of the Dukes Mattei, and feveral adjacent buildings, are erected on its fite.

The modern Piazzi Navona occupies a great part of the area of the *Agonal* circus, of which the name Navona feems to be a corruption. The curved direction of the houfes fituated at its northern extremity, indicates that they are founded upon the circular end of the circus, oppofite to the carceræ.

The right fide of the great bafilica of the Vatican is placed upon the walls of a circus, which, begun by Caligula and terminated by Nero, was one of the moft remarkable at Rome. To this belonged the fuperb obelifk which at prefent ornaments the place of St. Peter's. This circus muft have been deftroyed as early as the time of Conftantine, fince the former bafilica of St. Peter, founded by him, occupied the fame fituation as the prefent edifice. Its direction may be feen in a print given by Fontana, *Il Tempio Vatic.* page 245, by which it appears that the circus was longer than the modern church with the colonnade.

There was another circus begun, as it is fuppofed, by Nero, in the gardens of his aunt Domitia, and finifhed by Adrian. In fome late excavations confiderable remains were difcovered, with many antique paintings.

Heliogabalus alfo built a circus beyond the Porta maggiore, from which was taken the obelifk at prefent erected in the interior garden of the Vatican.

In the Salluftian gardens there was a very fine circus, which it is faid might be filled with water for the exhibition of naumachiæ.

Very little is known of the circus of Flora on the Quirinal, except that the exhibitions were given by the courtefans of Rome.

Uncertain traces remain of fome other circufes, which

Panvinius has marked in his plan of Rome. But one circus, which is fubject to no doubt, is that which is fituated beyond the Porta Capena, at prefent Porta S. Sebaftiana, and whofe ruins have been, by an uniform tradition, defignated as the circus of Caracalla. Of this, which is the only one that preferves any confiderable traces of its ancient form, we fhall give a detailed defcription in a fubfequent portion of this article.

Befides thefe, there are the traces of three circufes in Spain, at Tarragona, Merida, and Saguntum, now called Murviedro; at Nifmes, at Milan and Antioch, and alfo at Conftantinople the Hippodrome.

Although the circufes were conftructed for the exhibition of chariot races, they were alfo ufed occfionally for various other purpofes; for befides the exercifes of wreftling, pugilifm, and the foot race, which made a part of the ludi circenfes, the magiftrates frequently affembled there, and exercifed thofe public functions, which, on account of the great multitude of the people, could not be held in the temples and bafilicas. The Agnaninians having to affemble a general council, appointed it in their circus, where they declared war againft the Romans. Cicero informs us, that many harangues were pronounced in the Flaminian circus. Plutarch fays that Lucullus exhibited his triumph in this circus; and it was in the fame place that Auguftus pronounced the funeral oration of Drufus. The circufes were alfo a kind of public places which charlatans, diviners, and other people of that clafs frequented.

We fhall now proceed, with the affiftance of figures, to defcribe the general and particular forms of circufes. See *Plate* of architecture, in which is reprefented a ground plan of the circus of Caracalla, the only circus of which the remains are fufficient to fhew the real form and proportions of thefe edifices.

A A A, area of the ftadium or fpace upon which the chariots ran. B B B, the *carceræ*, or ftarting pofts. They were not difpofed in a ftraight line making right angles with the fides of the circus, as they have frequently been reprefented, but upon the arc of a circle of which the centre is at the point *c*; the reafon of this oblique and circular difpofition appears obvioufly to equalize the diftance which each chariot had to run. The carceræ, which were open behind and clofed in front by latticed gates, had only the width neceffary for five horfes abreaft, and the length of a car with the horfes harneffed to it. D D, *agere* or *fpina* round which the chariots raced. This fpine was a folid platform of mafonry of about 20 feet wide and 132 toifes long; it was placed nearly upon the right line which may be called the axis of the circus. E E, the *metæ* or goals; E 1 the firft, E 2, the fecond meta; the firft meta was at a determinate diftance from the carceræ, that is at a little more than half the length of the fpine. F F F, circumference of the circus, upon the width of which were diftributed the feats for the fpectators. G, principal gate of the circus, called alfo the triumphal gate. H H, two lateral gates which feparate the fides of the circus from the carceræ. I, gate between the carceræ fomewhat wider than thefe, but of the fame height. K, *porta libitinaria* or *fandapilaria*, a gate for the purpofe of carrying out the bodies of thofe who died in the area. L L, towers at the extremities of the carceræ.

Some of the circufes at Rome were furrounded exteriorly with vaft porticoes, except on the fide where the carceræ were placed; others were merely enlofed with a wall having doors and windows, as is the cafe with the circus of Caracalla. The porticoes not being neceffary for the ufes of the circus, were only added to give magnificence to the exterior, or to ferve as a place of retreat to the fpectators in bad weather. The lower part of the circumference of the circus beneath the feats, together with the porticoes, formed long galleries of arcades or *fornices*, ferving in part for an accefs to the ftaircafes leading to the feats, and in part for the fhops of various traders, among whom were particularly reckoned the courtefans.

The diftribution and difpofition of the interior ftaircafes depended upon the will of the architect; thofe of the circus of Caracalla are very ingenioufly difpofed. The principal ftaircafes led to a number of little doors in the *podium*, which was a long open platform or paffage, leading quite round the edifice, at an elevation of fome feet from the area of the circus. The podium was confidered as the place of honour, into which only the principal magiftrates, the pontiffs, veftals, and perfons of the imperial family, entered. It feems that the feats on the podium were not permanent, fince it was the privilege of thofe who had places there to fend their magifterial chairs. Behind the podium there was a low wall or precinction, in which were diftributed the little doors before mentioned. The feats rofe above one another their whole height, in the manner of the fteps of a ftaircafe; they were fupported on the inclined vault of the gallery or portico beneath them, and afcended from the podium to the top of the external wall. The feats of the circus of Caracalla are to the number of ten, and it is calculated that they might contain about 18,000 fpectators; thus it can only be reckoned one of the fmaller or private circufes.

The great circufes as well as the theatres and amphitheatres were divided into feveral ranges of feats for the purpofe of placing the fpectators according to their condition. The feats began from the wall at the back of the podium, and after fetting off a number fufficient to place perfons of the firft rank, the ftaircafe of feats was interrupted by the omiffion of two or three; this interruption produced neceffarily a platform or ambulatory altogether fimilar to the podium, in which thofe fpectators remained, who, coming too late to the exhibition, found the feats occupied; behind the paffage was erected a wall or precinction from which the feats recommenced. The ambulatory was called *via*, and, according to Vitruvius, its width was to be equal to the height of the precinction. The ranks of feats were called *mœniana*, and of courfe there were as many precinctions and ambulatories as ranks of feats. Separate ftaircafes led to each via through doors in the precinction, which entrances were called *vomitoria*. As the fpectators entered by thefe paffages at the top of the ranges of feats, they would have to defcend to occupy the firft rows of each mœniana, but the feats themfelves were too high to ferve as fteps for this purpofe; accordingly there were ftaircafes provided, called *fcalares*, formed by cutting down a feat into two fteps, thus giving to the ftep half the height and width of a feat. Thefe fcalares were placed exactly oppofite the vomitoria, and beginning from the via, defcended to the lower feat of each range, which was thus divided into a number of compartments called *cunei* in the theatres and amphitheatres, as from the curved form of thefe buildings the compartments of feats were longer above than below, and thus acquired a wedge fhape. In the circufes, the fides being ftraight, thefe divifions were rectangular, but from cuftom were called cunei.

Above the feats there was generally a portico or covered gallery for the lower clafs of people.

To maintain order in fuch a concourfe of people as attended the exhibition, there were perfons called defignators, who were to affign to every one his place that there might be no mixture of perfons of different ranks, a point in which

which Roman pride was very jealous. Tarquin divided his circus into thirty compartments, a number equal to that of the curiæ, into which the people of Rome were at that time divided.

All the feats were covered with wood, which circumftance accounts for the fires which are mentioned to have happened in thefe edifices. It was alfo cuftomary for women to bring cufhions, and ftools to place their feet upon. The boards which covered the feats were divided by fillets into places for one perfon.

It remains to mention the place of the emperor and the imperial family; this was called the *pulvinar*, and appears to have been a magnificent open loggia. The fituation of the pulvinar is not known, but it feems probable that it was placed between the carceræ and the firft metæ, whence the emperor might give the fignal for the ftarting of the cars, and obferve the beginning and termination of the race. Auguftus, in a letter to Livia, fays that he does not wifh Claudius, young at that time, to go to the pulvinar to fee the games, as he was too much in the fight of the people. This prince having fhewn figns of ftupidity from his earlieft years, Auguftus did not like that he fhould be fo foon known to the people. Trajan took away the pulvinar from the Circus Maximus, and Pliny praifes him for having thus, by a rare clemency, familiarized himfelf with the people.

The extremity of the circus oppofite to the femicircular end was called the *oppidum;* this confifted of a feries of thirteen arcades contiguous to one another, but without communication. At each extremity there was placed a tower which rofe confiderably above the reft of the edifice. The arch in the middle, wider than the others, but of the fame height, ferved as an entrance to the circus. This combination of arches and towers, feen at a diftance, gave the idea of a caftle, from which circumftance it derived the name of oppidum. The twelve remaining arcades were the carceræ, whence the chariots begun the race. The divifions of the arcades on the interior front were ornamented with hermas fupporting a cornice in the manner of caryatides; the carceræ were clofed with grated doors to the height of the fpringing of the arch, and the femicircular opening above was filled with a marble lattice. Two of thefe lattices, very elegantly ornamented, are at prefent in the fecond court of the palace Mattei, which is founded upon a part of the Flaminian circus. Each carcera was diftinguifhed by a number, and as fome were lefs advantageous than others, the place of the cars was determined by lot. Diocles, a celebrated charioteer, voluntarily took the worft place during 24 years, to difplay his fuperior fkill. The top of the carceræ formed a terrace, upon which was placed the tribune of the conful. It is not known what was the purpofe of the towers of the oppidum. Bianconi fuppofed that in the upper part was placed a band of mufic, while the lower might ferve to receive machinery for opening the doors of the carceræ.

The *fpina* was the moft refpectable part of the circus, or, in fact, the fanctuary, fince it was dedicated to the gods; this was a bank or platform, nearly $\frac{2}{3}$ of the length of the circus, which, running down the middle of the arena, divided it into two nearly equal parts, thus refembling the fpine of a fifh; upon the fpina were placed a great variety of objects which we fhall proceed to defcribe as nearly as poffible.

At the two extremities of the fpina were placed the metæ or goals, which confifted of three cones placed in a triangle. They were at firft made of wood, but afterwards of marble, and even gilded. On the fummit of each was placed a large egg in memorial of the eggs of Caftor and Pollux. The metæ refted upon the vault of a femicircular temple or chapel, a little wider than the fpina; the circular part of thefe little chapels was at the firft goal turned towards the carceræ, and at the fecond towards the triumphal gate, and their entrances were placed in paffages between them and the fpina. The firft of thefe temples, according to Tertullian, was dedicated to the goddefs Murcia; the altar of the god Confus, who is faid to be the fame as the equeftrian Neptune, was alfo placed here. The long extent of the fpina was ornamented with columns, ftatues, and altars. The fun was the deity to whom it appears the circufes were principally dedicated; this great luminary had a temple on the middle of the fpine, but after the conqueft of Egypt, Auguftus having tranfported feveral obelifks to Rome, this circumftance gave rife to the idea of placing an obelifk upon the fpine in honour of the fun, inftead of the former temple, which became a univerfal practice. One of the many obelifks at Rome bears this infcription on its bafe, "AEGYPTO IN POTESTATEM POPULI ROMANI REDACTA SOLI DONUM DEDIT." The emperor Conftans brought from Egypt the largeft obelifk at Rome, which he caufed to be erected in the Circus Maximus, near to that placed by Auguftus.

According to fome baffo relievos and medals, the ftatue of the goddefs Ifis or Cybele feated on a lion, was placed on the fpina near the obelifk; there were alfo many columns, on fome of which were placed little ftatues of the gods to which they were dedicated. The columnæ meffiæ, feffiæ, and tutelinæ, were among the number, and one column fupported a ftatue of Victory. Before the columns were placed altars, among which Tertullian diftinguifhes thofe dedicated to the three gods of Samothrace, who were called great, powerful, and valiant. There were alfo columns fupporting an architrave, on which were placed feven dolphins, probably of wood, dedicated to Neptune. Thefe were moveable, and ferved to mark the number of turns which the chariots made round the metæ; on another architrave were placed eggs, which probably ferved a fimilar purpofe.

It ought to be remarked, that the fpina was fituated not exactly in the middle of the arena, nor parallel to the fides of the circus, but in an inclined direction, fo that the courfe was wider on the right fide of the circus where it began than on the left, and was gradually diminifhed all the way. The reafon of this deviation appears to be, that the chariots ftarting altogether, required more room in the firft courfe than when they came in feparated by the conteft.

The area of the circus was of earth, but probably beaten. Caligula and Nero carried their extravagant luxury fo far as to cover the area with chryfocolla and minium difpofed in regular figures.

In feveral of the circufes the arena was furrounded at the foot of the podium with a canal called *euripus;* this was 10 feet in width and the fame depth. The euripus feems to have been intended for the defence of the fpectators in thofe cafes where the podium was not fufficiently elevated; it does not, however, appear to have been abfolutely neceffary, fince Nero had it covered over to enlarge the area of the Circus Maximus. On one occafion, it is faid, that Heliogabalus filled the euripus with wine. There is no euripus in the circus of Caracalla.

After the defcription of the circufes, that of the games exhibited in them will naturally find a place. Thefe games were celebrated regularly on certain fixed days, and were named from various deities, as Apollo, Flora, Ceres, Saturn, Confus, Bacchus, &c. They were more or lefs magnificent, according to the ritual; fome were celebrated only once in a century, and were therefore called fecular. Some were inftitut-

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ed for the birth-day of the emperor; others for every lustrum, which were called *vota quinquennalia*; and others for ten years, or *decennalia*. The games sometimes lasted several days. There were public funds appropriated to defray the expence, but they were frequently given by individuals who aspired to popular favour. In the lower ages the consuls and principal members of the imperial family generally gave the games and often at a ruinous expence. There is in Gruterus an inscription, in which we read that Aponia Montana, priestess of the god Augustus, gives the Circensian games *ob honorem sacerdotii*, and in another inscription L. Lucretius Fulvianus gives the games *ob honorem pontificatus*.

The games of the circus, which some call "Circensian Games," were combats celebrated in the circus, in honour of Consus, the god of councils; and thence also called "Consualia."

They are also called Roman games, "Ludi Romani," either on account of their antiquity, as being coëval with the Roman people, or because established by the Romans: and the games held there, the great games, *ludi magni*, because celebrated with more expence and magnificence than others; and because held in honour of the great god Neptune, who was their Consus. Those who say they were instituted in honour of the sun, confound the *pompa circensis*, or procession of the circus, with the games. The games of the circus were instituted by Evander, and re-established by Romulus: the pomp, or procession, was only a part of the games, making the prelude thereof, and consisting of a simple cavalcade of chariots.

Till the time of the elder Tarquin, they were held on an island of the Tiber, and were called Roman games: after that prince had built the circus, they took their name therefrom, as being constantly held there.

There were six kinds of exercises in the circus: the first was wrestling, and fighting with swords, with staves, and with pikes; the second was racing; the third saltatio, dancing; the fourth, disci, quoits, arrows, and cestus; all which were on foot: the fifth was horse-coursing; the sixth, courses of chariots, whether with two horses or with four.

In this last exercise, the combatants were at first divided into two squadrons or quadrils; then into four; each bearing the names of the colours they wore; and they were denominated *albati*, *russati*, *prasini*, and *venati*. At first there were only white and red; then green was added, and blue. Domitian added two more colours, but they did not continue. It was Oenomaus who first invented this method of distinguishing the quadrils by colours. These four factions soon acquired a legal establishment: and their fanciful colours were derived from the various appearances of nature in the four seasons of the year; the red dog-star of summer, the snows of winter, the deep shades of autumn, and the cheerful verdure of the spring. Another interpretation preferred the elements to the seasons, and the struggle of the green and blue was supposed to represent the conflict of the earth and sea. Their respective victories announced either a plentiful harvest, or a prosperous navigation; and the hostility of the husbandmen and mariners was somewhat less absurd than the blind ardour of the Roman people, who devoted their lives and fortunes to the colour which they had espoused. Such folly was disdained, and yet indulged by the wisest princes; but the names of Caligula, Nero, Vitellius, Verus, Commodus, Caracalla, Elagabalus, were enrolled in the blue or green factions of the circus. The follies of ancient Rome were adopted by Constantinople; and the same factions which had agitated the circus, raged with redoubled fury in the hippodrome. Whilst a secret attachment to the family or sect of Anastasius was imparted to the greens; the blues were zealously devoted to the cause of orthodoxy and Justinian.

The great Circensian games consisted of a solemn procession, called *pompa*, which was terminated by various sacrifices upon the spina, and a course of a hundred chariots for the diversion of the public.

The exhibition began by the pompa, which descended from the capitol, and, crossing the Forum Romanum, proceeded towards the Circus Maximus, through the street called *Velabrum*; during this time it was unlawful for any person to appear at the windows of the houses. The procession being arrived at the circus, which was already filled with spectators, entered by the great gate; first went the magistrates in their solemn costume, they were followed by a company of children of senatorial and equestrian families divided into centuries, and marching in the same order that they observed in their palestric exercises. After these a hundred aurigæ displayed their cars with two or four horses each car, being accompanied by a light horseman. Wrestlers and athletæ followed, together with dancers and players on musical instruments, who performed pyrrhic and satyric dances. Then came another musical choir, with those who carried the incensers, and other instruments of sacrifice, when the flamens imposed silence in their usual form, *favete linguis*, *favete animis*, upon which it was only permitted to applaud by clapping hands, as the statues of the divinities were carried by. The first deity that appeared was Victory, to whom the Romans were so much indebted; then followed Neptune, to whom the games of the circus were particularly dedicated, and Mars, the father of Romulus and Remus; the Sun and Moon, Minerva, Ceres and Bacchus, Castor and Pollux, Venus and Cupid, with many others followed. In later ages, the statues of deified emperors and their wives were introduced into the circensian pomp. The procession was terminated by the victims destined for the sacrifices, preceded and followed by the pontiffs, priests, augurs, aruspices, flamens, and other ministers of religion: then the sacrifices being performed with all the necessary ceremonies, the persons composing the procession took their places on the seats of the circus, and every thing was prepared for the races.

Each exhibition consisted of twenty-five courses, and each course of four chariots; thus the whole number of chariots required was one hundred; these were divided into four factions, which were distinguished by different colours, white, red, green, and blue. For each course there were drawn by lot the names of four charioteers, one of each colour, together with the number of the carceræ assigned to each, that there might not be any complaint of partiality.

The chariots had at first only two horses, and were called *bigæ*. In process of time there was added another horse, which was called *funarius*, because he was attached to the car by a rope; at length one more horse was added, and the car became a *quadriga*, which was the most general practice. But sometimes the directors of the games added to each car a fifth horse, with a rider; and in the inscription relating to Diocles, there are even mentioned six and seven horses abreast. Such races must have been personal challenges between the most distinguished charioteers, for the regular courses were performed with four horses.

The light cars used in the Circensian games had two wheels, and were nearly balanced upon the axle; the front, which was circular, had a kind of parapet, about the height of the drive-knee: this parapet was gradually diminished

nished on the sides, till it ended in a point, and the back of the car was left open; thus the charioteer mounted behind, and stood upon the floor of the chariot.

The horses destined for the Circensian courses were preserved entirely for this purpose; and the greatest care was taken to maintain the vigour and purity of the race: their keepers were called *conditores gregis*. It is remarkable, that these horses, as appears by various basso-relievos and mosaics, had their tails cut short. As all the turns round the metæ were made to the left hand, the funarius horse on that side became the leader, and was never changed. The horses were so well accustomed to the contest, that they often ran without the whip. Pliny relates, that once a charioteer, having fallen from his car, the horses performed the course in the usual manner, and gained the palm.

The aurigæ were men accustomed to the employment, who had no other occupation. They were generally slaves, though sometimes persons of rank and fortune exercised this art for their amusement. Nero frequently exhibited himself as a charioteer in the public games. The business of an auriga required great address, agility, and practice, and demanded infinite pains to learn it perfectly. They were dressed in the colour of their faction; but their only cloathing consisted of a light tunic, without sleeves, which did not reach below the knees. They wore a round helmet, fastened under the chin, to defend their heads in case of a fall: the tunic was closely and strongly girded with belts, probably of leather, which covered the chest and stomach. An antique torso at the Museo Pio-Clementino, gives a very clear representation of this part of the costume. A crooked knife stuck among the belts was an essential part of their equipment; for as the reins were fastened round the middle of the driver, he would, if he happened to fall from the chariot, have been exposed to the danger of being dragged round the circus, if he had not had the means of delivering himself by cutting the reins.

Now the charioteers and horses, shut up in the carceræ, eagerly expected the moment of departure. In winter the breath of the horses was seen coming through the lattice of the gates, and they were heard to beat with their hoofs the hardened ground. The prætor gave the first signal, on which the gates of the carceræ were opened all at once by means of some machinery; this signal was different at different times, anciently it was a lighted torch; in the time of Nero a piece of white cloth thrown from above was the signal; at the second and last signal, the sound of a trumpet, a cable which crossed from one herma to another fell, the chariots left the carceræ, and advanced towards the right side of the circus. Tending to the same centre by so many radii, the chariots could not encounter till they entered into the course; but from this time there was a continual struggle and conflict among the cars to obtain the nearest place to the spina, and turn the goals as close as possible. The whole course consisted of seven turns, and he, who after the seventh turn, arrived first at the meta opposite the carceræ was the conqueror. Thus, the object was not only to run as fast as possible, but to shorten the way, by keeping close to the spina, and turning short round the meta, without, however, touching, or even grazing, for the smallest shock would overturn the car. This accident, in Circensian phrase, was called a shipwreck. The charioteers were permitted to clash with and overturn their adversaries, provided it did not happen before they entered into the course, that is, before they had passed the space between the carceræ and the first meta. It appears, that a white chalk line was drawn across the circus, to mark the beginning and termination of the course.

If, in commencing the course, there was reason to suspect any trick, or foul play, it was lawful for the people to require that it should be recommenced: this demand was made by shaking their togas; and when this sign was general, the prætor was obliged to comply.

There were twenty-five courses, as before observed, and the usual number of cars was four; there were, however, exceptions from these rules. At the celebration of the secular games, Domitian, instead of 25, gave 100 courses in one day; but the chariots, instead of seven, made five turns. Commodus frequently had six cars run at once; and on a sepulchral bas-relief at Foligno nine chariots are represented in full career. The victor obtained a palm, and, in later times, a crown. He was called *bravium*, which term is apparently the origin of bravo, and brave, in modern languages. The second and third charioteers were not without some reward, but the fourth had only the disgrace of being vanquished.

After the chariot races, the charioteers ran foot races in the arena; and the athletæ and wrestlers finished the exhibition of the day.

The Roman people were excessively attached to the games of the circus. To this purpose is the verse of Juvenal,

> " — Atque duas tantum res anxius optat,
> Panem et Circenses ——— "

These words *panem et circenses*, formed the cry of the multitude, who frequently remained whole nights and days in the circus, exposed to the weather, and without leaving their places to take any refreshment. At Constantinople this passion was more violent than ever, and the factions of the circus endangered the empire. Bianconi "Descrizione del Circo di Caracalla." "Mosaique d'Italica."

CIRCUS, in *Ornithology*, a name by which Bellonius, Gesner, and Aldrovandus distinguish the moor buzzard, *Falco æruginosus* of Linnæus and later authors. The name circus has been likewise applied to other birds of the falco tribe: Brisson, for example, calls the *Falco gallinarius*, *Circus major*, and the Gmelinian falco brasiliensis, or Brasilian kite, *Circus brasiliensis*.

CIRE', in *Geography*, a town of France, in the department of the Lower Charente, and district of Rochefort; $2\frac{1}{2}$ leagues N. of it.

CIRELLA, a town of Naples, in the province of Calabria Citra, near which were formerly mines of gold, silver, and lead, some traces of which are now visible; 8 miles E.S.E. of Scalea.

CIRENCESTER, or CICETER, a borough and market town of Gloucestershire, England, was formerly the seat of a Roman colony, and is supposed to have been the metropolis of the Dobuni. The circumstance of the junction of the three Roman roads, called the Foss-way, the Irmin-street, and the Icknield-way, on this spot, evinces its eligibility for a Roman station: numerous ancient remains have at various times been discovered, and scarcely a year elapses, but some memorial of antiquity is found in the vicinity. The ancient city was inclosed by a wall and a ditch, the remains of which demonstrate the circumference to have been upwards of two miles. It is supposed that the fortifications were razed soon after Henry IV.'s reign; but that they were not wholly obliterated, appears from the following authorities. Leland observes that "a man may yet, walking on the bank of Churne, evidently perceyve the compace of foundation of towers sumtyme standing in the waul. And nere to the place wher the right goodly clothing mylle was set up a late by the abbate, was broken down the ruine of an old tower,

towards

towards making of the mylle waulles, in the which place was fownd a quadrate ſtone fawllen down afore, but broken in many pieces, wherin was a Roman inſcription, of the which one ſcantlie letterd that ſaw yt, told me that he might perceyve PONT. MAX. Among divers coins found frequently there, Diocleſian's be moſt faireſt." The abbot of Cirenceſter informed Leland that he had found in the ruins arched ſtones, ſculptured with large Roman letters. Hearne obſerves that coins with a figure holding a patera in the right hand, and a palm-branch in the left, were found here in his time; and he had been informed of the diſcovery of a pavement before the year 1711, compoſed of many coloured teſſeræ. Sir Robert Atkyns mentions a ſubterraneous building, fifty feet long, forty broad, and about four high, ſupported by an hundred pillars curiouſly inlaid. Dr. Stukeley mentions a moſaic pavement dug up here in Sept. 1723; and adds, that a vault was diſcovered ſixteen feet by twelve, ſupported by pillars of Roman brick, three feet ſix inches high, on which was a ſtrong floor of terras; ſeveral other vaults adjoining, were ſhaded by cherry trees; and broken pillars, mouldings, cornices with carved medallions, baſes, capitals, &c. were found indiſcriminately ſcattered. Theſe remains have been recently aſcertained to belong to a Roman hypocauſt. A teſſelated pavement, about ſixteen feet ſquare, was found in 1777, beneath a warehouſe in Dyer-ſtreet; another, and more beautiful fragment, was diſcovered in digging a cellar in the ſame ſtreet; and the Bull-ring in the Querns is ſuppoſed to have been an amphitheatre.

The caſtle of Cirenceſter is firſt mentioned in hiſtory as being garriſoned by the earl of Glouceſter for the empreſs Maud againſt king Stephen, by whom it was taken. In the reign of Henry III. it was garriſoned by the barons; but being recovered by the king, he ordered its total demolition. The town, notwithſtanding, appears to have been a place of ſtrength, and is celebrated for the ſuppreſſion of the conſpiracy of the nobles againſt Henry IV. Cirenceſter was formerly celebrated for its rich abbey, which aroſe from a decayed college of prebendaries of ancient Saxon foundation. Rumbaldus, dean of this college, and chancellor to Edward the Confeſſor, witneſſed a grant of that monarch to the abbey at Weſtminſter. Leland mentions a "ſepulchre croſſe," of white marble, as remaining in the abbey church. This building, as appears from Leland and William of Worceſter, was of the Saxon ſtyle of architecture, 280 feet in length, and of proportionable dimenſions. At the diſſolution, the ſite of the abbey was granted to Roger Baſing eſq. on condition that all the buildings within the precincts ſhould be pulled down and carried away; which was ſo effectually executed, that the ſpot occupied by the church cannot now be exactly aſcertained. The ſeat of Thomas Maſter, eſq. now called the abbey, includes the ſite of moſt of the monaſtic buildings. The pariſh church at Cirenceſter, is one of the moſt magnificent parochial edifices in the kingdom. It was completed but a few years prior to the ſuppreſſion of the abbey, yet the regular ſtyle of the fifteenth century prevails in every part. The interior conſiſts of a nave, ſide aiſles, a choir or chancel, and five chapels; at the weſt end is a handſome embattled tower, 134 feet high, ornamented with pinnacles and ſtatues: and on the ſouth ſide is a beautiful porch richly decorated externally with groteſque figures, carved niches, canopies, oval windows, ſculptured cornices, and open-worked battlements; and internally adorned by radiant tracery, ſpreading over the roof in eight circular fan-ſhaped compartments, which riſe from ſingle pillars and meet in the centre, where the lozenges formed by the extremes of the circles, are ornamented with quatrefoils. The porch is 38 feet in length, by 50 in height. The inſide of the church contains two rows of cluſtered columns, five in each; which, with two pilaſters at each end, ſupport the roof. The windows were formerly filled with painted glaſs, but a conſiderable part has been mutilated or miſplaced. Of the chapels, that on the north ſide, dedicated to St. Catherine, is worthy of particular notice, from the ſculptures in the compartments of the roof. In Trinity chapel are two marble monuments, to the memory of Allen, earl Bathurſt, and his ſon the lord chancellor.

Cirenceſter has ſeveral ſchools: the moſt ancient is the free grammar ſchool, founded by biſhop Ruthall, who was a native of this town, and privy counſellor to Henry VII. Queen Mary added 20*l.* to the endowments. Several perſons of eminence have received their education in this ſchool. There are alſo a blue-coat ſchool, and a yellow-coat ſchool, both eſtabliſhed early in the eighteenth century. Among other charitable inſtitutions, are three hoſpitals: St. John's, founded by Henry I.; St. Lawrence's, by Edith, lady of the manor of Wiggold, time unknown; and St. Thomas's, by ſir William Nottingham, attorney-general to Henry IV.

The manufactures of this town ſeem generally in a declining ſtate, with the exception of that for curriers' knives, which are held in high eſtimation throughout Europe and America, and are made by three or four houſes here, by one at Glouceſter, and ſcarcely any where elſe in the kingdom. There are alſo a clothing-houſe, a ſmall carpet manufactory, and two breweries.

The markets, which are held on Monday and Friday, are much frequented, and well ſupplied, eſpecially with corn and meat. Great quantities of wool were formerly brought from Buckinghamſhire, Berkſhire, Northamptonſhire, and Oxfordſhire, and ſold at the Booth-hall, where large rooms were provided for the reception; but the modern practice of dealers travelling to make their purchaſe, has effectually deſtroyed this market. Three fairs are annually held, and two mops, or ſtatute markets, on the Mondays preceding and following the tenth of October. Great numbers of farmers and others attend theſe markets to hire labourers and ſervants, who wear, in their hat or boſom, badges of whip-cord, wool, or cow-hair, thus diſtinguiſhing themſelves as candidates for the offices of carter, ſhepherd, dairy-maid, &c.

The diſtrict called the hundred of Cirenceſter included, at the Domeſday ſurvey, ſeven villages; but Henry IV. made the town a diſtinct hundred, as it ſtill remains, excluding the abbey, almery, and Spiringate lane. He alſo made it a corporate town, to be governed by a mayor, two conſtables, &c.; but his charter was cancelled 37 Eliz. The hundred conſiſts of ſeven wards; the ſteward of the manor annually appoints two high conſtables and two petty conſtables for each ward, with the other neceſſary officers. Repreſentatives were ſent from this borough to a great council 11th Edward III.; but the firſt regular return to parliament was made under a grant of 13 Eliz. Different deciſions of the Houſe of Commons have confined the right of election to the inhabitant houſeholders not receiving alms; the number is about 500.

The town conſiſts of four principal, and ſeven ſmaller ſtreets, with ſeveral lanes, extending over an area of about two miles in circumference. The buildings are chiefly of ſtone; and the more reſpectable houſes are generally detached. The ſtreets, excepting the ſouth ſide, have a gradual declivity from the centre to the extremities. The population has increaſed but little ſince the beginning of the laſt century; the inhabitants amounting then nearly to 4000, and being returned under the act in the year 1801 at 4130; the number of houſes 885. Cirenceſter is ſituated 89 miles W. from London. It is very near to the grand ridge of England; and not far from the famous Sapperton tunnel, by which the Thames and Severn canal crosses it: a short branch of this canal is conducted up to the town of Cirencester. See CANAL.

Ricardus Corinienfis, or Richard of Cirencester, so call'd from being a native of this town, was the compiler of the celebrated Itinerary, part of which, relative to England, was published under his name by Dr. Stukeley.

Oakley Grove, the feat of Henry earl Bathurst, lies on the west of Cirencester. The mansion is only at a small distance from the town, the view of which is intercepted by a lofty wall lined with perennial trees. It was built early in the last century; and, though very spacious, is more convenient than grand. Lysons' Gloucestershire Antiquities. Rudder's History of Gloucestershire. Rudge's History of Ditto, 2 vols. 8vo.

CIRENZA, a town of Naples, in the province of Calabria Ultra, 12 miles N. of Girace.

CIREY, a town of France, in the department of the Meurthe, and district of Luneville, 8 miles E. of Blamont.

CIRIE, a town of Italy, and capital of a marquisate, in the principality of Piedmont, comprehending the towns of St. Maurice, Nolli, and Robasome, seated near the foot of the Grecian Alps, in the Doria; 8 miles N.N.W. of Turin.

CIRIS, in *Ornithology*, the painted bunting of Pennant and Latham, a species of *emberiza*, which see.

CIRKNITZ, in *Geography*, a small village of Carniola, seated on a lake called the "Cirknitz sea," surrounded with steep and rugged mountains; 14 miles S.S.W of Laybach, and 168 S.S.W. of Vienna. In winter this lake is very extensive, and overflows a considerable part of the adjacent fields, which, in summer, are quite dry, and fit for tillage; whence it is commonly said, that a person may sow and reap, hunt and fish, in this lake, within the space of a year. When it is dry the rushes, which it yields in great abundance, are mowed for manure and litter for the cattle; and when it remains long dry, it produces a kind of grass which is used as fodder. The most remarkable circumstance attending this lake is, that it generally continues to ebb for 25 days; the water during that time running off by holes or cavities, which are 18 in number, and are so many eddies or whirlpools. Instances have occurred of its being dried up, by the absorption of these eddies, three times in a year. The lake abounds with fish: and in spring and autumn it is frequented by large flocks of wild ducks. There are three pleasant islands in this lake, besides a kind of peninsula. It is somewhat more than a German mile in length, and about half as broad. Its greatest depth, exclusive of the cavities or holes, is about 24 feet. Strabo calls it Lugea palus, either from the town of Lueg, which lies near it, or from its deep and cavernous bed.

CIRL-BUNTING, in *Ornithology*. See EMBERIZA CIRLUS.

CIRLUS STULTUS, the foolish bunting; *Emberiza cia*, is so named by Aldrovandus and Willoughby; the former calls it likewise *emberiza pratensis*.

CIRNA MONS, in *Ancient Geography*, *Dghibbal Ifkol*, a mountain of Africa, S.W. of the Hipponites lake, and 5 leagues from the town of Hippozaritus. It is mentioned by Ptolemy, and distinguished by its round figure.

CIRO, in *Geography*, a town of Calabria, standing on the site of Crimissa, a city founded by Philoctetes, the friend and heir of Hercules. This is a very poor place, though it contains about 6000 inhabitants; it belongs to Spinelli, prince of Tarsia, who monopolizes all the silk made by his vassals. The territory produces also very fine oil and corn, bad wine but good water.

CIRPHIS, in *Ancient Geography*, a town of Greece, in the Phocide territory. Strabo places it near Mount Parnassus.

CIRQUINCON, in *Zoology*, the name under which Buffon describes the weazel-headed armadillo, *dasypus 18-cinctus* of Linnæus, and *tatu mustelinus* of Ray.

CIRRADIA, or CIRRHADIA, in *Ancient Geography*, a canton of India, on the other side of the Ganges, according to Ptolemy, who says that it yielded the best *malabathrum*. M. d'Anville places it towards the 26th degree, on the course of the river Catabeda.

CIRRHA, a maritime town of the Phocide territory, seated on the gulf of Corinth, and serving as a port to the town of Delphi, and 60 stadia distant from it. On an adjoining plain was an hippodrome, dedicated to Apollo. Homer calls this town Crissa. We learn from Pausanias, lib. ii. c. 37, that Cirrha had a beautiful temple of Apollo, Diana and Latona, in which were large statues of these deities, which belonged to the school of Athens.

CIRRHOSE, in *Botany*, a term applied to the leaves or other parts of a plant, when they throw out cirrhi or tendrils, by which they cling to neighbouring plants or other bodies.

CIRRI, GIOVANNI BATTISTA, in *Biography*, a native of Italy, whose instrument was the violoncello, upon which he was a more useful than shining performer. He was a regular bred musician, a good contrapuntist, and wrote correctly for several instruments besides his own. He resided in England many years. His first work was published at Verona in 1763, where he is styled *professore di violoncello*, born at Forli. In 1785 he had published in London, Paris, and Florence, 17 different works, consisting of quartets, trios, solos for his own instrument, and pieces for the organ.

CIRRIS, in *Ornithology*, one of the synonymous names of the long-legged plover, *charadrius himantopus*. Cirris is the name under which it is described by old writers; it was formerly considered as appertaining to the ardea or heron tribe, but is certainly by no means related to that genus. The general plumage of this bird is white, with the wings blackish and glossed with shining green; the legs a very beautiful red. The species is occasionally found in England. Donov. Brit. Birds, &c.

CIRRUS, in *Antiquity*, an ornament added to the edges and borders of garments, much in the manner of fimbriæ or fringes, only that these were single and run along the borders of the dress; whereas the cirri were knotted together, and hung down from the extremities of the robe.

CIRRUS, in *Botany*, a tendril or clasper, by whose numerous convolutions plants lay hold of other bodies for support. The name refers to the naturally curling locks of a child after they have been once cut, called by the Romans previously *comæ*, but afterwards *cirri*, most probably from κειρειν, *to shear*. Some of the old botanists used the name of *cirri* for the *stamina*, and others for the fibrous crown of the root, formed of the remains of leaf-stalks in several plants, as *Meum athamanticum*. Linnæus, who first applied this term to tendrils, writes it *cirrhus*. Haller retained the old names of *capreolus* and *claviculus* for the part in question. See CAPREOLUS and CLAVICULUS

Tendrils are enumerated by Linnæus among those appendages to a plant which he denominates *fulcra*, or props, and of which he reckons seven kinds. They are the only one of the seven to which the term he has chosen can, with strict propriety, be applied. They serve to support weak and climbing stems upon such as are strong and upright, and they are most abundant in annual stems, Bryony and the Vetch kind for instance, which springing from strong and durable roots, thrive with great luxuriance during summer, decorating with their foliage, blossoms and fruit, many, otherwise otherwife naked, ftems and branches; till, having perfected their feeds, they no longer encumber the face of nature, and their living principle fhrinks, as it were, into its winter quarters in the root. In the forefts of India and America the climbers are often of a more fhrubby kind, and afcend to the tops of the higheft trees, affifted frequently by twining ftems as well as by the organs in queftion.

Tendrils generally grow ftraight, and more or lefs horizontally at firft, but their extremities foon affume a fpiral fhape, and make a certain number of turns, which being accomplifhed, they, in many inftances, perform about as many more in the contrary direction, and even afterwards refume their original one, by which they have fo much the more chance of catching hold of any neighbouring branches. Some of them, as in *Vicia* and *Lathyrus*, are repeatedly branched, rendering the chances ftill more in their favour; while others are perfectly fimple, and turn but in one direction, as thofe of *Gloriofa fuperba* and *Flagellaria indica*, which are merely a fpiral elongation of the points of their leaves, hence denominated *folia cirrofa*. In many pinnated leaves, particularly thofe of the Vetch tribe, a *cirrus*, either fimple or branched, terminates the common foot-ftalk, the leaves thus circumftanced being, of courfe, abruptly pinnated. When the *cirrus* is quite diftinct from the leaves, it is ufually axillary, as in the genus *Paffiflora*; fometimes it proceeds from the flower-ftalk, as in *Cardiofpermum halicacabum*, and *Annona hexapetala*, *Linn. Suppl.* 270. The extremity of the flower-ftalk in the latter forms a hook, which embraces the branch, and gathering great ftrength after the flower is paft, ferves to fufpend the large and heavy fruit refembling a bunch of grapes, for which purpofe the bafis or receptacle of the flower does not perhaps poffefs fufficient firmnefs.

Profeffor Willdenow has an idea that *cirri* are, "in fact, *petioli* without the leafy expanfion, but which, not having wafted their fap in the formation of leaves, have grown the longer, and thus have become too thin and feeble to preferve their ftraight direction." The obfervation of the leguminous plants favours this hypothefis, the branches of whofe tendrils actually feem each to have taken the place of a leaflet. So alfo the *Gloriofa fimplex*, a plant obferved by Miller alone, and now generally fuppofed to have been a mere variety of *G. fuperba*, deficient in the fpiral appendage to its leaf, may be prefumed to have beftowed all its vigour in the expanfion of the leaf itfelf, without accomplifhing more. But the *cirri* in *Paffiflora*, *Vitis*, *Bryonia*, *Cucumis*, &c. are, unqueftionably, diftinct organs, which never affume the forms nor functions of leaves.

Willdenow further remarks, that "it appears as if the diminifhed force of the current of air had fome influence upon the tendril. For each plant that fupports itfelf by tendrils, when diftant from a wall, tree, or fhrub, fends out all its tendrils towards that fide on which the plant is to attach itfelf." This feems to us not fatisfactory. If the fact be true, for which we cannot vouch, it is rather to be explained by this ingenious writer's preceding theory, that part which, if fituated where it had received more air and light, would naturally have expanded into a leaf, being in oppofite circumftances contracted into a tendril. We are perfuaded, however, that, except poffibly in the above-mentioned leguminous plants, the *cirrus* and the leaves are organs totally diftinct in their nature. The latter are ftimulated to expand by the action of light and air, and prefent themfelves fo as to receive thofe ftimulants; the former feem to thrive moft from refiftance, and to court that refiftance, turning with much more vigour round any extraneous body than in a void fpace. So the tendrils of *Hedera quinquefolia*, properly a fpecies of *Vitis*, when they attain the trunk of a tree, or the even furface of a ftone, efpecially a fmooth flint, no fooner fix upon it than their extremities dilate, clinging with a fort of appetency to what feems to ftimulate them to an extraordinary exertion. Much the fame thing may be obferved in our common ivy, *Hedera helix*.

Tendrils feldom afford good fpecific characters, being too much alike in the fame genus to anfwer any fuch purpofe. In the various climbing fpecies of Virgin's-bower, *Clematis*, there are no real *cirri*, but the leaf-ftalks effectually perform their functions, efpecially in the beautiful *C. cirrofa*, where thofe ftalks are permanent, for a year at leaft, after their leaves are fallen, and having all the appearance of naked *cirri*, feem to have been taken for fuch by Linnæus. Hence Juffieu was induced, in the Paris garden, to change the name of this fpecies to *pyrifolia*; but the femblance of *cirri* is fufficient to juftify the original denomination, though the Linnæan fpecific character requires correction. S.

Cirrus, Cirri, in *Ichthyology*, the Linnæan term applied in general to the beard, or foft *appendiculæ* which hang about the mouth or jaws of fifhes; it is alfo occafionally employed to exprefs the fkinny or flefhy appendages about other parts of the body. See Ichthyology.

CIRSELLIUM, in *Botany*, a genus formed by Gærtner, for fome fpecies of the Atractylis of Linnæus, with the following character. *Calyx* imbricated either with fpinous, or with fpinelefs fcales. *Receptacle* befet with briftly chaff. *Florets* of the difc hermaphrodite; of the ray feminine, ftrap-fhaped; both fertile. *Seeds* uniform; down feathered. He refers to it, Atractylis cancellata and humilis, and doubts whether A. gummifera, lancea, ovata, with Carthamus folicifolius, ought not to be added.

CIRSIUM, in *Botany*, (Circium; Tourn.) a genus taken up by Gærtner, with the following character. *Calyx* bellying or cylindrical, imbricated; fcales acuminate, either with, or without prickles, but never with appendicles. *Florets* all hermaphrodite. *Receptacle* chaffy; *feeds* crowned with a feathery down; rays of the down filiform, nearly equal, united into a ring at the bafe. The Cirfium and Cirfellium of this author differ only in the former being without, and the latter with a ray.

CIRSOCELE, in *Surgery*, corruptly written Circocele, from κιρσος *varix*, and κηλη, *tumor*; fometimes called *Hernia varicofa*, though improperly, as it has no affinity to a real Hernia, which fee.

The cirfocele is an unequal and irregular enlargement of the fpermatic veffels, near the teftis in which are felt, as it were, hard ftrings or varicofe veins, of the thicknefs of a quill or even larger, involved together like a mafs of worms, and preffing down upon the tefticle. The diforder is moft common in young plethoric men, and in thofe efpecially who are unmarried. It is more troublefome than dangerous, and feldom requires any other attention than wearing a bagtrufs to fupport the part.

The tumor is generally firft difcovered near the bottom of the fcrotum; in moft cafes it makes a gradual progrefs. At its commencement, the patient perceives a fenfe of weight in the fcrotum; which, as the difeafe increafes, becomes more fenfible, but diminifhes in its bulk upon the application of a fufpenfory bandage, or when the patient lies upon his back. When the tumor is fqueezed, the patient feels that peculiar fenfation, which always is produced by preffure applied to the tefticle. At length the tumor gradually enlarges upwards, approaches the abdominal ring, widens it, and alters its fituation or form; fo that nothing but a confufed irregular mafs can be difcovered upon examining this part.

The cirfocele may be thus diftinguifhed from the omental hernia, with which it has fome fimilarity in its advanced ftate:

ſtate: viz. The omental hernia deſcends from the abdominal ring downwards, whilſt the cirſocele always commences at the bottom of the ſcrotum, and increaſes upwards. It alſo comes on very gradually, and is not attended by thoſe ſymptoms which accompany the omental hernia in conſequence of the omentum dragging down the inteſtines. The maſs which forms the cirſocele can never be puſhed into the abdomen, whereas the protruded omentum frequently may be returned. In the cirſocele, the teſticle often diminiſhes in ſize, and even waſtes entirely away; whilſt in the omental hernia, it is found to be perfect and ſound. Finally, when the tumor in an omental hernia is preſſed as above mentioned, the patient experiences no peculiar ſenſation or pain; whilſt in the cirſocele, pains are frequent even without any apparent cauſe.

The cirſocele may be diſtinguiſhed from the hydrocele, with which it has alſo much ſimilarity, by the following circumſtances: In a ſimple hydrocele, the teſticle and the epidydymis are perfectly natural and ſound, whilſt in the cirſocele theſe parts are always found to have ſome preternatural and irregular conformation: the tumor in the hydrocele is alſo of a more pyramidal figure, and when the patient lies down or ſtands up it yields to preſſure, and riſes upwards; and as ſoon as the preſſure is removed, recovers its former ſituation. Moreover in the hydrocele, the patient does not feel pain in the ſcrotum, or even in the tumor itſelf, as in the cirſocele, but merely in the region of the groin: the more the hydrocele increaſes, the more the teſticle is concealed, and can only be felt at the bottom; but when the diſeaſe has attained its height, it entirely diſappears, as in the cirſocele. Finally, the elaſticity and fluctuation perceived upon preſſing the tumor between the fingers, are ſymptoms by which the hydrocele may readily be diſtinguiſhed from the cirſocele.

The cirſocele is frequently combined alſo with other diſeaſes of the male organs of generation, from which however it may readily be diſtinguiſhed.

The cauſes of this diſeaſe are: hypochondriaſis, obſtructions or irregularities of the hæmorrhoidal diſcharge, immoderate laſciviouſneſs, redundance of ſemen, &c. The diſeaſe conſiſts in a tumefaction of the ſmall veſſels compoſing the teſticle, which protrude out of the proper membrane of the teſticle, and mix themſelves with thoſe of the epidydymis. Frequently the diſeaſe is occaſioned by preſſure on the upper part of the ſpermatic chord by a rupture-bandage, or a ſcirrhous tumor. (See the article TRUSS.) Sometimes it is occaſioned merely by a relaxation of the veſſels of the ſpermatic cord; in which caſe a ſuſpenſory bandage, the horizontal poſture, cold bathing, and the external application of a ſolution of alum produce beneficial effects. When theſe remedies do not entirely remove the tumor, they at leaſt check its further progreſs.

The mode of cure ought properly to be regulated according to the different cauſes that have produced the diſeaſe. Antiphlogiſtic remedies are chiefly to be employed. (See INFLAMMATION.) Above all, the patient ſhould keep in a horizontal poſture, and uſe a ſpare diet. In proportion to the ſtrength of the ſubject, local bleeding muſt be employed, and ſometimes repeatedly. Emollient and anodyne glyſters, as alſo gentle and cooling laxatives, are likewiſe ſerviceable. The ſcrotum ſhould be conſtantly ſupported by a ſuſpenſion bandage; and water cooled with ice may be frequently daſhed over it, in order to reſtore the tone of the parts.

Some of the ancient ſurgeons have recommended to lay the diſeaſed parts bare, and either to tie or extirpate the tumefied veins; but probably when obſtructions of the hæmorrhoidal veſſels have cauſed this diſeaſe, it might be effectual, without laying bare the ſpermatic chord itſelf, merely to apply leeches under the abdominal ring, and thus produce a topical evacuation of blood. The advantage of this practice is the more to be expected, as it is known that the ſpermatic veins anaſtomoſe with the veins of the external ſurface.

Should all the remedies we employ be of no effect, we are told there may be even danger of cancer, and that caſtration muſt follow; but this operation ſhould not be haſtily performed, as we have never ſeen any ſuch conſequences, and are inclined to doubt the propriety of this advice in any caſe of ſimple cirſocele. (See CANCER.) The doctrine of cirſocele terminating in cancer, has particularly been inſiſted on by the German ſurgeons.

CIRSOPHTHALMIA, from κιρσος, *varix*, and οφθαλμια, Ophthalmia varicoſa, varicoſitas conjunctiva: a varicoſe dilatation of the veſſels of the tunica conjunctiva. In this diſeaſe there appear red varicoſe veſſels diſtended with blood upon the tunica conjunctiva of the eye: they are generally in the form of bundles, uniting commonly near to one of the angles of the eye, where they form a kind of trunk, on which account this diſeaſe has ſometimes been termed *Ophthalmia angularis.* At the point where the ſmall veſſels join, a ſmall tubercle is obſerved, which is actually varicoſe; ſometimes this tubercle burſts and is changed into a ſmall troubleſome ulcer. From the angles of the eye the veſſels ſpread themſelves further towards the cornea, and diverge more from each other; ſometimes ſeveral of them croſs the cornea, and ſenſibly impede viſion, or in ſome inſtances entirely obſtruct it. (See OPHTHALMIA.)

Theſe veſſels may now and then be made to diſappear by the long-continued external application of cold water, or a ſolution of alum in water, a ſolution of white vitriol, or a weak ſolution of pure kali, &c. The laſt mentioned remedies are to be applied ſeveral times a day, by means of a ſmall hair-pencil, or a few drops of them let fall into the eye.

Mr. Janin recommends an ointment containing white precipitate of mercury, &c. When the ſmall point at which the veſſels of the bunch unite, has already changed into a ſmall ulcer, the ſame remedies are to be uſed as in other ulcers of the conjunctiva: but when theſe remedies are inſufficient, the veſſels muſt be cut through with the point of a cataract knife or lancet; and in order that the divided veſſels may not reunite, they muſt be cut completely through, and the inciſion repeated ſeveral times in the ſame line, ſo that it may penetrate quite through the conjunctiva coat, and the ends of the veſſels muſt be removed from each other with the point of the knife. It is alſo proper that the inciſion ſhou'd be made ſomewhat longer than the breadth of the bunch, as in that caſe, the ends of the veſſels may be more eaſily removed from each other. Should the veſſels re-appear after a few days, the operation muſt be repeated, their bleeding ſhould be promoted by bathing them with warm water, and we may afterwards apply a ſolution of white vitriol, or ſome other aſtringent remedy.

CIRSOTOMY, from κιρσος, *varix*, and τεμνω, *ſeco*, the operation for varices. This operation was formerly in uſe for evacuating the contents of deep-ſeated varices; and is ſtill ſometimes practiſed. (See VARIX.) The teguments over the varix are cut open, and the varix ſeparated from the ſkin and neighbouring parts, by means of a probe or other blunt inſtrument; after which the vein is tied above and below the varix, in the ſame manner as the artery in caſes of aneuriſm. See ANEURISM.) The tumor, ſituated between the two ligatures, ſeparates itſelf together with the ligatures in the courſe of a few days; or we may divide it at firſt, or only ſeparate its anterior part with the ſciſſars. When the varix is ſituated near

near to a bone, it is not neceſſary to tie the vein; but as ſoon as the integuments have been divided we may immediately extirpate the whole tumor, and ſtop the hæmorrhage by compreſſion upon the bone. When the ſkin, as ſometimes happens, adheres ſo ſtrongly to the varix that it cannot be ſeparated, we muſt cut out the adhering portion. If the operation has been performed by ligature, we muſt wait for the ſeparation of the threads, and then promote the union of the wound. Now and then this operation has been followed by inflammation, and even death!

CIRTA, or CIRTHA, in *Ancient Geography*, a town of Africa in Numidia, or in the eaſtern province of Algiers, now called Conſtantina, anciently the Mauritania Cæſarienſis. It derived its name, according to Bochart, from קרתא *cartha*, *i. e.* city; which denotes that it was formerly a conſiderable place. It was ſeated on an eminence, about 48 miles from the ſea, and became the capital of the kingdom of Numidia, and the royal reſidence. Its magnitude and ſtrength may be inferred from the extent of its ruins, and from its particular ſituation; the greateſt part of it being built upon a peninſular promontory, inacceſſible on all ſides, except towards the S. W. where it was joined to the continent. This promontory was computed by Dr. Shaw (Trav. p. 60.) to be a good mile in circuit, lying a little inclined to the ſouthward, but towards the north it terminated in a precipice, at leaſt 100 fathoms perpendicular, from whence is a beautiful landſkip, over a great variety of vales, mountains, and rivers, which lie to a great diſtance before it. Eaſtward the proſpect is bounded by an adjacent range of rocks much higher than the city; but towards the S. E. the country is more open; and in this direction the peninſular promontory is ſeparated from the continent by a deep narrow valley perpendicular on both ſides, where the Rummel or Ampſaga conveys its ſtream. The neck of land to the S. W. where ſtood the principal gate of the city, is about the breadth of half a furlong, being entirely covered with broken walls, ciſterns, and other ruins, which are continued quite down to the river; and carried on from thence over a ſtrip of plain ground, that runs parallel with the abovementioned valley. The preſent city has not the ſame dimenſions, being confined to the peninſular promontory only. Near the centre of the city there ſtill remain thoſe capacious ciſterns which received the water brought thither from Phyſgeah by an aqueduct, a great part of which ſubſiſts and is very ſumptuous; they are about 20 in number, and form an area of 50 yards ſquare. The gate conſiſts of a beautiful reddiſh ſtone, not inferior to marble, well poliſhed and ſhining; an altar of pure white marble makes part of a neighbouring wall, and the ſide in view preſents a well ſhaped ſimpulum in a bold relief. The gate towards the S. E. reſembles the other, though ſmaller, and lies open to a bridge that was built over this part of the valley; the bridge is much extolled; the gallery and columns of the arches being adorned with cornices and feſtoons, ox-heads and garlands. The key-ſtones of the arches are charged with caducci and other figures. Below the gallery, betwixt the two principal arches, is ſeen in bold relief, well executed, the figure of a lady treading upon two elephants, with a large eſcallop ſhell for her canopy. Below the bridge the Rummel turns towards the north, and runs near a quarter of a mile through a rocky ſubterraneous paſſage, laid open in ſeveral places for the convenience of drawing up the water, and cleanſing the channel. To the S. W. of the bridge is ſeen among the ruins the greateſt part of a triumphal arch called "Coſſir Goulah," or the caſtle of the giant, conſiſting of three arches, the mouldings and frizes of which are curiouſly embelliſhed with the figures of flowers, battle-axes, and other ornaments. Under the great precipice without the precincts of the city, are ſeveral ſepulchral inſcriptions, one of which is upon a "Cippus" with the figure of a loaded beeve in baſſo relievo above it, and of a crab below it. Beeves are ſtill uſed in Numidia as beaſts of burden. The Rummel at a ſmall diſtance falls in a large caſcade from its ſubterraneous channel, and above it lies the higheſt part of the city, from whence criminals are precipitated into the river, as they uſed to be in former times.

This place was very conſiderable in the time of Syphax. Strabo ſays, that Micipſa eſtabliſhed in it a colony of Greeks; and it afterwards became ſo flouriſhing as to be able to raiſe 10,000 horſe and 20,000 foot. After the conqueſt of Numidia by the Romans, Sittius Nucerinus revolted againſt the republic, made himſelf maſter of it, and gave it his name, "Cirta Sittianorum." Upon Cæſar's carrying his arms into Africa, it revolted to the republic, which ſent a colony thither, and the city took the name of "Cirta Julia." This city having been ruined A. D. 311 by the conqueſts of the tyrant Alexander, was re eſtabliſhed by order of Conſtantine the Great, and aſſumed the name of "Conſtantina." Juſtinian repaired its fortifications. The name of Conſtantina is ſtill preſerved in the weſt; but the people of the country call it Cucuntia. Count Caylus has engraved the veſtiges of an ancient tomb which are ſtill to be ſeen near this city. Mem. de Lit. t. xxvi. p. 334.

CIRTIPUR, in *Geography*, a city of India in the kingdom of Nepal, ſeated on a hill of the ſame name, containing about 8000 houſes, about a league's diſtance from Catmandu. The inhabitants of this town vigorouſly reſiſted the repeated attacks of the king of Gorcha; but, after a ſiege of ſeveral months, the army of the enemy was treacherouſly introduced into the town; and the people, on the faith of promiſed amneſty, ſurrendered themſelves priſoners. In ſhameful violation of this promiſe, an order was iſſued to put the principal inhabitants to death, and to cut off the noſes and lips of every one, even infants, who were not found in the arms of their mothers; and it was likewiſe required that the noſes and lips which had been cut off ſhould be preſerved, for the purpoſe of aſcertaining how many ſouls they were; and that the name of the town ſhould be changed into "Naſkatapur," ſignifying "the town of cut-noſes." The order, it is ſaid, was carried into execution with every mark of horror and cruelty, none eſcaping but thoſe who could play on wind-inſtruments; although father Michael Angelo, who, without knowing that ſuch an inhuman ſcene was exhibited, had gone to the houſe of the perſon who had received the ſavage order, and interceded much in favour of the poor inhabitants. Many of them put an end to their lives in deſpair; others applied to the Roman miſſion for medicines; "and it was moſt ſhocking," ſays father Giuſeppe, prefect of the miſſion, "to ſee ſo many living people with their teeth and noſes reſembling the ſkulls of the deceaſed." Aſiatic Ref. vol. ii. p. 319.

CIS, a hill of Paleſtine, in the tribe of Juda, ſituated at the N.W. of the Dead Sea, at ſome diſtance from the mouth of the brook Cedron.

CISALPINE, any thing on this ſide the Alps.

The word is formed from the prepoſition *cis*, on this ſide, and *Alpes*; which, though properly confined to the mountains ſeparating Italy and France, yet is uſed by authors for any very high mountains.—Thus Auſonius ſpeaks of the Alps of the Pyreneans, the Alps of the Apennines, &c.

The Romans divided Gaul and the country now called Lombardy into *Ciſalpine* and *Tranſalpine*.

That which was *Ciſalpine*, with regard to the Romans, is *Tranſalpine* with regard to us. See GALLIA.

Cis-

Cisalpine, (rather *Tranſalpine*, or *Paduan*), or as it has been ſince denominated, the Italian *Republic*, in *Geography*, a new ſtate formed by the union of thoſe governments which had been denominated Ciſpadane and Tranſpadane, from their ſituation on the right and left ſides of the Po, created by the French republic in the year 1796, firmly eſtabliſhed in conſequence of the peace of Campo Formio in 1797, by the 8th article of that treaty, further re-eſtabliſhed by the 12th article of the treaty of Luneville in 1801, and acknowledged by his majeſty the emperor, the kings of Sardinia, Spain, Switzerland, the pope, &c. It comprehends by the 8th article of the treaty of Campo Formio, beſide the whole of Auſtrian Lombardy, and part of the former republic of Venice, to the eaſt and ſouth of the Legner, the Bergameſque, the Breſcian, the Cremoneſque, the Modeneſe, the principality of Maſſa and Carrara, and the three legations of Bologna, Ferrara, and Romagna. In a "Geographical and Statiſtical Account of the Ciſalpine Republic, &c." tranſlated from the German by Dr. Oppenheim, 8vo. 1798, the whole territorial dimenſions of the Ciſalpine Republic are ſtated to contain 3,567 ſquare miles, and 3,447,384 ſouls; *viz.*

	Sq. Miles.	Inhabitants.
1. The Duchy of Milan - -	811	1,116,892
2. The Duchy of Mantua 3. The principalities of Caſtiglione and Salferino - -	185	207,331
4. The acquired provinces formerly belonging to the Republic of Venice, *viz.* the Bergameſco, the Breſciano, and the territories of Verona and Rodigo, ſituated on the right bank of the Adige, the White Canal, the Tartaro, the canal Poliſella, and the Po -	463	666,000
5. The Duchy of Modena, with the principalities of Maſſa and Carrara	431	460,000
6. The lands obtained from the duke of Parma, the duchy of Guaſtillo, Sabionetta, and Bozzolla -	27	18,000
7. The three legations, Ferrara, Bologna, and Romagna, formerly Papal - - - - -	1152	775,861
8. The territories of the Griſons, belonging to Worms, Cleves, and the Valteline - -	324	100,000
9. The four (commonly called) Italian Bailiwicks - - - - -	174	103,000
Total - -	3,567	3,447,084

The conſtitution of this republic was eſtabliſhed at a conſulta, aſſembled at Lyons in January 1802, when the name of Italian republic was ſubſtituted for that of *Ciſalpine*, and the magiſtracy was veſted in Buonaparte, the firſt conſul of France, who attended on the occaſion. This conſtitution declares the catholic religion, apoſtolic and Roman, to be the religion of the ſtate; and though it has merely the name of a republic, under the deſpotic government of Buonaparte, the ſovereignty was pronounced to reſide in the whole body of the citizens. The territory of the republic is divided into diſtricts, departments, and communes. The rights of citizenſhip belong to thoſe who are born of Ciſalpine fathers, and reſide in the republic. Strangers holding landed property, or being concerned in commercial or manufacturing eſtabliſhments, and who have reſided ſeven years, may be naturalized; and alſo perſons of eminent talents, by a ſpecial act of favour.

There are three electoral colleges; the college of the poſſidenti, of the dotti, and of the commercanti. They are to meet once in two years at leaſt, on the invitation of the government, to complete their number, to appoint the members of the conſulta, of the legiſlative body, of the tribunal of reviſion and appeal, and the commiſſaries of finance. Their ſeſſion is to continue fourteen days. They are to deliberate, but not to diſcuſs. Their determinations are to be by ſecret ballot; and one-third of the members conſtitute a houſe. The members of the colleges forfeit this right, 1ſt, by bankruptcy; 2d, by abſence during three ſucceſſive ſeſſions; 3d, by accepting any employment under a foreign government; 4th, by continuing in a foreign country ſix months after being recalled.

The college of poſſidenti conſiſts of three hundred citizens, choſen from ſuch as poſſeſs an annual income, from land, of 8000 livres at leaſt. The place of its meeting, for the firſt ten years, is Milan. Every department may ſend members to this college in the proportion of one to thirty thouſand inhabitants.

The college of the dotti conſiſts of two hundred citizens choſen from amongſt the moſt eminent in the arts, ſciences, and various branches of literature. Its place of meeting, for the firſt ten years, is Bologna.

The college of commercanti conſiſts of two hundred citizens, alſo choſen (as the name imports) from among commercial men.

The cenſurati is a committee of twenty-one members nominated by the colleges, of whom ſeventeen is a quorum. Its ſitting is only for ten days.

The government reſides in the preſident, vice-preſident, a conſulta of ſtate; in the miniſters and legiſlative body. The preſident retains his office for ten years, and is re-eligible. With him all laws originate; and he has the ſole conduct of all diplomatic negociations. He is excluſively inveſted with the whole executive power. He appoints the miniſters, the civil and diplomatic agents, the chiefs of the army, &c. He nominates the vice-preſident, who is to repreſent him in his abſence. The vice-preſident, once appointed, cannot be diſmiſſed during the preſidency of him by whom he was appointed. The ſalary of the preſident is 500,000 livres of Milan, of the vice-preſident, 100,000.

The conſulta of ſtate conſiſts of eight perſons, above the age of forty, elected for life by the colleges; one of its members is to be miniſter of ſtate for foreign affairs. This conſulta is charged with every matter relative to foreign affairs. Nothing comes, however, under their deliberation except what the preſident chooſes. In caſe of a vacancy, the conſulta elects a new preſident, and cannot ſeparate till the choice is made. Their ſalaries are 30,000 livres each.

The legiſlative council cannot be compoſed of leſs than ten members, above the age of thirty. They are appointed by the preſident, and may be diſmiſſed by him at the end of three years. They have a deliberative voice on the projects propoſed by the preſident, and are ſpecially charged with drawing up the projects of laws. Their ſalary is 20,000 livres each.

The legiſlative body is compoſed of ſeventy-five members, of above thirty years of age, choſen by each department according to its population. One half is to be taken from the colleges. One third goes out every two years. The going out of the firſt and ſecond third to be determined by lot. The government convokes and prorogues the legiſlative body; but the ſeſſion cannot be leſs than two months annually. The ſalary of the members 6000 livres of Milan.

The

The tribunals, civil and military, are on the model of the French. The judges are for life.

The members of the colleges, the cenfurati, the prefident, vice-prefident, confulta of ftate, are not refponfible. The minifters are refponfible.

The freedom of religious worfhip is declared; and no impediments are admitted to induftry and commerce, but thofe founded in law. No armed body can deliberate. The purchafers of national property are protected. The church is to be maintained out of a portion of the national property. The confulta may, at the end of three years, propofe any alteration in the conftitution.

CISAMUS, or CISAMUM, in *Ancient Geography*, a town placed by Ptolemy in the northern part of the ifle of Crete, and, according to Strabo, the port of the town of Aptera. In the Notitia of Hierocles, it is an epifcopal town.

CISEAUX, or rather CISEAUX DU MINEUR, in *Military Language*, inftruments like chiffels, which miners make ufe of for loofening the earth, and trimming the fides of their excavations, and which, to avoid being heard, they ftrike with the hand.

CISERUSA, or CISSERUSSA, in *Ancient Geography*, an ifland of the Ægean fea, near that of Cnidos. Pliny.

CISIPADES, a people of Africa, who occupied the weftern fide of the Greater Syrtis, according to Pliny.

CISLEU, in *Chronology*, the ninth month in the ecclefiaftical year, and the third in the civil or political year among the Hebrews, containing 30 days: it anfwers to part of our November and December. An annual faft is obferved by the Jews to this day on the 18th of this month, in commemoration of the taking of Jerufalem by Nebuchadnezzar.

CISMAR, in *Geography*, a town of Germany, in the duchy of Holftein, not far from the Baltic; 17 miles N. of Travemunde. N. lat. 54° 14′. E. long. 11° 2′.

CISME. See CHISME.

CISMONE, a river of the country of Tyrol, which runs into the Brenta, near Kofel.

CISNER, CLAUDIUS, in *Biography*, a learned German, born in 1529. He ftudied firft at Heidelberg, and afterwards at Strafburg, where he imbibed the Lutheran tenets under Martin Bucer. At Wittemberg, he was made profeffor extraordinary of moral philofophy. He afterwards ftudied the law in different cities in France, and took the degree of doctor of laws at Pifa in 1559. He foon after returned to Heidelberg, and was nominated profeffor of the pandects, and counfellor to the elector-palatine. He died in 1583. Cifner was author of many works, but the principal was his "Opufcula Hift. et Polit. Philog. diftributa in Libros IV." This collection contains feveral curious tracts on German hiftory, together with poems, orations, and epiftles.

CISPADANA, in *Ancient Geography*, an epithet ufually annexed by the Romans to Gallia, when they wifhed to denote, in Gallia Cifalpina, that part which was fituated, with regard to Rome, on this fide of the Po, or Padus. See GALLIA.

CISPIUS, the name, according to Feftus, of one of the fix hills of Rome, which formed the Efquiline mount. Varro fays, that Cifpius had feven fummits near the temple of Juno Lucina.

CISSA, an ifland of the Adriatic, according to Pliny, and the Notitia Imperii.

CISSA, CRISSA, or CRESSA, a town in the Thracian Cherfonefus, upon the river Ægos, which no longer fubfifted in the time of Pliny.

CISSA, a river of Afia, in Pontus Cappadocia, according to Ptolemy.—Alfo, a fountain of Greece, in the Peloponnefus, placed by Paufanias near Mantinæa.

CISSÆI, a people placed by Diodorus Siculus in Media.

CISSÆRO, or CISSERON, a mountain of Paleftine.

CISSAMPELOS, in *Botany*, (κισσαμπελος, Diofc. *vine of ivy*.) Linn. Gen. 1138. Schreb. 1555. Juff. 285. (Caapeba, Plum. Gen. tab. 29. Pareire, Lam. and Poiret in Encyc.) Clafs and ord. *Dioecia monadelphia*. Nat. ord. *Sarmentaceæ*, Linn. *Menifpermæ*, Juff.

Gen. Ch. Male. *Cal.* perianth four-leaved; leaves lanceolate, obtufe, concave, fpreading, coloured. *Cor.* none. *Stam.* filaments five, united, inferted into the nectary; anthers fhort, four-lobed. *Nectary* fhorter than the calyx, membranous, entirely coloured, a little concave, wheel-fhaped, occupying the centre of the flower. Female. *Calyx* one-leafed, opening laterally in the fhape of an oval fpathe, narrowed at its bafe, inferted into the lower part of the germ. (Linnæus confiders it as a bracte.) *Cor.* one-petalled, egg-fhaped, obtufe, convex, caducous, opening laterally, half the length of the calyx, and placed in its concavity, (nectary, Linn. which he calls the lateral edge of the germ, dilated outwards.) *Pift.* germ roundifh, villous, fixed obliquely upon a fhort peduncle; ftyle upright, awl-fhaped; ftigma trifid. *Peric.* berry or drupe roundifh, a little compreffed, with one feed. *Seed* wrinkled, compreffed, hard. Poiret.

Eff. Ch. Flowers dioicous. Male. *Calyx* four-leaved. Corolla none. Stamens four, monadelphous, attached to a nectareous difc at the centre of the flower. Female. Calyx one-leafed. Stigmas three. Berry globular, with one feed.

Sp. C. *ciffampelos*, *pareira*, Linn. Sp. Pl. 1. Mart. 1. (Clematis baccifera, Sloan. Jam. i. 200. Plum. Amer. tab. 93. Convolvulus brafilianus, Rai Hift. 1331. Caapeba, Marcg. Braf. 24. Pic. Braf. 94. *β*. C. fcandens, Browne Jam. 357. Caapeba folio orbiculari umbilicato, et tomentofo, Plum. Gen. 33.) "Leaves peltate, heart-fhaped, emarginate, entire." Linn. 2. C. *caapeba*, Linn. Spec. 2. Mart. 2. (Caapeba folio orbiculari non umbilicato, Plum. Gen. 33. Ic. 6. fig. 2.) "Leaves petioled at the bafe, entire." Linn. We have followed Linnæus in keeping thefe two diftinct, efteeming the mode of the infertion of the petiole into the leaf a found fpecific character. Poiret, from a diligent comparifon of fpecimens in the herbariums of La Marck, Juflieu, and Commerfon, brought fome from the Weft, and others from the Eaft Indies, makes them one fpecies, which he calls C. *cocculus*, uniting with them under the fame trivial names, menifpermum cocculus of Linnæus and Gærtner, which produces the cocculus indicus of the fhops. See COCCULUS *indicus*. He gives the following defcription of thefe united fpecies, formed from the above-mentioned fpecimens. *Stems* woody, farmentous, cylindrical, climbing, and twining, a little ftriated, flightly villous. *Leaves* two or three inches broad, alternate, petioled, almoft orbicular, heart-fhaped, or fometimes entire at the bafe, obtufe, or flightly emarginate at their tip, mucronate, entire at the edges, green on the upper furface, cloathed underneath with more or lefs of a fhort whitifh down, foft to the touch; petioles from one to two inches long, villous, cylindrical, with a remarkable curvature near the bottom, inferted in many individuals into the leaves at a fmall diftance from the bafe, fo as to make them appear peltate or orbicular (C. pareira, Linn.), in others directly into their lower edge (C. caapeba, Linn.). Male flowers very fmall, panicled. *Panicles* lateral, fhort, peduncled, loofe, much branched, folitary or in pairs, fometimes by threes, and feldom more, fhorter than the petioles, and fituated a little above their axils; ramifications of the panicle villous, dichotomous, flender, almoft capillary, forming a kind of cyme, with very fmall, villous bractes. *Female flowers* in racemes, altogether different from the males in their mode of inflorefcence. *Racemes* elongated, narrow, foft, tomentous, pendulous, often longer than the petioles, and even than the leaves, axillary, from one to three in an axil. *Bractes* refembling the leaves, but fmaller, alternate, orbicular, mucronate, tomentous. *Flowers* very fmall, axillar, fafcicled. *Fruit* gibbous on one fide, flightly villous when young, fmooth afterwards, about the fize of a hazel nut. A native of the Eaft and Weft Indies. 3. C. *fmilacena*, Linn. Sp. 3. Mart. 3. (Smilax lenis, Catef. Car. 1. tab. 51.) "Leaves heart-fhaped, acute, angular." *Stems* flender, running up walls, and twining about pofts and trees. *Leaves* refembling thofe of common ivy. *Berries* about the fize of fmall peas, growing in clufters, red. Linnæus never faw the fructification complete. 4. C. *fruticofa*, Linn. jun. Supp. 432. Mart. 3. Thunb. "Stem erect, fhrubby; leaves egg-fhaped, petioled, entire." A native of the Cape of Good Hope. 5. C. *ovata*, Poir. 2. "Leaves egg-fhaped, obtufe, almoft entirely fmooth; racemes flender, elongated, pubefcent." *Stems* woody, cylindrical, flightly ftriated. *Branches* numerous, alternate, climbing, a little villous. *Leaves* about two inches long, from twelve to fifteen lines broad, alternate, petioled, mucronate, entire, firm, finely veined, green, fmooth, and a little fhining above, with a few fhort hairs along the nerves underneath; petioles about an inch long, flender, cylindrical, villous towards their upper extremity. *Flowers* fmall; racemes fimple, lateral, folitary or in pairs, fituated a little above the axils of the leaves; bractes villous, very narrow, almoft awl-fhaped, very fhort, alternate. *Fruit* a dry berry or drupe, kidney-fhaped, orbicular, fmooth, flightly compreffed at the fides, about the fize of a lentil. A native of the Eaft Indies; obferved by Sonnerat, who fent fpecimens to La Marck. 6. C. *laurifolia*, Lam. 3. "Leaves coriaceous, ovate-oblong, quite fmooth; fruit very large." *Stems* farmentous, fhrubby, fmooth, ftriated, yellowifh. *Branches* pendulous. *Leaves* alternate, petioled, quite entire at their edges, with a ftrong longitudinal nerve underneath, narrowed, and obtufe at their fummit, rounded at the bafe; petiole fhort, thick. *Flowers* of the female in fhort, axillary racemes. *Fruit* oval, much wrinkled, pulpy, dark brown when ripe. A native of America. Specimen fent to La Marck from the ifland of St. Thomas by Richards. 7. C. *capenfis*, Poir. 4. (C. apenfis, Linn. jun. ?) "Leaves ovate-acute, flightly obtufe, fmooth; petioles much fhorter than the leaf." *Stems* woody, greyifh. *Branches* flender, climbing. *Leaves* alternate, petioled, elongated into a weak point, mucronate, entire, green, reticulated, thickifh; petioles from two to four lines long. *Flowers* panicled, about the fize of a pin's head, nearly fpherical, clothed with a cottony down; panicles fmall, axillary, tomentous, whitifh, much branched, a little longer than the petioles. A native of the Cape of Good Hope. Specimen fent to La Marck by Bergius. 8. C. *humilis*, Poir. 5. "Leaves fomewhat heart-fhaped; the younger ones femi-orbicular; axils woolly; ftem low, fhrubby." *Stems* not more than from eight to ten inches high, flender, cylindrical, ftriated, branched. *Leaves* alternate, petioled, obtufe, mucronate, fmooth; petiole flender, fcarcely half the length of the leaves. *Flowers* whitifh, in fmall, tomentous, fafcicles. A native of the Cape of Good Hope; obferved by Sonnerat, who fent fpecimens to La Marck.

Poiret obferves, that though the fpecies of Ciffampelos are eafily diftinguifhed from thofe of menifpermum by the fructification, yet as both genera refemble each other in habit, and as the flowers of each are fo fmall that they cannot be eafily diffected in a dried fpecimen, it is poffible that fome fpecies of Menifpermum may have been referred to Ciffampelos, and *vice verfâ*.

CISSE, in *Ancient Geography*, a town of Africa, in Mauritania Cæfarienfis, according to Ptolemy. The Itinerary of Antonine calls it *Cifi*, and makes it a Municipium; about 12 miles from Rufucurrium. It was epifcopal.

CISSENE, a mountain of Thrace.

CISSIA, a country of Afia, whofe capital was Sufa, marked by Philoftratus at one journey from Babylon. Sufiana formed a part of Ciffia, and it is now called Chofiftan, or Khofiftan, which fee. The inhabitants were called Ciffii.

CISSII *Montes*, mountains of Afiatic Sarmatia, where was the fource of the river Imitys.

CISSINE, a town of Thrace, in the vicinity of the mountain *Ciffene*.

CISSINUS, a town of Afia in Perfia, mentioned by Æfchylus, and placed by Ortelius in the country called *Ciffia*.

CISSITES, in *Natural Hiftory*, a name given by the ancients to that fpecies of the flinty *ætites*, or eagle-ftone, which is covered with the common white coat of the flints. Pliny mentions it as found principally about Captos, and being externally of a white colour, and rattling when fhaken.

CISSOID, in *Geometry*, a curve of the fecond order, firft invented by Diocles; whence it is peculiarly called the ciffoid of Diocles.

The genefis of the ciffoid may be thus conceived: to the diameter A B (*Plate Analyfis, fig.* 1.) of the femicircle A O B, draw an indefinite line, at right angles, B C: then, draw the right line A H, and make $AM = IH$, or $HM = AI$; and in the other quadrant, $LC = AN$, or $CN = AL$. Thus will the points M and L be in a curve line, A M O L; which is the ciffoid of Diocles.

If the circle were completed, with the fame conftruction in the other femicircle, we fhould have another part of the curve A *m o l*. Sir Ifaac Newton refers this curve to the clafs of defective hyperbolas, being the 42d fpecies in his "Enumeratio Linearum tertii Ordinis." And in his appendix "De Equationum Conftructione Lineari," at the clofe of his "Arithmetica Univerfalis," he gives another elegant method of defcribing this curve, by the continual motion of a fquare ruler.

Properties of the CISSOID.—From the genefis it follows:

1. That the curve has two infinite legs, A M O L, A *m o l*, meeting in a cufp A, and tending continually towards the indefinite line C B D, which is their common afymptote.

2. That drawing the right lines P M and K I, perpendicular to A B; we fhall have $AP : KB :: AM : IH$. But $AM = IH$; confequently, $AP = KB$. And therefore $AK = PB$; and $PN = IK$.

3. After the fame manner, it appears that the ciffoid A M O bifects the femicircle A O B.

4. Again, $AK : KI :: KI : KB$ from the nature of the circle. That is, $AK : PN :: PN : AP$. And again, $AK : PN\ (KI) :: AP : PM$, by the property of fimilar triangles A K I, A P M; therefore, $PN : AP :: AP : PM$. Confequently, A K, P N, A P, and P M, are four lines in continual proportion. And if $PN = v$, $AP = x$, $PM = y$; $x^2 = vy$. And after the fame manner it may be fhewn, that A P, P N, A K, and K L, are in continual proportion. Or, if the diameter A B be $= a$, the abfcifs $AP = x$, and P M the ordinate $= y$, as before;

fore; we fhall have x (A P) : $a - x$ (P B) :: $y^2 : x^2$, or $x^3 = \overline{a - x} \times y^2$; which is the equation of the curve.

5. Hence, in the ciffoid, the cube of the abfcifs A P is equal to a folid arifing from the fquare of the femiordinate P M, multiplied into the complement of the diameter of the generating circle P B. Confequently, when the point P falls on B, then $x = a$, and B C $= y$; and $y^2 = \frac{a^3}{o}$. Wherefore, o : 1 :: $a^3 : y^2$; that is the value of y becomes infinite; and, therefore, the ciffoid A M O L, though it continually approach B C, will never meet it.

6. Whence it appears, that B C is an afymptote of the ciffoid.

7. The whole infinitely long ciffoidal fpace, contained betweeen the infinite afymptote B C D, and the curves L O A o l, &c. of the ciffoid, is equal to triple the generating circle A O B o A.

The ancients made ufe both of the conchoid and ciffoid, for the finding of two mean continual proportionals between two given right lines.

Sir Ifaac Newton, in his laft letter to M. Leibnitz, has fhewn how to find a right line equal to one of the legs of this curve, by means of the hyperbola; but the inveftigation which he there fuppreffed, may be found in his Fluxions. See more on this curve in Wallis's Works, vol. i. p. 545.

For the quadrature, fubnormal, and fubtangent of the ciffoid, fee QUADRATURE, SUBTANGENT, &c.

CISSOID *angle*. See ANGLE.

CISSUS, in *Botany*, Diofc. from Κισσος, ivy. Linn. Gen. 147. Schreb. 192. Juff. 267. Vent. 3. p. 168. Lam. Ill. 228. Achit. Lam. Encyc. Clafs and order, *tetrandria monogynia*. Nat. Ord. *Hederaceæ*, Linn. *Vites*, Juff.

Gen. Ch. *Cal.* Perianth one-leafed, fhort, almoft entire, or obfcurely four-toothed. *Cor.* Petals four, ovate-oblong, fomewhat concave, a little fpreading; nectary, a rim furrounding the germ. *Stam.* Filaments four, the length of the corolla, inferted into the nectary; anthers roundifh. *Pift.* Germ fuperior, roundifh, retufe; ftyle the length of the ftamens; ftigma fimple, acute. *Peric.* Berry round or didymous, retufe, fhining, furrounded at the bafe by the calyx. *Seeds,* one or two (rarely three or four), boney, roundifh, fomewhat angular.

Eff. Ch. Calyx nearly entire. Petals four. Berry one or two-feeded, furrounded at the bafe by the calyx.

* *Leaves fimple.*

1. C. *vitiginea*, Linn. 1. Mart. 1. Lam. Encyc. 1. Ill. 1612. Willd. 1. (Arbufcula baccifera; Pluk. Mart. 27. tab. 337. fig. 2.) "Leaves heart-fhaped, with about five lobes, tomentous," Linn. "Leaves heart-fhaped, repand-toothed, villous underneath," Lam. A fhrub, with the habit of a vine. *Stem* farmentous. *Branches* thinly covered with a fhort down. *Leaves* two inches long, alternate, petioled. *Flowers* in compound umbels, one oppofite to each leaf, longer than the petioles, very fmall, numerous, cottony on the outfide; peduncles of the univerfal and partial umbels, unequal in length. *Berries* bluifh, pear-fhaped, about the fize of a pea. A native of the Eaft Indies, introduced into England about 1772. 2. C. *tomentofa*, Lam. Ill. 1613. (C. capenfis, Willd. 2. Vitis capenfis, Thunb. 2.) "Leaves generally pentagonal, obtufely-toothed, clothed underneath with a ferruginous down." *Root* perennial. *Leaves* fomewhat truncated at the bafe. A native of the Ifle of Bourbon. 3. C. *angulata*, Lam. Ill. 1614. "Leaves generally pentagonal, angularly lobed, cornulate, tomentous underneath." A native of the Eaft Indies. 4. C. *rotundifolia*, Mart. 5. Lam. Ill. 1615. (Sælanthus rotundifolius, Forfk. Ægypt. tab. 4.) "Leaves cordate-roundifh, toothed, fmooth." *Flowers* numerous, in oppofite racemed umbels, about four on each common peduncle and fimple; peduncles nearly the length of the leaves. A native of Arabia. 5. C. *cordifolia*, Linn. Sp. Pl. 2. Mart. 4. Lam. Encyc. 2. Ill. 1616. Willd. 5. Burm. Amer. tab. 259. fig. 3. (Vitis, Plum. gen. 18. Icon. 269. fig. 3.) "Leaves heart-fhaped, quite entire," Linn. *Root* perennial. *Stems* farmentous, woody, clothed with a fhort down, efpecially the younger branches. *Leaves* terminated by a fhort point, almoft entire, flightly angular, fmooth above, a little cottony underneath, particularly on the nerves. *Flowers* in compound corymbs, oppofite to the leaves. *Berries* bluifh, fmall, almoft pear-fhaped, with a point at the fummit, one-feeded. A native of South America. 6. C. *ficyoides*, Linn. Sp. Pl. 3. Mart. 6. Lam. Ill. 1617. Pl. 84. fig. 1. Willd. 7. (C. latifolia β Lam. Encyc. 3. Vitis, Plum. Ic. 259. fig. 2. Bryonia; Sloan. Jam. 106. hift. tab. 144. fig. 1.) "Leaves egg-fhaped, naked, fetaceous-ferrated," Linn. "Leaves heart-fhaped, ferrated, fmooth and even on both fides, edged with mucronate teeth," Lam. *Root* perennial. *Stem* fomewhat woody, herbaceous at the top, climbing, branched, marked with red fpots. *Leaves* petioled, alternate, nerved, fomewhat fucculent. *Flowers* yellow; petals broader at the bafe, egg-fhaped, reflexed, deciduous; anthers orange. *Berry* oblong, black. A native of Jamaica, cultivated by Miller before 1768. The berries are fometimes eaten by the negroes and natives. 7. C. *latifolia*, Lam. Encyc. 3. Ill. 1618. Willd. 4. (Funis crepitans major; Rumph. Amb. 5. tab. 164. fig. 1. Schunambu Valli; Rheed. Mal. 7. tab. 11.) "Leaves cordate-ovate, villous, acuminate, fetaceous-ferrated; branches tetragonal." *Stems* woody, knotty, farmentous, climbing up the neighbouring trees. *Leaves* large, at leaft five inches broad, fometimes a little three-lobed; petioles near three inches long; tendrils large, oppofite to the leaves. *Flowers*, according to Rheede, fmall, whitifh; ftamens none; ftyle one. Hence La Marck conjectures this fpecies to be monoicous. *Berries* black, fmooth and fhining, fucculent. A native of woods in the Eaft Indies and ifland of Madagafcar. 8. C. *repanaa*, Willd. 3. Vahl. Symb. 3. p. 18. "Leaves heart-fhaped, entire, fometimes a little lobed, repand, fmooth on both fides." *Root* perennial. *Stem* cylindrical, zig-zag, jointed, tomentous when young, afterwards fmooth. *Leaves* petioled, fometimes terminated with a fhort obtufe point; ftipules egg-fhaped, membranous, acute, oppofite, deciduous. *Flowers* in a dichotomoufly branched umbel of three rays, oppofite to the leaves. *Berries* pear-fhaped, the fize of a pea, mucronate with the permanent ftyle. A native of the Eaft Indies. 9. C. *ovata*, Lam. Illuft. 1619. Brown. tab. 4. fig. 1, 2. "Leaves egg-fhaped, acuminate, fparingly toothed, fmooth and even on both fides." A native of Guadaloupe. 10. C. *canefcens*, Lam. Ill. 1620. "*Leaves* ovate-oblong, oblique, finely toothed, fomewhat tomentous, grayifh." Refembling the preceding in the form of its leaves. A native of Peru, obferved by Dombey. 11. C. *umbellata*, Mart. 15. Lour. Cochin. 84. "Leaves egg-fhaped, quite entire; flowers in umbels." *Stem* fhrubby, twining, long, branched. *Leaves* oppofite, fmooth. *Flowers* white, in compound terminal umbels; corolla bell-fhaped, woolly within; calyx truncated. A native of China about Canton. 12. C. *quadrangularis*, Linn. Mant. 39. Mart. 7. Lam. Encyc. 4. Ill. 1621. Willd. 8. (Funis quadrangularis, Rump. Amb. 5. tab. 44. fig. 2. Planta baccifera fcandens, Pluk. Phyt. 310. fig. 6. Sælanthus quadrangularis, Forfk. Defc. 33. Icon. tab. 2.) "Leaves toothed,

 flefhy,

fleshy, serrate-toothed; stem tetragonous, somewhat swell[illegible].” Linn. “Leaves somewhat deltoid, serrate-toothed, naked; stem tetragonous, jointed, fleshy.” Lam. *Root* perennial, tuberous. *Stem* very long, climbing, thickened, contracted, smooth and even, perennial. *Leaves* alternate, petioled, smooth on both sides, acutely and remotely serrated; petioles cylindrical; tendrils opposite to the leaves. A native of Arabia and the East Indies; found also by Loureiro near Mosambique in Africa. The inhabitants of Bengal, and of the coast of Coromandel, eat the branches stripped of their bark, and boiled or macerated in water.

* *Leaves compound.*

13. C. *acida*, Linn. Sp. Pl. 4. Mart. 8. Lam. Encyc. 5. Ill. 1622. Willd. 9. (Sicyos trifoliata, Linn Sp. Pl. ed. 1. Irsiola, Brown. Jam. 147. Bryonia, Sloan. Jam. 106. hist. 1. tab. 142. fig. 6. Bryonioides, Pluk. Alm. 71. tab. 152. fig. 2. Vitis, Plum. Sp. 18. tab. 259. fig. 5.) “Leaves ternate, inversely egg-shaped, smooth, fleshy.” Linn. *Stem* from three to five feet high, woody, and much [illegible], climbing; branches slender; tendrils simple. *Leaves* [illegible], of a fine green colour, small; leaflets oval-wedge-shaped. *Flowers* in umbels, small, herbaceous, L[illegible]. A native of Jamaica, in woods near the coast. The whole of the plant is acid. 14. C. *trifoliata*, Linn. Sp. Pl. 5. Mart. 9. Willd. 11. (C. alata, Lam. Enc. 5. Ill. 1623. Jacq. Amer. tab. 182. fig. 10. Irsiola triphylla scandens, Brown. Jam. 147. Bryonia, Sloan. Jam. 106. hist. 1. tab. 144. fig. 2.) “Leaves ternate, serrated; branches membranous-angular.” *Stem* somewhat shrubby, climbing, with five or six angles, rooting, branched, green; angles slightly winged. *Branches* herbaceous, lax. *Leaves* on long pentangular petioles; leaflets on short peduncles, egg-shaped, acute; the lateral ones oblique, serrated, nerved, smooth on both sides (tomentous underneath, Lam.) stipules at the base of the petioles roundish. *Flowers* in four-cleft umbels, blood red, small. *Berry* roundish, black, one-seeded. A native of Jamaica, where it climbs high above the branches of the trees upon the mountains. C. 15. C. *obtusifolia*, Lam. Encyc. 7. Ill. 1625. “Leaves ternate; leaflets inversely egg-shaped, obtuse, toothed, pubescent.” Nearly allied to the preceding, and perhaps only a variety. A native of the East Indies, observed by Sonnerat. 16. C. *cinerea*, Lam. Ill. 1624. “Leaves ternate; leaflets pubescent, toothed, lateral ones somewhat heart-shaped; petioles cylindrical. Perfectly distinct from the preceding. A native of the East Indies. Sonnerat. 17. C. *cirrhosa*, Willd. 10. (Vitis cirrhosa, Thunb.) “Leaves ternate, villous; leaflets egg-shaped, serrated.” A native of the Cape of Good Hope. 18. C. *carnosa*, Lam. Encyc. 11. Ill. 1626. Willd. 14. (Tsjori-valli, Rheed. Mal. 7. tab. 9.) “Leaves ternate, egg-shaped, obtuse, serrated, smooth; branches and petioles cylindrical.” Vahl. “Leaves ternate; leaflets ovate-acute, serrated, naked; root thick.” Lam. Whole plant smooth. *Branches* striated, cylindrical. *Leaves* petioled; leaflets petioled, fleshy; lateral ones smaller, an inch long; common petiole the length of the leaves. *Flowers* small, reddish brown, umbelled; universal umbel with three rays; partial one with dichotomous divaricating branches; general peduncle longer than the leaf. *Berries* blackish, a little flattened above, with three or four seeds. A native of the East Indies. 18. C. *microcarpa*, Willd. 12. (Vitis, Plum. Ic. tab. 259. fig. 4.) “Leaves ternate, oblong, serrated, smooth, membranous.” *Branches* angular, but winged with a decurrent membrane as in C. trifoliata. A native of the West Indies. 19. C. *crenata*, Mart. 10. Willd. 13. (Vitis trifolia, Linn. Sp. Pl. Folium caussonis, Rumph. Amb. 5. tab. 166. fig. 2.) “Leaves ternate; leaflets roundish, crenate.” *Branches*, petioles, younger leaves and peduncles villous. *Tendrils* opposite to the leaves, compound. *Leaves* petioled; leaflets petioled, an inch long; lateral ones smaller and narrower on one side; the crenatures remote and mucronate; stipules small, oblong, obtuse. *Flowers* in dichotomous cymes; peduncles longer than the leaf and opposite to it; calyx minute; petals arched; filaments shorter than the corolla. A native of the East Indies. 20 C. *obovata*, Mart. 12. Willd. 15. Vahl. Symb. 3. p. 19. “Leaves ternate; leaflets inversely egg-shaped, quite entire, smooth.” *Stem* climbing, smooth. *Tendrils* opposite to the leaves, and of the same length, bifid. *Leaves* petioled, alternate; leaflets mucronate, membranous; lateral ones smaller and sessile; middle one petioled, three times the size of the others. *Peduncles* axillary, solitary, longer than the leaves, smooth, trichotomous; branchlets three-flowered, flowers pedicelled. Vahl. A native of the island of St. Crux and other parts of the West Indies. 21. C. *digitata*, Lam. Ill. 1627. (Sælanthus digitatus, Forsk. Ægyp. tab. 3.) “Leaves fingered, egg-shaped, serrated; lower ones with five leaflets, upper ones with three.” A native of Arabia. 22. C. *pentaphylla*, Willd. 17. (Vitis pentaphylla, Thunb. Jap. 105.) “Leaves quinate; leaflets undivided, serrated.” *Stem* herbaceous, filiform, climbing, furrowed, smooth. *Leaves* alternate, petioled; leaflets egg-shaped, attenuated at the base, acuminate, thin, smooth; lateral ones less, about an inch long. *Flowers* very small, remote, in axillary racemes longer than the leaf; petioles two inches long. Thunb. A native of Japan. 23. C. *heptaphylla*, Mart. 14. Retz. Obs. 5. tab. 52. “Leaves with seven leaflets, serrated, hispid.” A sarmentous, climbing shrub. *Branches* pubescent. *Tendrils* opposite to the leaves, bifid. *Leaves* alternate, petioled; leaflets ovate-lanceolate, acuminate. *Flowers* small, panicled; panicles fastigiate, brachiate, peduncled, opposite to the leaves. Sent by Koenig from Calcutta. 24. C. *pedata*, Mart. 13. Lam. Enc. 10. Ill. 1628. Willd. 18. (Belutta-tsjori-villi, Reed. Mal. 7. tab. 10.) “Leaves pedate, with nine leaflets; leaflets ovate-lanceolate, somewhat toothed, pubescent underneath.” *Stems* cylindrical, villous. *Tendrils* opposite to the leaves, bifid. *Leaves* alternate, on petioles three inches long; leaflets from five to nine; leaflets petioled, green above, pubescent underneath, cottony on the nerves and petioles. *Flowers* in axillary dichotomous cymes, small, pubescent on the outside. *Berries* whitish, round, a little flattened at the top, ending in a small point. *Seeds* from one to four. A native of the East Indies. 25. C. *japonica*, Willd. 16. (Vitis japonica, Thunb. Jap. 104.) “Leaves pinnate, somewhat pedate, smooth; leaflets crenate, crenatures awned.” A native of Japan. 26. C. *orientalis*, Lam. Ill. 1629. Pl. 84. fig. 2. “Leaves somewhat bipinnate; leaflets egg-shaped, serrated; stem rather shrubby.” The habit of vitis arborea, but larger, the leaves less compound, and the leaflets larger. A native of the East. 27. C. *connivens*, Lam. Ill. 1630. “Leaves somewhat bipinnate; leaflets egg-shaped, rather obtuse, somewhat toothed; petals connivent.” Allied to the preceding, but distinct. Observed by Commerson in the island of Madagascar. 28. C. *mappia*, Lam. Ill. 1631. “Leaves somewhat bipinnate, smooth and even; leaflets egg-shaped, quite entire.” Observed by Commerson in the Isle of France.

Obs. The cissus arborea of Forskal is salvadora persica. Dryander in Linn. Trans. vol. ii. p. 220.

Cissus, in *Ancient Geography*, a mountain of Macedonia. —Also a town of Thrace. The town and mountain are situated,

tuated, according to Ortelius, toward the ſea, near Theſſalonica.

CISSUSA, a fountain of Greece in Bœotia, placed by Plutarch between the town of Thebes and that of Haliartes.

CISSYBIUM, in *Antiquity*, a drinking cup, moſt in uſe among country people. It was ſo called, either becauſe it was made of the wood of ivy, or was uſually crowned with its leaves.

CISTATOME, in *Surgery*, more properly written cyſtatome, from κυςις, *the bladder*, and τέμνω, *to cut*. See CYSTATOME.

CISTERCIANS, in *Eccleſiaſtical Hiſtory*, an order of religious reformed from the Benedictines, which formerly took its riſe from twenty-one zealous monks in the monaſtery of Moleſme, in Burgundy; who, with their abbot Robert, complaining that the rule of St. Benedict was not ſtrictly enough obſerved, obtained permiſſion of Hugh archbiſhop of Lyons, and legate of the holy ſee, to ſettle in a place called Ciſteaux, in the dioceſe of Chalons, five miles from Dijon.

In this retreat, which at that time was a miſerable deſert, covered with brambles and thorns, Eudes duke of Burgundy erected for them a houſe, into which they were admitted in 1098; endowing it with a conſiderable revenue. The biſhop of Chalons gave Robert the paſtoral ſtaff, in quality of abbot, and erected the new monaſtery into an abbey. This order made a moſt rapid and aſtoniſhing progreſs; it was propagated through the greateſt part of Europe in the following century, and was not only enriched with the moſt liberal and ſplendid donations, but alſo acquired the form and privileges of a ſpiritual republic, and exerciſed a ſort of dominion over all the monaſtic orders. In about 100 years after its firſt eſtabliſhment it boaſted of 1800 abbies, and was become ſo powerful, that it governed almoſt all Europe, both in ſpirituals and temporals. Within this period after their firſt riſe, the monks of this order were diſtinguiſhed by the patronage of St. Bernard, abbot of Clairval, whence they obtained the title of "Bernardin monks;" and, in the year 1132, they were exempted from the payment of tythes, and inveſted with other privileges and immunities by Innocent II. In 1152 this order had no fewer than 500 convents, all dedicated to the Bleſſed Virgin. They came into England in the year 1128, and had their firſt houſe at Waverley in Surry. Before their diſſolution they had eighty-five houſes here.

CISTERN, is properly uſed for a ſubterraneous reſervoir of rain-water.

The word, according to ſome, comes from *cis*, and *terram*; i. e. *in terram*; others derive it from *ciſta*, a *duct*, &c.

Earthen ciſterns muſt be made with good cement, to retain the water. And the bottom ſhould be covered with ſand to ſweeten and preſerve it.

Authors mention a ciſtern at Conſtantinople, the vaults whereof are ſupported by two rows of pillars, 212 in each row; each pillar being two feet in diameter. They are planted circularly, and in radii tending to that in the centre.

Anciently there were ciſterns all over the country in Paleſtine. There were ſome likewiſe in cities and private houſes. As the cities for the moſt part were built on mountains, and the rains fell regularly in Judea at two ſeaſons of the year only, in ſpring and autumn, people were obliged to keep water in ciſterns in the country, for the uſe of their cattle; and in cities for the conveniency of the inhabitants. There are ciſterns of very large dimenſions to be ſeen at this day in Paleſtine, ſome of which are a hundred and fifty paces long, and fifty-four wide. There is one to be ſeen at Ramah of two and thirty paces in length, and eight and twenty in width. Wells and ciſterns, fountains and ſprings, are generally confounded in the ſcripture language.

If the farmers of England would fall into the method uſed in Spain, and at Amſterdam, Venice, and other places, for ſaving the rain-water for the whole year, or at leaſt ſo much of it as would be neceſſary, in ciſterns, they would have always water for their cattle in the ſummer droughts, and many thouſand acres of land, now left uſeleſs, might be turned to profit.

The beſt way of preſerving the water for the ſervice of the houſe, is in ciſterns in the cellars. Theſe may be made with brick or ſtone, joined with plaiſter of Paris, which will keep out the wet very well; or with a kind of mortar made of ſlacked ſifted lime, with linſeed oil, and tow or cotton. A bed of good ſound clay may be laid at the bottom, and on this the bricks for the floor, and then the walls may be raiſed in the ſame manner, only leaving ſpaces behind them, into which clay is to be rammed in the like manner. Thus it will be a clay ciſtern, faced with brick; and the bricks will keep the clay moiſt, and prevent it from cracking, though it be not full of water. This will do in any ſhadowy place, as well as in cellars; and thus may a ciſtern be made in a garden, in ſome ſhadowy place, and covered over, which may receive the water running from the walks, and will retain it at hand, for the ſervice of the garden, all the year.

Where there is want of water for the cattle in the fields, the way is to dig a pond in ſome place into which there is a deſcent; then cover the bottom and ſides with a double coat of tough clay, each ſix inches thick, and each very well rammed; then to cover the bottom with large ſtones, which will keep the clay moiſt, and prevent its cracking, when not covered with water. But this is a troubleſome thing; for if there happen to be a crack in any part, it is often found neceſſary to go over the whole work again, before the pond will hold a drop of water.

Another method of making a pond hold water, is to daub it over with clay and mortar mixed together, and then with mortar alone. This has an advantage over the other way, becauſe if any crack happen, it may be mended by a cement of clean hair and tallow, mixed with ſlacked lime and the yolks of eggs, well beat together. This applied to the crack, will cloſe it ſafely, without neceſſity of undoing the whole work, as in the other caſe.

In chalky countries it is common to find a low place on the downs, and, digging a hole by way of a pit there, they cover the bottom evenly with the chalk rubbiſh, and when it is wetted by the rain, they ram it well, and afterwards drive cattle into it, and fold ſheep in it; the conſequence of all ſuch trampling is, that the bottom at length becomes ſo firm, that it holds the water perfectly well. By one or other of theſe means, ciſterns or reſervoirs may be made in every part of the country; and our farmers, if they would carefully try one or the other of them, as their land moſt required, would not have ſo much to complain of from droughts.

Ciſterns are often of the greateſt advantage in a place of war, by holding large quantities of rain-water for the uſe of the garriſon and inhabitants, when their wells or fountains fail through the drought, or the courſes of their ordinary ſupplies of water are diverted by an enemy.

CISTERN-*lock*, the ſame with chamber or pound-lock, a modern contrivance for raiſing or letting down boats from one canal to another, on a different level. See CANAL and LOCK.

CISTERNA, in *Geography*, a town of Piedmont; 12 miles E.S.E. of Turin.

CISTERNA,

[illegible], a town of Naples, in the province of [illegible] S. E. of Monte Angelo.

[illegible], a town of Naples, in the province of [illegible] S.E. of Monopoli.

Cisthena, in *Ancient Geography*, a town of Asia situated in the Adramyttian gulf, in Mysia, according to Pliny. Strabo speaks of it as a town that had been abandoned though it had a port, and he places it out of the gulf on the promontory of Pyrrha. Mela, as well as Pliny, places it in the gulf.

CISTHENE, a small island of Asia Minor, with a town of the same name, situated on the coast of Lycia, according to Strabo and Isocrates.

Cist-*Hepatic*. See Cyst-*Hepatic*.

Cisti, in *Botany*, (Cistoidæ; Vent.) one of the natural orders of Jussieu, with the following characters: *Calyx* five-parted. *Petals* five. *Stamens* numerous. *Germ* simple. *Style* one. *Stigma* one. *Capsule* many-seeded, either one-celled and three valved, or many-celled and many-valved; valves bearing the seeds in the middle; receptacle either septiform separating the cells, or linear and not prominent. *Seeds* numerous, small. *Stem* shrubby, or somewhat shrubby, or herbaceous. *Leaves* generally opposite, with or without stipules. *Flowers*, in spikes or umbellar corymbs. *Perisperm* fleshy. *Embryo* spiral, or else the radicle simply curved upon the lobes. He includes under it the following genera; *Cistus*, *Helianthemum*, both belonging to the cistus of Linnæus, *Viola*, *Pirequeta*, *Piparea*, and *Tachibota*, but observes that the last four are only allied to the cisti, differing from them in having a determinate number of stamens.

Ventenat has also the first three species, omitting, as usual, the genera taken up by Jussieu, with their barbarous names, and not very decided generic characters; but observes that they and Viola will probably form a new natural order, intermediate between the cisti and rutaceæ, differing from the former, and approaching some species of the latter in the determined number of their stamens, their sometimes three-celled fruit, and their uncurved embryo.

CISTIS. See Cystis, and Hypo-cistis.

CISTOCELE. See Cystocele.

CISTOIDES, in *Botany*. See Maternia.

CISTOPHORA, ancient silver coins, concerning the origin and date of which antiquarians have been much divided in opinion. M. Leblond, in a late "History of Ephesus," has assigned these circumstances with a great degree of probability. Among these coins which were struck in six towns of Asia, those of Ephesus are distinguished by numeral letters on the face, which are dates of years; these were struck upon the arrival of every new Roman proconsul in Asia; and this was a right peculiar to the Ephesians, on which they highly valued themselves.

CISTOTOMY. See Cystotomy.

CISTIC. See Cystic.

CISTRUM. See Sistrum.

CISTULA Catoptric. See Catoptric.

CISTUS, in *Botany*, (Κιστος, Gr.; derivation uncertain), Linn. Gen. 673. Schreb. 913. Gært. 483. Jussieu, 294. Tourn. cl. 6. s. 4. gen. 10. Helianthemum, Tourn. Juss. 294. Gært. 484. Vent. vol. iii. p. 220. Class and order, *polyandria monogynia*. Nat. ord. *Rutaceæ*, Linn. *Cisti*, Juss.

Gen. Ch. *Cal.* either three or five-leaved; leaves roundish, concave. *Cor.* Petals five, roundish, flat, spreading. *Stam.* Filaments numerous, capillary, shorter than the corolla; anthers roundish, small. *Pist.* Germ superior, roundish; style simple, the length of the stamens; stigma flat, orbiculate. *Peric.* Capsule roundish, surrounded by the calyx; three, five or ten-valved; one, three, five, or ten-celled. *Seeds* small, numerous.

Eff. Ch. Calyx three or five-leaved; leaves unequal. Capsule superior, angular, many-seeded.

Obs. The cistus and helianthemum of Tournefort, Jussieu, Ventenat, and Gærtner, certainly form one natural genus, as Linnæus has made them; but they may advantageously be separated in two grand divisions, as La Marck has distributed them. The cistus of Tournefort, &c. has a many-celled capsule, with as many valves as there are cells, and seeds affixed to the axis, and a spiral embryo. These are either shrubs or undershrubs; the leaves opposite and without stipules; flowers in umbels, with very unequal calyx-leaves, either purple or white, commonly large and specious. Helianthemum has a one-celled, three-valved capsule, with seeds fixed to the valves, and a curved embryo. They are shrubs, undershrubs, or herbaceous, their leaves opposite or rarely alternate, either with or without stipules; their flowers in terminal spikes or racemes, most frequently yellow, smaller than those of Tournefort's cistus, but very deciduous in both.

* *Cisti*, Tournefort.

Without stipules.

Capsule five or ten celled, with the same number of valves.

1. C. *capensis*, Linn. Sp. Pl. 1. Mart. 1. Willd. 1. Vahl. Sym. 3. p. 68. "Arborescent; leaves ovate-lanceolate, petioled, three-nerved, finely toothed, naked on both sides." *Branches* cylindrical, with a few scattered hairs, purplish. *Leaves* three inches long, remote, ciliated with long hairs; upper ones sessile, not connate at the base; lower ones attenuated at the base into a very short petiole, acute, with about three nerves, which become evanescent towards the middle of the leaf. *Flowers* yellow; peduncles terminal, trifid; partial ones three-flowered; calyx-leaves heart-shaped, acuminate, hairy, finely toothed, ciliated, very hairy when young. Vahl. A native of the Cape of Good Hope. La Marck has not taken up this species, and Ventenat doubts whether its existence has been sufficiently ascertained; but Vahl's description here given will, we presume, establish its right to "a local habitation and a name." It is distinguished by its leaves being finely toothed. 2. C. *villosus*, Mart. 2. Lam. 1. Willd. 2. (C. pilosus, Linn. Sp. Pl. 2. C. mas folio rotundo hirsutissimo, Bauh. Pin. 464. Tourn. 259.) "Arborescent; leaves egg-shaped, petioled, hairy." Linn. *Stem* woody, much branched, forming a large, bushy head, three or four feet high. *Branches* cylindrical; the smaller ones villous, a little cottony and whitish. *Leaves* slightly wrinkled, of a cinereous green colour above and underneath, narrowed into a petiole towards their base. *Flowers* of a fine red colour, near an inch and half in diameter; peduncles an inch long or more, one-flowered. A native of Spain and Italy. 3. C. *creticus*, Linn. 9. Mart. 9. Lam. 2. Willd. 13. (C. ledon cretense, Bauh. Pin. 467, but not all the synonyms. C. ladanifera cretica, Tourn. Cor. 19.) "Arborescent; leaves spatulate-ovate, petioled, nerveless, scabrous; calyx-leaves lanceolate." Linn. "Shrubby; leaves spatulate-ovate, petioled, wrinkled, hairy, undulated at the edges; peduncles short, one-flowered; calyx-leaves mucronate, villous." Lam. *Root* hard, woody, white within, reddish without, with long hairy fibres. *Stems* commonly several, a foot and half high or more, sometimes an inch thick, brown or greyish, cracked. *Branches* reddish-brown; young shoots villous, whitish-green. *Leaves* deep green, opposite, thickish, narrowed into a petiole at their base, an inch or more long, eight or nine lines long; petioles three or four lines long, very villous. *Flowers* rose-purple,

purple, with a yellow claw, terminal, on short peduncles; calyx five-leaved; petals five, roundish, thin, rumpled. *Capsule* egg shaped, obtuse, about five lines long, hard, brown, surrounded with the leaves of the calyx, five-celled. *Seeds* red, angular. A native of the Levant; found by Tournefort in the isle of Candy or Crete. It is from this shrub that the officinal drug, ladanum, or, as it is sometimes spelt, labdanum, is obtained; a resinous substance secreted from the leaves and branches of the plant. Three sorts have been described by authors, but only two are now to be met with in the shops. The best and rarest is in dark-coloured masses, of the consistence of a soft plaster, and growing still softer on being handled. The other is in long rolls, coiled up, much harder than the preceding and less dark. The soft kind has an agreeable smell, and a lightly pungent bitterish taste; the hard is much weaker, owing to its having a larger admixture of fine sand, which in that examined by the French Academy amounted to three-fourths of the mass. But independently of designed adulterations, it can scarcely be collected pure; the dust blown from the loose sands among which it grows, being retained by the tenacious juice. It was formerly employed internally as a pectoral and astringent in catarrhal affections, dysenteries, and several other diseases. In England it is now wholly confined to external use. It is an ingredient in the stomachic plaster, or emplastrum ladani, of the London Pharm. It is also used in the way of fumigation, on account of its pleasant smell. Woodvil. Med. Bot. vol. ii. p. 249. Tournefort saw seven or eight country fellows in their shirts and drawers, and in the hottest part of the day, drawing over the plant a kind of whip composed of numerous long leathern thongs, and collecting the resin, which is afterwards scraped clean off with a knife, and made up into cakes of different sizes for sale. In the time of Dioscorides it was carefully detached from the beards and thighs of goats who had broused upon the shrub. 4. C. *purpureus*, Lam. 3. "Shrubby; leaves lanceolate, acute at both ends, wrinkled; peduncles short, one-flowered." A shrub four feet high or more. *Branches* numerous, a little villous, straight, and rather upright. *Leaves* two inches long or more, about half an inch broad, a little undulated at the edges. *Flowers* red, large, terminal; petals with a brownish purple spot at their base; calyx-leaves five, egg-shaped, mucronate, a little villous. Cultivated at Paris by Cels, and supposed to have been brought from the Levant. 5. C. *parviflorus*, Lam. Enc. 4. Willd 14. (C. mas creticus, breviori folio, parvo flore, Tourn. Cor. 19.) "Shrubby; leaves petioled, egg-shaped, acute, tomentous, peduncles villous, generally one-flowered." *Root* an inch thick, hard, divided into many long and thick fibres. *Stems* several, woody, branched. *Leaves* opposite, of a cinereous-green colour, reticulated underneath with nerves, and generally channelled. *Flowers* only an inch broad, rose-coloured: petals somewhat heart-shaped, yellowish at the base; calyx-leaves five, mucronate, villous on the back. Found by Tournefort in the isle of Candy. 6. C. *complicatus*, Lam. Enc. 5. (C. folio rotundiore, incano, quasi complicato, Tourn. Cor. 19.) "Shrubby; leaves petioled, egg-shaped, tomentous, almost donbled together; peduncles short, many-flowered." A small tufted shrub, without branches near the base. *Leaves* small, reticulated underneath, bent, growing almost double, so as to form a deep channel. *Flowers* red; common peduncles from the forks of the upper branches short, bearing three or four pedicelled flowers. *Capsules* very small, egg-shaped, brown, not angular. A native of the Levant. 7. C. *incanus*, Linn. 7. Mart. 8. Lam. 6. Willd. 12. Bot. Mag. 43. (C. mas angustifolius, Bauh. Pin. 464. C. mas secundus, Clus. Hist. 1. p. 69. Lob. Ic. ii. p. 111. C. mas 2 folio longiore, Tourn. 259.) "Arborescent; leaves spatulate, tomentous, wrinkled; lower ones sheathing the base, connate." Linn. *Stem* two feet high. *Branches* villous, whitish towards the summit. *Leaves* opposite, sessile, oblong, a little cottony on both sides, with three nerves at the base. *Flowers* purple, on simple peduncles; petals heart-shaped. A native of Spain and the south of France. 8. C. *breviorifolius*, Mart. 52. (C. mas folio breviore, Bauh. Pin. 464. C. mas 3. Clus. Hist. 69.) "Shrubby; leaves ovate-lanceolate, connate, hirsute, wrinkled; peduncles longer." *Stem* three or four feet high. *Leaves* shorter and greener than those of C. villosus and incanus. *Flowers* deep purple, small. A native of Portugal. 9. C. *lusitanicus*, Mart. 53. (C. mas lusit. fol. amplissimo incano, Tourn. Inst. 259.) "Shrubby; leaves egg-shaped, obtuse, villous, nerved, and wrinkled underneath; flowers larger." *Branches* white and hairy. *Leaves* larger and rounder than those of the preceding species, even on their upper side, rough, and full of veins underneath. *Flowers* light purple, very large. A native of Portugal. 10. C. *hispanicus*, Mart. 54. "Shrubby, villous; leaves lanceolate, green, connate; flowers sessile; calyxes acute." *Stem* not so high as in either of the three preceding species, branched near the root; branches hairy, erect, with three or four terminal flowers, sitting close, without peduncles. At each joint of the stem there is a slender branch, having three pairs of small leaves, of the same shape with the others, and terminated by a single flower. *Flowers* deep purple. A native of Spain. 11. C. *heterophyllus*, Willd. 11. Desfont. Fl. Atl. i. p. 411. tab. 11. "Leaves ovate lanceolate, sheathed at the base, revolute at the edges; calyxes and peduncles hirsute; peduncles generally one-flowered." *Stem* two feet high, much branched. *Younger branches* cylindrical, villous, hoary. *Leaves* opposite, smooth, and rather even on their upper surface, paler underneath, nerved; nerves beset with very short hairs, on short connate petioles. *Flowers* rose-coloured, large, terminal, one, two, three, or four, peduncled; peduncles with two small leaves proceeding from a little knot about their middle; calyx five leaved; leaves nearly equal, two inner ones acute. *Capsule* roundish, villous, five-celled. The same plant has frequently its lower leaves roundish, and its upper one lanceolate, whence the trivial name. Nearly allied to C. *incanus*. A native of uncultivated hills about Algiers. 12. C. *crispus*, Linn. Sp. Pl. 11. Mart. 11. Lam. 7. Willd. 18. (C. mas foliis chamedrys, Bauh. Pin. 464. C. mas 5. Clus. Hist. i. p. 69. C. mas foliis undulatis & crispis, Tourn. Inst. 259.) "Arborescent; leaves lanceolate, pubescent, three-nerved, undulated." Linn. A small shrub. *Stems* several, a foot and a half high, branched, a little decumbent at the base. *Branches* a little cottony or woolly, with many loose hairs. *Leaves* small, sessile, wrink'ed, whitish on both sides. *Flowers* purple, nearly sessile, three or four together at the summit of each branch, forming a head enveloped with floral leaves; calyx-leaves lanceolate. A native of Portugal. 13. C. *albidus*, Linn. 8. Mart. 10. Lam. 8. Willd. 15. (C. mas, folio oblongo incano, Bauh. Pin. 464. Tourn. Inst. 259. C. mas 1, Clus. Hist. i. p. 68.) "Arborescent; leaves ovate-lanceolate, tomentous, hoary, sessile, slightly three-nerved." Linn. *Stem* three or four feet high. *Branches* tomentous, not hairy. *Leaves* opposite, flat. *Flowers* purple, or rose-coloured, large, spacious; peduncles scarcely an inch long, terminal, cottony, one-flowered; petals not emarginate; calyxes cottony. A native of Spain and the south of France. 14. C. *sericeus*, Mart. 60. Willd 16. Vahl. Symb. i. p. 37. (C. latifolius magno flore, Barrel. Ic. 1315.) "Arborescent; leaves egg-shaped, tomentous, three-nerved; lower ones petioled; upper ones sessile;

fessile; peduncles hairy." *Stem* two or three feet high. *Branches* cylindrical, densely tomentous, hoary-white. *Leaves* very soft, obtuse, flat. *Flowers* purple, with a yellow spot in the middle; peduncle terminal, solitary, erect, beset with long purplish hairs; pedicels spreading towards the summit; lower ones three-flowered; upper ones one-flowered; calyx cloathed with soft silky hairs; inner leaves of the calyx three, egg-shaped, quite smooth on the inside; outer ones lanceolate; filaments purple; anthers yellow. 15. C. *hybridus*, Mart. 61. Willd. 17. Vahl. Symb. 1. p. 57. "Arborescent; leaves egg-shaped, petioled, hoary; branches scaly; peduncles elongated, hairy." *Stem* two or three feet high. *Branches* cylindrical, angular near the tip, hoary, covered with yellowish scales. *Leaves* half an inch long, nerved, easily broken. *Flowers* purple, in a terminal raceme; outer calyx-leaves caducous; germ villous. A native of Spain. 16. C. *vaginatus*, Mart. 57. Willd. 5. Hort. Kew. ii. p. 232. Jacq. Hort. Schoenb. iii. p. 17. tab. 282. (C. symphytifolius, Lam. 9.) "Shrubby; leaves petioled, oblong-lanceolate, villous on the upper surface; petioles sheathing at the base, connate." Lam. "Arborescent; leaves oblong, hairy, reticularly wrinkled underneath; petioles united at the base, sheathing, furrowed." Hort. Kew. *Stem* five or six feet high. *Branches* rough, reddish, grey, villous, white and almost cottony near the top. *Leaves* opposite, four or five inches long, nearly two broad. *Flowers* reddish, large, terminal; stamens yellow. A native of Africa. 17. C. *cordifolius*, Mart. 55. "Shrubby, leaves oblong, heart-shaped, smooth, petioles longer." *Stem* four or five feet high. *Branches* woody, slender, with a smooth brown bark. *Flowers* white, terminal, on long peduncles, cultivated by Miller. 18. C. *fasciculatus*, Mart. 56. "Leaves in bundles." *Stem* about nine inches high. *Leaves* narrow and fine, growing in clusters. *Flowers* pale straw-coloured, lateral and terminal, on slender peduncle; petals falling off in about two hours after opening. A native of the Cape of Good Hope; sent to Miller from Holland by Dr. Adrian-Van Royen. 19. C. *salvifolius*. Linn. Sp. Pl. 10. Mart. 7. Lam. 10. Willd. 10. C. femina, folio salviæ; Bauh. Pin. 464. C. femina; Clus. Hist. i. p. 70. Jacq. Collect. 2. p. 120. tab. 8. Hall. Helv. 1031. "Arborescent; leaves egg-shaped, petioled, hairy on both sides." Linn. "Shrubby; leaves petioled, egg-shaped, wrinkled, somewhat hairy; peduncles long, one-flowered." Linn. *Stem* from one and a half to three feet high, much branched, in some varieties procumbent. *Leaves* opposite, obtuse, greenish on the upper surface, with abundance of very short hairs, whitish, green, and almost cottony underneath. *Flowers* white, sometimes pale yellow. *Capsules* egg-shaped, pentagonal, five-celled, surrounded by the calyx. A native of Italy, Switzerland, the south of France, and Spain. There is a variety mentioned by La Marck, C. Cobariensis of Pourret, with leaves almost heart-shaped, acute, less villous, much wrinkled, and viscous, which may be the C. cordifolius, n. 17. Cultivated by Miller, and inserted in his dictionary, without any indication of its native country. 20. C. *populifolius*. Linn. Sp. Pl. 3. Mart. 3. Lam. 11. Willd. 3. C. ledon foliis populi nigræ major et minor; Bauh. Pin. 467. Tourn. 260. Ledon latifolium majus et minus; Clus. Hist. i. p. 78. Lob. Ic. ii. p. 121.) "Arborescent; leaves heart-shaped, even-surfaced, acuminate, petioled." Linn. "Shrubby; leaves petioled, heart-shaped, acute, veined underneath; peduncles bracteated, many-flowered." Lam. *Stem* three or four feet high, branched, with a brown even bark. *Branches* brittle; younger ones, petioles and peduncles beset abundantly with loose hairs. *Leaves* opposite, ciliated when young. *Flowers* white, large; peduncles axillary, with three or four pairs of oblong bractes; petals not spotted, but slightly stained with purple at their edges; calyxes trigonous before the flowers open; calyx-leaves five, almost heart-shaped, acute, the two inner ones coloured and transparent, Lam. A native of Portugal. 21. C. *longifolius*, Lam. 12. "Shrubby; leaves nearly sessile, ovate-lanceolate, villous and undulated at the edges, veined underneath; peduncles many-flowered." *Branches* reddish brown; small ones rendered harsh to the touch by loose hairs. *Leaves* opposite, acute at both ends, greenish on both sides; lower ones on very short petioles. *Flowers* white; axillary, from two to five-flowered; calyx-leaves slightly villous, a little heart-shaped, acute. Nearly allied to the preceding, but the leaves are almost sessile, and not at all heart-shaped. A native of Spain. 22. C. *laurifolius*, Linn. 4. Mart. 4. Lam. 13. Willd. 4. (C. ledon, foliis laurinis, Bauh. Pin. 467. Tourn. 360. Ledon. 1. Clus. Hist. 1. p. 77.) "Arborescent; leaves oblong egg-shaped, petioled, three-nerved, smooth on the upper surface; petioles connate at the base," Linn. "Leaves ovate-lanceolate, petioled, three-nerved, smooth above, tomentous underneath; petioles connate at the base; peduncles naked, many-flowered," Lam. A shrub five or six feet high. *Branches* brown, smaller ones beset with fine close-pressed hairs, not erect or loose, as in the preceding species. *Leaves* opposite; petioles villous, sheathing. *Flowers* white, upper ones forming an umbel; calyx-leaves three, egg-shaped, mucronate, concave on the inside, pubescent on the out. A native of Spain. Ladanum may be procured from it. 23. C. *cyprius*, Lam. 14. (Ledon. 3. cyprium; Clus. Hist. 1. p. 78.) "Shrubby, leaves petioled, lanceolate, smooth above, tomentous, hoary underneath; peduncles naked, with about three flowers; flowers spotted." An intermediate species between the preceding and following, differing from the former in its narrow leaves, and from the latter in its three or four-flowered peduncles. A shrub three or four feet high, with a brown bark, emitting in warm weather from its young branches, its petioles and the upper surface of its branches, a viscous humour like that of the next species, but rather less abundant. *Leaves* opposite, three-nerved underneath. *Flowers* white, peduncles solitary, three inches long; petals with a violet spot near the claw. *Capsules* somewhat egg-shaped, five-celled. A native of the isle of Cyprus, where ladanum is collected from it. 24. C. *ladaniferus*. Linn. 5. Mart. 5. Lam. 15. Willd. 7. Bot. Mag. tab. 112. (C. ladanifera hispanica, Ileis folio, flore candido.) "Arborescent; leaves lanceolate, even on the upper surface; petioles united at the base, sheathing;" Linn. "Shrubby; leaves nearly sessile, connate, lanceolate-linear, smooth above; tomentous underneath; peduncles bracteated, one-flowered; capsules ten-celled." Lam. *Stem* four or five feet high, branched. *Leaves* three inches long, about half an inch broad. *Flowers* very large, two or three inches in diameter, white, lateral, peduncles simple, furnished with bractes their whole length; bractes forming at their base a loose sheath, caducous; stigma sessile. *Capsules* ten-celled, ten-valved. There is a variety with a purple or violet spot in the centre of the flower. Willdenow makes C. undulatus and C. planus of Hortus Kewensis varieties of this species. The former has undulate, the latter flat leaves. A native of Spain. As this is not the plant by which the officinal ladanum is produced, the trivial name is not strictly proper; but as it has obtained the sanction of general usage, it is better to retain it, than to hazard the confusion which must arise from changing every specific name which is not so appropriate as might be wished: care should be taken to distinguish ladanum from laudanum, a well known invaluable medicine from papaver somniferum. 25. C. *ledon*, Lam. 16. Willd.

Willd. 6. (C. ladanifera monfpelienfium. Bauh. Pin. 467.) "Shrubby; leaves nearly feffile, lanceolate, nerved, connate, fmooth on the upper furface; flowers in corymbs, erect; peduncles and calyxes cloathed with filky hairs." A low fhrub from one to two feet high. *Leaves* oppofite, a little fhining, dark green above, pale or whitifh underneath. *Flowers* white, with a yellowifh tint at their centre, of a moderate fize, from three to five on each peduncle. A native of the fouth of France about Narbonne. It exudes a vifcous matter in tolerable abundance, and, according to La Marck, is the true ladaniferus of Montpelier, though not the monfpelienfis of Linnæus. 26. C. *hirfutus*, Lam. 17. (C. laxus, Hort. Kew. ii. p. 233. Willd. 9. C. ledon hirfutum, Bauh. Pin. 467. Tourn. 260. Ledon 4. Cluf. Hift. i. p. 78.) "Shrubby; leaves feffile, oblong, obtufe, hirfute; peduncles many-flowered; capfules fmall, covered by the large pyramidal calyx." A fhrub. *Stem* a foot and a half high. *Branches* numerous, flexible, villous, whitifh. *Leaves* oppofite, dark green, foft. *Flowers* white; peduncles befet with ftrong hairs; capfules egg-fhaped, fmooth, five-valved, five-celled. A native of Spain. We have preferred La Marck's trivial name on account of its correfpondence with the fynonyms of C. Bauhin and Tournefort. 27. C. *florentinus*, Lam. 18. (C. ladanifera florentina, Michael. Sherard.) "Shrubby; leaves narrow, lanceolate, wrinkled, reticulated underneath, nearly feffile; peduncles villous, about three-flowered." *Branches* brown, fmooth towards the bottom, pubefcent near the top. *Leaves* an inch and half long, oppofite, a little cottony underneath, not three-nerved. *Flowers* white; peduncles and calyxes befet with white, very fine, almoft filky hairs. Suppofed to be a native of Italy, defcribed by La Marck from a fpecimen in the herbarium of Juffieu. 28. C. *monfpelienfis*, Linn. Sp. Pl. 6. Mart. 6. Lam. 19. Willd. 8. Gært. tab. 76. fig. 10. (C. ledon foliis oleæ, fed anguftioribus, Bauh. Pin. 467. Tourn. 260. Ledon. 5. Cluf. Hift. i. p. 79.) "Shrubby; leaves linear-lanceolate, feffile, villous on both fides, three-nerved; peduncles branched, nearly unilateral." Lam. *Stem* about three feet high, branched. *Leaves* dark green, vifcous. *Flowers* white; peduncles villous. A native of the fouth of France. 29. C. *libanotis*, Linn. Sp. Pl. 13. Mart. 13. Lam. 20. Willd. 22. "Arborefcent; leaves linear, revolute; flowers umbelled." Linn. "Shrubby; leaves linear, revolute at the edges; flowers fomewhat umbelled; calyx three-leaved." Lam. α. "leaves green on both fides." C. ledon foliis anguftis, Bauh. Pin. 467. Tourn. 260. Ledon 6 and 9. Cluf. β. "Leaves canefcent; flowers fomewhat capitate." Ledon 7. Cluf. γ. Leaves hoary underneath." Ledon. 8. Cluf. *Stem* about two feet high. *Branches* cinereous; young ones cottony and whitifh near the top. *Leaves* feffile, narrow, revolute like thofe of rofemary. *Flowers* white or cream-coloured, fmall. *Capfules* fmall, five-celled, five-valved. A native of Spain.

* * *Helianthema*, Tourn.

Capfule three-valved, one or three-celled.

† *Without ftipules.*

(1.) *Stem woody.*

30. C. *umbellatus*, Linn. Sp. Pl. 14. Mart. 14. Lam. 21. Willd. 23. "Somewhat fhrubby, procumbent; leaves oppofite, linear; flowers umbelled." Linn. "Somewhat fhrubby; leaves oppofite, linear, revolute at the edges; flowers at the top of the peduncle umbelled." Lam. α. "leaves hoary underneath; ftem procumbent." β. "Leaves greenifh on both fides; ftem erect. (C. ledon, foliis thymi, Bauh. Pin. 467. Helianthemum foliis thymi, floribus umbellatus, Tourn. 250. Ledon 10. Cluf.) *Stem* fcarcely a foot high. *Flowers* white, numerous, partly lateral on the peduncle, partly terminal in a kind of umbel; calyx three-leaved. The *branches* of var. α. are procumbent, flender, regular, whitifh; its *leaves* rolled back at the edges like thofe of C. libanotis, white underneath, green above, a little ciliated at the edges. The ftems of var. β. are erect; its leaves not white underneath, narrower, the edges more rolled back, and fcarcely ciliated when completely open. A native of Spain and the fouth of France. 31. C. *ocymoides*, Mart. 66. Lam. 22. Will. 30. Vahl Symb. 3. p. 68. (C. folio fampfuci incanos, Bauh. Pin. 465. Cluf. Hift. i. p. 72. Lob. Ic. ii. p. 114. Helianthemum folio fampfuci, Tourn. 250.) "Leaves inverfely egg-fhaped, three-nerved; thofe of the fmall branches hoary on both fides, reflexed at the tip; flowers in racemes; peduncles and calyxes quite fmooth." Vahl. "Somewhat fhrubby; leaves petioled, keeled, hoary, very fmall; peduncles branched, umbel panicled." Lam. *Stem* about a foot high. *Branches* flender, cinereous. *Leaves* numerous, oppofite. *Flowers* white, with a dark purple fpot in the centre; peduncles long, flender. There is a variety in which the leaves are whiter, and the branches abundantly cloathed with rather long loofe hairs. C. fampfucifolius. Cav. Ic. tab. 366. A native of Spain. 32. C. *halimifolius*, Linn. Sp. Pl. 12. Mart. 12. Lam. 23. Willd. 20. "Two of the calyx leaves linear." Linn. "Shrubby; oblong-ovate; fomewhat acute, leffening into the peticle, hoary on both fides; peduncles long, branched, fomewhat panicled." Lam. *Stem* two or three feet high, much branched. *Branches* forming a regular head. *Leaves* larger than thofe of the preceding fpecies, but not more than feven or eight lines long, and three or four lines broad, oppofite. *Flowers* yellow, with a purple fpot in the centre. There is a variety in which the leaves are obtufe and almoft rounded at the tip. A native of Italy and Spain. 33. C. *algarvenfis*, Bot. Mag. 627. (C. lafianthus, Lam. 26. Helianthemum algarvienfe, Tourn. Inf. 250.) Arborefcent; ftem afcending; leaves hoary, ovate-lanceolate; peduncles fomewhat panicled; calyxes three-leaved, acute, hirfute" Bot. Mag. "Somewhat fhrubby; leaves oblong-obovate, keeled, tomentous, peduncles fhort, about one-flowered; calyxes very hirfute." Lam. *Stems* a foot and half high, much branched. *Branches* darkifh grey, cottony towards the fummit. *Leaves* rather fmall, oppofite, almoft feffile, obtufe, cottony on both fides, without being white but only grey. *Flowers* yellow, with a purple fpot in the centre, terminating the fmall lateral branches, remarkable for the long hairs with which the outfide of the petals is abundantly cloathed. Lam. Calyx-leaves three, equal, acute. Bot. Mag. We have no doubt with regard to the algarvenfis of Bot. Mag. and the lafianthus of La Marck being the fame plant, though La Marck makes no mention of the afcending ftem, and have preferred the former trivial name, as it feems to have the right of priority, on the high authority of Tournefort, an authority which we prefume La Marck will not be inclined to difpute. A native of Portugal. 34. C. *formofus*, Willd. 19. Bot. Mag. 264. (C. lafianthus, β. Lam.? Helianthemum humilius lufitanicum, halimi folio nigrore, magno flore luteo, Tourn. Inft. 250.) *Leaves* darkifh grey. Peduncles a little branched. Lam. *Flowers* yellow, thrice as large as thofe of C. halimifolius; petals marked with a dark purple fpot a little above the claw; peduncles and calyx cloathed with red hairs. Bot. Mag. We have almoft as little doubt with refpect to the identity of Curtis's and La Marck's plants. A native of Portugal. 35. C. *cheiranthoides*, Lam. 24. C. halimifolius β. Willd. (C. femina portulacæ marinæ folio anguftiore mucronato; Bauh. Pin. 465. C. folio halimi 2. Cluf. 1. p. 71). "Shrubby; leaves tomentous, oblong-lanceolate, narrower at the bafe; peduncles fhort, about two-flowered." *Stem* three feet high.

Leaves oppoſite, very white when young, a little three-nerved underneath, about an inch long. *Flowers* yellow. A native of Portugal. 36. C. *atriplicifolius*, Lam. 25. (C. halimi folio, flore luteo amplo, maximus, hiſpanicus, Barrel. Ic. 292. Helianthemum hiſpanicum, halimi folio ampliſſimo incano et nervoſo; Tourn. 250). "Shrubby; leaves petioled, egg-ſhaped, undulated towards the baſe, hoary on both ſides; flowers in racemes; peduncles and calyxes hiſpid." *Stem* from four to ſix feet high or more, upright. *Branches* into a regular head, whitiſh, cloathed with a very ſhort cottony down. *Leaves* oppoſite, nerved underneath, about an inch broad. *Flowers* yellow, not ſpotted, numerous, more than an inch in diameter, terminal, and from the forks of the upper branches; peduncles from three to five inches long; calyx-leaves three, ovate-acute concave; ſometimes two exterior ones very ſmall, narrow, acute: petals falling off ſoon after opening. Capſules even-ſurfaced, one-celled, three-valved. A native of Spain. 37. C. *elongatus*, Mart. 65. Willd. 21. Vahl. Symb. 1. p. 38. "Arboreſcent; leaves lanceolate, hoary; peduncles elongated, two-leaved; calyxes racemed, hirſute." *Stem* a foot high or more, upright, much branched. *Branches* ſhort; younger ones tomentous, hoary, beſet with yellowiſh ſcales. *Leaves* oppoſite, veinleſs, hoary, on both ſides, flat; younger ones doubled together, ſpreading at the tip; petiole very ſhort, with a few long hairs. *Flowers* yellow, with a duſky ſpot in the centre, nodding before they open; peduncles terminal, half a foot long, erect, not hoary, hairy, eſpecially near the bottom, with a pair of ſeſſile leaves towards the middle; pedicels towards the top of the peduncle, remote, filiform, quite ſimple, commonly five, with a bent joint at top; lower ones in pairs, the reſt alternate: calyx oblong, acuminate, ſmooth within; two leaves caducous. A native of Spain. 38. C. *involucratus*, Lam. 27. (Helianthemum hiſpanicum, halimifolio minimo; Tourn. Inſ. 251.) "Somewhat ſhrubby; leaves ſmall, inclining to egg-ſhaped, tomentous, ſeſſile; peduncles very ſhort, lateral; flowers with leafy involucre. *Stem* about a foot and half high, much branched. *Branches* ſlender, filiform, cottony, greyiſh. *Leaves* as ſmall as thoſe of C. ocymoides, n. 31, keeled, cinereous. *Flowers* ſmall, ſolitary; calyx villous. A native of Portugal. 39. C. *alyſſoides*, Lam. 28. "Somewhat ſhrubby; leaves oblong, egg-ſhaped, beſet with ſhort ſtiff hairs; younger ones ſomewhat hoary; older ones green: peduncles and calyxes hairy." *Stem* about a foot high, much branched. *Branches* ſpreading, ſlender, rough towards the ſummit, with whitiſh, rather woolly, hairs. *Leaves* oppoſite, narrowed towards the baſe, ſome obtuſe, others rather acute, a little roughened on the ſurface by ſtar-ſhaped hairs, as in many ſpecies of alyſſum. *Flowers* yellow, rather large; peduncles ſhort, two or three flowered, near the top of the branches, unopened flower-buds bright purple at their ſummit. A native of France and Spain. It varies in the ſize and ſhape of the leaves. 40. C. *roſeus*, Mart. 22. Lam. 29. Jacq. Hort. vol. iii. tab. 65. "Somewhat ſhrubby, almoſt without ſtipules, procumbent: leaves oppoſite, petioled, oblong, revolute at the edges, greeniſh on both ſides." *Stem* branched. *Branches* ſlender, weak, almoſt ſmooth, greeniſh, leafy near the top, two or three pair of the upper leaves narrower, furniſhed with ſtipules. *Flowers* roſe-coloured, in terminal racemes. 41. C. *alandicus*, Linn. Sp. Pl. 20. Mart. 24. Lam. 30. Willd. 38. Jacq. Auſt. 4. tab. 399. Hall. Helv. n. 1034. (C. helianthemos flore parvo luteo, Bauh. Hiſt. 2. p. 17. C. alpeſtris: Scop. Car. tab. 23. Chamæciſtus 2. Cluſ. Hiſt. 1. p. 73). "Somewhat ſhrubby, procumbent, leaves oppoſite, oblong, ſmooth on both ſides; petioles ciliated; petals emarginate." Linn. "Leaves ciliated." Lam. *Stem* ſmall, woody, branched from its baſe. *Branches* ſlender, villous, reddiſh, diverging. *Leaves* almoſt ſeſſile, ſmall. *Flowers* yellow, ſmall, peduncled, terminal, in ſhort almoſt corymbous racemes. A native of the ſouth of France, Switzerland, Auſtria, and the iſle of Eland. 42. C. *marifolius*, Linn. 19. Mart. 21. Willd. 32. Eng. Bot. 396. (C. myrtifolius, Lam. Var. β. γ. C. hirſutus, Hudſ. Flor. Ang. C. anglicus, Linn. Mant. 245. Lam. 33. Willd. 36. C. canus, Jacq. Auſt. 277. but not of Linnæus; Helianthemum alpinum, folio Piloſellæ minoris Fuchſii, Bauh. Hiſt. vol. ii. p. 19. H. ſerpylli folio incano, flore minore luteo, inodoro, Dill. Elth. vol. i. tab. 145. fig. 173. Chamæciſtus luteus, thymi durioris folio, Barrel. Ic. 44). "Somewhat ſhrubby; leaves oppoſite, petioled, oblong, tomentous underneath." Linn. *Roots* long, woody. *Stem* three or four inches high, woody, cylindrical, branched, decumbent at the baſe. *Leaves* ſpreading, flat, green above, hiſpid with depreſſed briſtles. *Flowers* yellow, rarely white, ſmall, ſcentleſs, in terminal racemes; racemes few-flowered, pubeſcent, bracteated; calyx hairy, with ſeveral brown ribs; petals inverſely egg-ſhaped, entire, ſlightly undulated; germ egg-ſhaped, ſmooth, with three or four hairy lines; ſtyle curved. A native of England, France, Spain, Italy, and Switzerland. 43. C. *canus*, Linn. 18. Mart. 19. Lam. 27. (C. myrtifolius var. α. Lam. 31. Jacq. Auſt. 3. tab. 277. Allion pedem. tab. 45. fig. 3. Chamæciſtus foliis myrti minoris incanis, Bauh. Pin. Tourn. 249. Chamæciſtus 3. Cluſ. Hiſt. 1. p. 74). "Somewhat ſhrubby, procumbent; leaves oppoſite, inverſely egg-ſhaped, villous, tomentous underneath; flowers ſomewhat umbelled." Linn. There is a variety with elliptic leaves, with a few ſcattered white hairs on each ſide, not tomentous underneath; calyxes always hirſute, in ſeſſile terminal umbels. (Helianthemum, ſerpylli folio villoſo, flore pallido. Barr. rar. tab. 366. H. alpinum ſerpylli folio nigricante et hirſuto. Seg. ver. 3. tab. 6. fig. 2). *Old ſtems* procumbent and naked; thoſe which bear leaves and flowers erect. *Flowers* deep yellow, from the axils of the upper leaves; calyxes tomentous. *Capſule* egg-ſhaped, ſomewhat acute, trigonous, nearly ſmooth, three-celled, three-valved, covered by the calyx. *Seeds* two or three in each cell, egg-ſhaped, acute, angular. Jacq. A native of the ſouth of Europe. 44. C. *italicus*, Linn. Sp. Pl. 17. Mart. 20. Lam. 32. Willd. 31. Helianthemum ſerpylli folio villoſo, flore pallido, Italicum. Barr. Ic. tab. 366). "Somewhat ſhrubby; leaves oppoſite, hiſpid; lower ones egg-ſhaped; upper ones lanceolate: branches ſpreading." *Stem* about ſeven inches high, erect. *Branches* oppoſite, long, ſpreading, ſomewhat deflexed, rufous, ſomewhat ciliated; lower ones petioled, upper ones nearly ſeſſile. *Flowers* pale yellow, in a terminal raceme; calyxes hiſpid; corollas ſcarcely emarginate. A native of Italy. Linnæus ſuſpects that it may be only a variety of the preceding ſpecies. 45. C. *vinealis*, Willd. 37. Hall. Helv. n. 1035. "Somewhat ſhrubby, procumbent; leaves petioled, oblong, obtuſe, hoary-tomentous underneath; flowers in racemes." It widely differs from C. marifolius in the form of its leaves, procumbent branches, and whole habit; and from C. celandicus in its leaves, being white with down underneath. A native of vineyards in Germany and Switzerland. 46. C. *echioides*, Lam. 34. "Somewhat ſhrubby; leaves linear, lanceolate, hairy on both ſides, rather rough, ſeſſile; racemes ſmall, hairy, recurved at the top." *Stem* half a foot high, erect, rough, with hairs, branched from the bottom almoſt to the top. *Leaves* oppoſite, acute, greyiſh. *Flowers* almoſt ſeſſile, in the axils of the bractes. A native of Spain, deſcribed by La Marck from a dried ſpecimen in the herbarium of Juſſieu. 47. C. *origanifolius*, Lam. 35. Willd.

33. Cavan. Ic. 3. tab. 262. fig. 1. "Somewhat ſhrubby; leaves oppoſite, petioled, egg-ſhapped, hairy on both ſides." *Stems* five or ſix inches high, much branched. *Leaves* reſembling thoſe of origanum, but much ſmaller; deſcribed by La Marck from ſpecimens without flowers preſerved in the herbaria of Juſſieu and Iſnard. *Flowers* yellow, ſcarcely longer than the calyx, only half as large as thoſe of C. marifolius; racemes from one ſide of the ſtem, in pairs, peduncled, hairy like the ſtem, Cavan. A native of Spain, near Cape St. Vincent. 48. C. *mollis*, Willd. 34. Cavan. Ic. 3. p. 32. "Somewhat ſhrubby; leaves roundiſh-egg-ſhaped, obtuſe petioled, flat, tomentous on both ſides, ſoft." *Stems* half a foot high, diffuſe, red, tomentous, branched. *Leaves* oppoſite, ſlightly nerved. *Flowers* three times as large as thoſe of the preceding ſpecies, in ſolitary terminal racemes. A native of Spain. 49. C. *dichotomus*, Willd. 35. Cavan. Ic. 3. tab. 263. fig. 1. "Somewhat ſhrubby, dichotomous; leaves egg-ſhapped, acute, ſmooth, revolute at the edges, oppoſite, petioled; flowers in racemes." *Leaves* ſmall, like thoſe of Thymus Piperella, on ſhort petioles. *Flowers* deep yellow, ſcarcely the ſize of thoſe of ſpergula nodoſa; racemes ſlender, few-flowered. A native of Spain. 50. C. *fumana*, Linn. Sp. Pl. 16. Mart. 18. Lam. 36. Willd. 26. (chamæciſtus ericæ folio luteus humilior; Bauh. Pin. 466. C. anguſtifolius, Ibid. Hall. Helv. n. 1032. C. minor, Barr. Ic. 286. and 2. 446. Helianthemum tenuifolium glabrum, luteo flore, per humum ſparſum, J. Bauh. 2. p. 18. Tourn. 249.) "Somewhat ſhrubby, procumbent; leaves alternate, linear, ſcabrous at the edges; peduncles one-flowered," Linn. *Stem* from five to eight inches high, woody, more or leſs upright, twiſted, branched. *Branches* ſlender, diffuſe, lower ones often procumbent. *Leaves* reſembling thoſe of Antirrhinum Linaria, but ſmaller, greeniſh; lower ones ſhorter and ſtiffer. *Flowers* yellow, on a ſolitary peduncle; calyx ſmooth, or cloathed with a very ſhort down, ſometimes with a purple tint, five-leaved; two outer leaves very ſmall, acute. *Capſules* three-celled, three-valved. A native of dry ſtony ground in Sweden, France, and Switzerland. 51. C. *calycinus*, Linn. Mant. 565. Mart. 16. Willd. 25. (C. fumana β. Lam. Deſfont. Fl. Atl. 1. tab. 105. C. ericoides, Cavan. Ic. 2. tab. 172. Chamæciſtus ericæ folio luteus elatior, Bauh. Pin. 466. Pluk. Alm. tab. 83. fig. 6.) "Somewhat ſhrubby, erect; leaves linear; peduncles one-flowered; calyxes three-leaved." *Stem* a foot high. *Branches* oppoſite, reddiſh. *Leaves* oppoſite, even-ſurfaced, obtuſely keeled underneath. *Flowers* yellow; peduncles terminal, ſolitary, ſcarcely longer than the leaves; calyx with three even-ſurfaced, equal leaves; ſtamens fifteen, very ſhort, yellow, all fertile; piſtil white; ſtigma warty. Nearly allied to the preceding. A native of the ſouth of Europe. 52. C. *ſcabroſus*, Mart. 59. Willd. 28. Hort. Kew. 2. p. 236. "Somewhat ſhrubby; leaves oppoſite, egg-ſhaped, hairy-ſcabrous, three-nerved; calyxes three-leaved." *Stems* decumbent, cylindrical, thickly cloathed with ſhort ſtellated hairs. *Branches* ſhort. *Leaves* an inch long, ſomewhat petioled. *Flowers* deep yellow, paler in the centre, terminal, ſomewhat panicled; calyx leaves equal, ovate-lanceolate, acuminate, pubeſcent on the outſide, with long ſtellated hairs; petals inverſely egg-ſhaped, ſomewhat retuſe, twice the length of the calyx. A native of Italy and Portugal. 53. C. *cinereus*, Willd. 29. Cavan. Ic. 2. tab. 141. "Somewhat ſhrubby; leaves oppoſite, egg-ſhaped, acute hoary; calyxes obtuſe; racemes panicled." Nearly allied to the preceding, but diſtinct. *Leaves* evidently petioled, veined. *Calyx* five-leaved, three of the leaves egg-ſhaped, obtuſe, two linear; petals quite entire, Cavan. 54. C. *ſyriacus*, Mart. 17. Mur. Syſt. 498. Jacq. Collect. 1. 98. (C. lavandula β. Lam. 54.) "Erect, leaves lanceolate, revolute; flowers racemed." *Leaves* acute, quite entire, nearly ſeſſile, alternate, ſomewhat villous, pale green. *Flowers* yellow; racemes terminal and axillary from the upper leaves, many-flowered, unilateral; calyx ſomewhat villous, pale green. Sent to Jacquin by Spielman in 1771. A native of the Levant. 55. C. *lævipes*, Linn. Sp. Pl. 15. Mart. 15. Lam. 37. Willd. 24. Jacq. Hort. 2. tab. 158. Ger. Prov. tab. 14. Pluk. Alm. tab. 84. fig. 6. (Helianthemum Maſſilienſe Coridis, fol. Tourn. 250.) "Somewhat ſhrubby, aſcending; leaves alternate, faſcicled, filiform, ſmooth; peduncles racemed," Linn. *Root* woody, creeping very much. *Stems* ſeveral, ſeven or eight inches long, woody when old, herbaceous when young, much branched. *Branches* ſlender, glaucous, quite ſmooth, except near the flowers, where they are often cloathed with ſhort ſeparate hairs. *Leaves* very numerous, alternate, ſetaceous-linear, from three to five inches long, glaucous; with each leaf come out two others, one-third ſhorter; between theſe, from the axil, other leaves come out ſucceſſively, ſo as to form a bunch ſitting cloſe to the branch. *Flowers* yellow, on long peduncles, terminal, ſcentleſs; calyx leaves five; three inner ones broad egg-ſhaped, acute, wrinkled longitudinally, variegated with white, green, and purple; petals egg-ſhaped, a little longer than the petals. *Capſule* obtuſely trigonous, obſcurely grooved, ſmooth, three-celled, three-valved. *Seeds* two in each cell, egg-ſhaped, convex on one ſide, angular on the other. A native of the ſouth of France. 56. C. *braſilienſis*, Lam. 38. (C. alternifolius, Willd. 39. Vahl. Symb. 1. p. 38.) "Somewhat ſhrubby; leaves alternate, ovate-oblong, villous, ſeſſile; peduncles one-flowered," Lam. Whole plant cloathed with rather long, white, almoſt ſilky hairs. *Stem* half a foot high or more, erect, a little zig-zag. *Leaves* villous on both ſides, flat, quite entire. *Peduncles* towards the top of the branch ſolitary, or ſometimes two or three together, one-flowered, in the axils of the leaves of the lower branches, ſpreading, twice the length of the leaf. A native of Brazil.

2. *Stem herbaceous.*

57. C. *globularifolius*, Lam. 39. Willd. 40. (Helianthemum Luſitanicum, globulariæ folio; Tourn. 250.) "Perennial; ſtem ſimple, nearly naked; root-leaves petioled ſpatulate, obtuſe." Root thick, woody. *Stem* from four to ſix inches high, furniſhed with two or three diſtant pairs of ſmall acute leaves. *Flowers* terminal, in a ſhort raceme. A native of Portugal. 58 C. *tuberaria*, Linn. Sp. Pl. 21. Mart. 25. Lam. 40. Willd. 41. Cavan. Ic. 1. tab. 67. (C. folio plantaginis, Bauh. Pin. 465. Helianthemum plantaginis folio, perenne, Tourn. 25. Buxb. Cent. 3. tab. 63. Tuberaria noſtras, et major mycoſis, J. Bauh. 2. p. 12.) "Perennial, root leaves egg-ſhaped, three-nerved, tomentous; ſtem leaves ſmooth, lanceolate; upper ones alternate," Linn. *Stem* half a foot high or more, commonly ſimple. *Root-leaves* ſpreading on the ground, white underneath; ſtem-leaves ſeſſile, diſtant. *Flowers* yellow, in a kind of corymb; two outer calyx-leaves ſhorter, lanceolate; three inner ones ovate-acuminate, concave. *Capſule* globular, three-valved. *Seeds* ovate-compreſſed, blackiſh, fixed to partitions oppoſite to the valves. A native of Spain, Italy, and the ſouth of France, cultivated by Miller in 1748. 59. C. *plantagineus*, Willd. 42. (C. ſerratus, Deſfont. Fl. Atl. 1. 416. excluding the ſynonym from Cavanilles. C. lanceolatus, Vahl. Symb. 2. p. 62?) "Herbaceous; leaves lanceolate, leſſened at both ends, three-nerved, hairy; racemes without bractes; petals finely toothed." Willd. "Inclining to ſhrub-

by

by near the bottom, herbaceous above; leaves lanceolate, three-nerved, hairy." Vahl. *Stem* a foot or a foot and a half high, sprinkled with long strait hairs, Willd.; branched at the base, Vahl. *Branches* quite simple, a short span long, ascending, smooth at the bottom, tomentous at the top, hoary their whole length, Vahl. *Leaves* two inches long, sessile, gradually smaller towards the top, opposite; two upper ones alternate, Vahl. *Root-leaves* oblong, acuminate, lessened into the petiole, three or five-nerved, hairy on both sides; the hairs on the under surface simple, scattered, close-pressed; on the upper more copious, stellated; stem-leaves opposite, lanceolate, sessile, three nerved, an inch and a half or two inches long, more hairy than the root-leaves, Willd. *Stipules* only to the last pair of leaves, Vahl. and Willd.; half an inch long, linear, hairy, Willd. *Bractes* none, Vahl. and Willd. *Raceme* terminal, Vahl. *Racemes* two at the top of the stem, Willd. *Flowers* yellow, without a central spot, Willd.; calyx five-leaved, Vahl. Willd. A native of Crete and the north of Africa; found by Vahl near Bizerta in Barbary. We have contrasted Willdenow's and Vahl's descriptions, that our readers may judge for themselves with respect to their identity. The only material difference seems to be, that Willdenow's plant is annual: Vahl's, perennial. 60. C. *serratus*, Willd. 43. Cavan. Ic. 2. tab. 175. fig. 1. "Leaves opposite, lanceolate, three nerved, hairy, viscous; root ones inversely egg-shaped; racemes without bractes; petals serrated." *Stem* only one-third the length of the preceding. *Leaves* obtuse. *Flowers* yellow, with a large black central spot. 61. C. *bupleurifolius*, Lam. 41. "Stem branched; stem-leaves lanceolate, three-nerved, even surfaced, smooth; upper ones alternate; flowers in corymbs." *Root* three or four inches long, slender, fibrous. *Stem* herbaceous, four inches high, smooth, leafy. *Branches* simple, a little villous towards the top. *Root leaves* oblong, lessened towards the base, slightly three-nerved, beset with short hairs; stem-leaves sessile, very acute, even-surfaced, smooth, sometimes, but rarely, furnished with some loose hairs underneath, most of them opposite, gradually diminishing in size towards the top. *Flowers* in short peduncles, in a small close corymb. Communicated to La Marck by Vahl, who found it in Spain. It seems to differ from his lanceolatus chiefly in its completely herbaceous stem, and its comparatively smooth leaves. 62. C. *guttatus*, Linn. Sp. Pl. 22. Mart. 26. Lam. 42. Willd. 44. Curt. Flor. Lond. fasc. 6. tab. 33. Eng. Bot. tab. 544. (C. flore pallido, punicante macula insignito, Bauh. Pin. 465. Rai. Syn. 342. C. annuus flore guttato, J. Bauh. Hist. vol. ii. p. 14. Helianthemum flore maculoso, Tourn. 250. Colum. Ecphr. tab. 77. fig. 1.) "Leaves opposite, lanceolate, three-nerved; racemes nearly naked." Dr. Smith. *Root* annual, small, fibrous. *Stem* near a foot high, erect, simple or branched, square, hairy; hairs white, spreading. *Leaves* rather obtuse, quite entire, hairy on both sides, somewhat viscid. *Flowers* yellow; racemes terminal, simple, unilateral, hairy, often without bractes, but sometimes with solitary lanceolate ones at the base of the pedicels; calyx glandular, hairy; petals unequally crenate, with an elegant purple spot near the base; stigma sessile. *Capsule* egg-shaped, three-celled. *Seeds* attached to the partitions, which are fixed to the middle of the valves, Dr. Smith. La Marck mentions two varieties; one smaller with linear-lanceolate leaves; the other larger with ovate-acute or ovate-lanceolate stem-leaves. A native of Italy, the south of France, and the isles of Jersey and Man. 63. C. *canadensis*, Linn. Sp. Pl. 23. Mart. 27. Lam. 43. Willd. 45. "All the leaves alternate, lanceolate; stem ascending." A native of Canada, observed by Kalm. 64. C. *alternifolius*, Mart. 63. Vahl. Symb. 1. 38. "Somewhat shrubby; leaves alternate; peduncles lateral and terminal, generally solitary, one-flowered." *Stem* erect. *Branches* slender, villous, brown. *Leaves* sessile, oblong, erect, flat, quite entire, villous on both sides. *Flowers* solitary towards the top, sometimes two or three together in the axils of the leaves on the lower branches; peduncles spreading, double the length of the leaf, villous, a little thicker at the end, with two linear caducous leaves at the top; calyxes egg-shaped, acute, hirsute. A native of Brazil. It has the calyx and inflorescence of salicifolius n. 103, but differs in being shrubby. 65. C. *medius*, Mart. 50. Allion pedem, n. 1657. "Leaves ovate-lanceolate, wrinkled, petioled, finely toothed." *Stems* shrubby, reddish, viscid. *Leaves* green. *Flowers* pale yellow; peduncles solitary, axillary and terminal. A native of the county of Nice.

† † *With stipules.*

66. C. *squamatus*, Linn. Sp. Pl. 27. Mart. 32. Lam. 44. Willd. 51. Barr. Ic. 327. Bocc. Mus. 2. tab. 64. fig. 3. "Stem somewhat shrubby; leaves covered with orbicular scales." Linn. *Stem* six or seven inches long, rather erect, tetragonous near the bottom. *Leaves* oval-lanceolate, thickish, petioled, opposite, some three together; scales silvery, with a hollow point in the middle. *Stipules* extremely small, acute, shrivelling, sessile. *Flowers* yellow, terminal, in small racemes, on short thick-set peduncles. A native of dry hills in Spain. 67. C. *lippii*, Linn. Mant. 245. Mart. 33. Lam. 45. Willd. 52. Vahl. Symb. n. 39. (C. stipulatus, Forsk. Desc. 100.) "Somewhat shrubby, erect; leaves alternate and opposite, lanceolate, scabrous; spikes unilateral." Linn. *Stem* from four to six inches high, cylindrical, pubescent, whitish, bifid, or but little branched. *Branches* white, alternate, often zig-zag. *Leaves* generally alternate, petioled, oblong, obtuse, pale green above, with short hairs, whitish and slightly cottony underneath. *Stipules* small, narrow-lanceolate, opposite, nearly the length of the petioles. *Flowers* yellow; racemes or spikes short, solitary, opposite to the leaves, sessile, scarcely opening, but appearing almost like buds till the fruit opens; petals smaller, scarcely longer than the leaves of the calyx. *Capsules* nearly globular, almost covered by the calyx. A native of Egypt. 68. C. *sessiliflorus*, Willd. 53. Desfont. Fl. Atl. 1. p. 427. tab. 106. "Somewhat shrubby, erect; leaves alternate and opposite, linear, hoary, revolute at the margin; spikes unilateral." *Stem* a foot or two feet high, erect, much-branched. *Leaves* somewhat petioled, rather obtuse. *Stipules* small, linear. *Flowers* yellow, a little longer than the calyx, sessile. *Bractes* minute, linear-lanceolate. *Calyx* pubescent. *Capsule* roundish, pubescent, longer than the calyx, Desfont. 69. C. *ellipticus*, Willd. 54. Desfont. Fl. Atl. 1. tab. 107. "Somewhat shrubby, erect; leaves opposite, elliptic, hoary, revolute at the edges; spikes unilateral." *Stem* a foot or two feet high, branched. *Branches* pubescent. *Leaves* on short petioles, cloathed on both sides with very short and very dense hairs. *Stipules* growing by fours, small, linear. *Flowers* yellow, small, sessile; petals a little longer than the calyx. *Capsule* roundish, pubescent, longer than the calyx. A native of the country about Algiers. 70. C. *canariensis*, Murray Syst. 499. Mart. 36. Lam. 46. Willd. 59. Jacq. Ic. 1. tab. 97. Jacq. Misc. 2. p. 339. "Procumbent; leaves somewhat egg-shaped, alternate and opposite; racemes erect." Jacq. "Procumbent; leaves opposite and alternate, pubescent, glaucous, oblong-inversely egg-shaped, acute; racemes unilateral." Willd. *Root* fibrous. *Stem* six or seven inches long, slender, woody, branched, slightly pubescent, reddish brown near the bottom.

bottom. *Branches* alternate, whitiſh and a little cottony towards the top. *Leaves* petioled, pale green, almoſt ſmooth above, pubeſcent and reflexed at the edges underneath. *Stipules* narrow, almoſt ſetaceous, ſhorter than the petioles, hooked, villous, caducous. *Flowers* yellow, peduncled; racemes an inch and a half long; peduncles cottony; calyxes with projecting ſtriæ. A native of the Canary iſlands. 71. C. *ſerpyllifolius*, Linn. Sp. Pl. 30. Mart. 38. Willd. 60. (Chamæciſtus repens ſerpyllifolia lutea, Bauh. Pin. 466.) "Somewhat ſhrubby; leaves oblong; calyxes even-ſurfaced." A native of mountains in the ſouth of Europe. La Marck has omitted this ſpecies. 72. C. *violaceus*, Willd. 61. Cavan. Ic. 2. tab. 147. "Somewhat ſhrubby, aſcending; leaves oppoſite, ſomewhat tomentous, linear, obtuſe, attenuated at the baſe, revolute at the edges; calyxes even-ſurfaced." *Flowers* white, in long erect racemes; calyxes of a reddiſh violet colour. 73. C. *linearis*, Willd. 62. Cavan. Ic. 3. tab. 216. "Somewhat ſhrubby, aſcending, a little tomentous; leaves linear, obtuſe, petioled, revolute at the edges; calyxes even-ſurfaced. *Leaves* petioled, not attenuated at the baſe, thrice the length of thoſe of the preceding ſpecies. *Flowers* white; the two ſmaller calyx-leaves acute, not obtuſe; petals inverſely-egg-ſhaped. In theſe reſpects, its white flowers excepted, and in its whole habit, it differs from C. violaceus. A native of Spain. 74. C. *lævis*, Willd. 63. Cavan. Ic. 2. tab. 145. fig. 1. "Somewhat ſhrubby, erect, leaves linear, ſeſſile, ſmooth, revolute at the edges, keeled; calyxes even-ſurfaced." *Leaves* acute at the tip; lower ones crowded, ſhorter; upper ones a little ſpreading. *Stipules* linear. *Flowers* deep yellow, longer than the calyx: two ſhorter calyx-leaves awl-ſhaped. A native of Spain. 75. C. *ſtrictus*, Willd. 64. Cavan. Ic. ii. tab. 263. fig. 2. "Somewhat ſhrubby, erect; leaves hoary, linear-awl-ſhaped, revolute at the edges; racemes unilateral; calyxes ſmooth." Willd. *Stem* half a foot high; branches numerous, oppoſite, ſtiff, and ſtraight, cloathed with a ſhort hoary down. *Leaves* oppoſite, nearly ſeſſile, with a few hairs at the tip. *Flowers* white, larger than the calyx; calyx ſtriated. 76. C. *ſurrejanus*, Linn. Sp. Pl. 28. Mart. 34. Lam. 47. Willd. 55. (C. helianthemum δ. Hudſ. Flor. Ang. 233. Helianthemum vulgare, petalis florum perangustis, Dill. in Rai. Synop. 341. Hort. Elth. tab. 145. fig. 174.) "Somewhat ſhrubby; leaves ovate-oblong, hairy underneath, dotted; petals lanceolate. *Stems* proſtrate, ſimple, leafy, cylindrical, cloathed with depreſſed matted hairs. *Leaves* petioled, obtuſe, flat, quite entire, nearly naked above, hairy, and ſtudded with hollow points underneath, green on both ſides, not hoary. *Stipules* two, lanceolate, ciliated. *Flowers* yellow, erect, racemes terminal, ſolitary, ſimple, many-flowered, recurved, pubeſcent, bracteate; calyx hairy, with red nerves; petals very narrow, acute, generally longer, but ſometimes ſhorter than the calyx. *Capſule* one celled, or obſcurely three-celled. Dr. Smith. Found by Edward du Bois near Croydon, in Surrey, whence Linnæus formed its trivial name. It does not appear to have been obſerved wild in any other ſituation, either in or out of England. It is diſtinguiſhed from C. *helianthemum*, to which it is nearly allied, by the remarkable form of its petals. 77. C. *polyanthos*, Willd. 56. Desfont. Flor. Atl. i. tab. 108. "Somewhat ſhrubby; lower leaves hoary underneath; ſtem ones green on both ſides, ciliated; calyxes hiſpid; racemes panicled. *Stems* a foot high, numerous, cylindrical, villous, rough, with tubercles. *Leaves* oppoſite, petioled, obtuſe, veined underneath; lower ones egg-ſhaped, ſmaller; upper ones ovate-oblong, or lanceolate. *Stipules* four, petioled, linear-lanceolate, rather obtuſe, longer than the petiole. *Flowers* yellow, ſmall, longer than the calyx; racemes erect, drooping before the flowers open; peduncles filiform; pedicels capillary; bractes linear, ſhorter than the pedicels; calyx cloathed with numerous, white, ſoft, ſpreading hairs. *Capſule* ſmall, villous at the tip. A native of the north of Africa. 78. C. *glaucus*, Willd. 57. Cavan. Ic. iii. tab. 261. "Somewhat ſhrubby, aſcending; leaves tomentous, glaucous, revolute at the edges; lower ones egg-ſhaped, upper ones lanceolate; racemes unilateral." *Petals* yellow, longer than the calyx, roundiſh, crenulate at the edges. A native of Spain. 79. C. *croceus*, Willd. 75. Desfont. Flor. Atl. i. tab. 110. "Somewhat ſhrubby, pubeſcent, cloathed with very ſhort ſtellated hairs; leaves elliptic, obtuſe." A foot high. *Stems* numerous, erect, cylindrical, tomentous, ſomewhat hoary. *Leaves* oppoſite, petioled, ſomewhat hoary underneath, revolute at the edges, pubeſcent on both ſides; with cloſe-ſet ſhort ſtellated hairs; lower ones ſmaller, roundiſh, middle ones elliptic, obtuſe; upper ones lanceolate, ſomewhat acute. *Stipules* four, awl-ſhaped, a little longer than the petiole. *Flowers* ſaffron-coloured; racemes, before the flowers open, convolute; bractes lanceolate, pubeſcent, the length of the pedicels, calyxes pubeſcent, angular, yellowiſh; petals quite entire. Nearly allied to the preceding, but diſtinct. A native of Spain, and the north of Africa. 80. C. *nummularius*, Linn. Sp. Pl. 29. Mart. 35. Lam. 48. Willd. 58. (Helianthemum ad nummularia accidens, J. Bauh. Hiſt. ii. p. 20. Tourn. 249. Ciſtus humilis, ſ. chamæciſtus nummulariæ folio, Mag. Monſp. 293.) "Somewhat ſhrubby; lower leaves orbicular; upper ones egg-ſhaped." Linn. *Stems* long, trailing, much branched. *Leaves* oppoſite, petioled, ſlightly villous; lower ones whitiſh underneath; all of them green on the upper ſurface. *Stipules* three, narrow, erect. *Flowers* large, white, in terminal racemes. Found by Magnol on Mount Capouladon near Montpelier. J. Bauhin received it from Baſil. 81. C. *ciliatus*, Willd. 70. Desfont. Flor. Atl. i. tab. 109. "Somewhat ſhrubby, procumbent; branches tomentous; leaves narrow, lanceolate, villous; calyxes membranous, with ciliated angles." *Stems* a foot high, branched at the baſe. *Branches* ſingle, cylindrical, hoary. *Leaves* oppoſite, on ſhort petioles, hirſute on the upper ſurface, caneſcent and tomentous underneath, revolute at the edges. *Stipules* four, linear, longer than the petiole. *Flowers* roſe-coloured; racemes terminal, revolute before the flowers open; bractes linear-lanceolate; two outer leaves of the calyx ſmall, linear. *Capſule* roundiſh, covered by the calyx. A native of ſandy hills in the north of Africa. 82. C. *anguſtifolius*, Murray Syſt. Veg. p. 500. Mart. 43. Willd. 71. Jacq. Hort. iii. tab. 53. "Somewhat ſhrubby, diffuſe; leaves lanceolate; calyxes hirſute." *Root* branched. *Stem* cylindrical, woody, branched from the baſe; younger branches, leaves, ſtipules and racemes ſlightly villous and hoary. *Leaves* oppoſite, ſomewhat acute, quite entire, rough on both ſides, on ſhort petioles. *Flowers* yellow, orange-coloured in the centre; racemes terminal, many-flowered, erect; pedicels bent back as the fruit ripens; ſtipules and bractes deciduous; outer calyx-leaves linear; inner ones egg-ſhaped, acute, nerved; petals either quite entire, or crenulate about the edge. *Capſule* hirſute, egg-ſhaped, Jacq. 83. C. *helianthemum*, Linn. 33. Mart. 44. Lam. 49. Willd. 72. Curt. Flor. Lond. Faſc. 5. tab. 36. Flor. Dan. tab. 101. Eng. Bot. 1321. (Chamæciſtus vulgaris, flore luteo, Bauh. Pin. 465. Helianthemum vulgare, Tourn. 248. Gært. tab. 76. fig. 11.) "Somewhat ſhrubby; ſtipules lanceolate; leaves oblong, revolute, ſomewhat hairy." Linn. "Somewhat ſhrubby, procumbent; leaves oblong, revolute, hoary underneath; calyxes ſomewhat hirſute." Lam. *Stems* generally ſimple, cylindrical,

cylindrical, leafy, hairy. *Leaves* small, various in size, elliptic, obtuse, on short petioles, entire green, and cloathed with simple hairs above; white, downy, and hairy underneath. *Stipules* acute, green on both sides, ciliated. *Flowers* bright yellow, in terminal racemes, on hairy peduncles; calyx coloured with hairy ribs; petals roundish, obscurely crenate; stamens the length of the style, erect; when touched with a pin or bristle, retiring from the style, and lying down in a spreading form upon the petals; but this can be seen only in calm warm weather, and when the flowers have not been ruffled by insects. Dr. Smith. A native of England, and other parts of Europe, chiefly on a calcareous soil, and flowering in July and August. It varies with paler and with white flowers. Willdenow makes C. *roseus* of La Marck with rose-coloured flowers only a variety. 84. C. *grandiflorus*. Mart. 51. Scop. Carn. n. 648, tab. 25. Allion. Ped. n. 4. (Helianthemum alpinum, vulgari simile, foliis latioribus; Bauh.) "Somewhat shrubby; leaves lanceolate, villous on both sides, acuminate; stipules longer than the calyx." *Stem* about six inches long, villous. *Leaves* an inch long. *Flowers* yellow, racemed; peduncles and calyxes villous; outer calyx-leaves linear; inner twice as long; petals almost half an inch in length. Allioni doubts whether it be distinct from the preceding species; but Scopuli asserts that it differs in the whole appearance of the flower, length of the racemes, and hardness of the leaves. 85. C. *mutabilis*, Mart. 45. Willd. 73. Jacq. Ic. 1. tab. 99. Misc. 2. p. 340. (C. hispidus γ, Lam. who says it is the effect only of cultivation.) "Somewhat shrubby, procumbent; stipules lanceolate; leaves oblong, smooth, flat." Native country unknown. *Flowers* either pale yellow or rose-coloured. 86. C. *hirtus*, Linn. Sp. Pl. 34. Mart. 46. Willd. 76. "Somewhat shrubby, leaves egg-shaped; calyxes hispid," Linn. *Stem* erect, much-branched. *Leaves* very narrow, opposite, revolute, bright green above, hoary underneath. *Flowers* white, large, in small terminal racemes. A native of Spain and the south of France, cultivated by Miller in 1759. Professor Martyn quotes C. rosmarini foliis of Allioni as a synonym; but the calyx of Allioni's plant is only whitish, with nothing rough or hairy about it. It seems therefore to be a distinct species. 87. C. *barbatus*. Lam. 50. (C. pilosus β, Willd. Helianthemum f. Cistus humilis, flore sampsuci, capitulis valde hirsutis; J. Bauh. 2. p. 20. Tourn. 249.) "Somewhat shrubby, erect; leaves egg-shaped, hairy, green on both sides; racemes hirsute-bearded." *Leaves* opposite, petioled, villous above and underneath. *Flowers* yellow, in terminal racemes, less loose than those of C. helianthemum. Lamarck suspects that this plant may be one and the same with the preceding, excluding the synonyms quoted by Linnæus; but C. hirtus of Linnæus, or at least of Miller, has its leaves hoary underneath; whereas those of Lamarck's barbatus are green on both sides. 88. C. *glutinosus*, Linn. Mant. 246. Mart. 39. Lam. 51. Willd. 65. Cavan. Ic. 2. tab. 145. fig. 2. (Chamæcistus incanus, tragorigani folio; Barrel. Ic. 415. Helianthemum folio thymi incano; J. Bauh. 2. p. 19 Tourn. 249.) "Somewhat shrubby; leaves linear, opposite and alternate; peduncles villous, glutinous." Five or six inches high. *Stem* much branched from the bottom. *Branches* regular, pubescent, viscous. *Leaves* of a cinereous green colour, small, somewhat acute, revolute, not much more than three lines long. *Flowers* yellow, small, in a loose terminal raceme. *Capsules* small, globular, three-celled. Lam. A native of the south of Europe. 89. C. *thymifolius*, Linn. Sp. Pl. 31. Mart. 40. Willd. 66. (C. glutinosus β. Lam. Chamæcistus luteus, thymi folio, oliganthes; Barrel. Ic. 444. Cistus alpina humilis, foliis thymi minutissimis; Pluk. tab. 84. fig. 5.) "Somewhat shrubby, procumbent; leaves linear, opposite, very short, clustered." Linn. A native of Spain and the south of France. 90. C. *ferrugineus*, Lam. 52. (C. minor thymi folio, flore ferrugineo; Burr. rar. tab. 285.) "Somewhat shrubby; leaves alternate, lanceolate, flat; lower ones somewhat linear; peduncles lateral, one-flowered." *Root* woody, long, rather thick. *Stems* from five to eight inches long, somewhat woody, diffused, leafy, pubescent towards the top. *Leaves* small, acute, greyish green. *Stipules* two, opposite, very small, acute. *Flowers* ferruginous or reddish yellow, solitary; peduncles and calyxes pubescent. *Capsules* globular, three-celled. A native of Spain. 91. C. *arabicus*, Linn. Sp. Pl. 37. Mart. 49. Willd. 79. Desfon. Flor. Atl. 1. p. 419. Vahl. Symb. 2. tab. 35. (C. ferrugineus; β. Lam.? Helianthemum creticum, linariæ folio, flore croceo; Tourn. Cor. 18.) "Somewhat shrubby; leaves alternate, lanceolate, flat, even-surfaced." Linn. "Somewhat shrubby, procumbent; leaves linear; those of the peduncles alternate, those of the smaller branches crowded." Vahl. *Stem* branched from the bottom. *Branches* often a foot long, at first procumbent, afterwards ascending, slender, cylindrical, smooth; branchlets numerous, alternate, distant, widely spreading; lower ones barren; upper ones floriferous, quite simple, elongated, cinereous, pubescent. *Leaves* of the barren branchlets crowded, marked with two lines, declining, linear, stiffish, without veins, rather obtuse; upper ones tomentose-ash-coloured. *Stipules* minute, egg-shaped. *Leaves* of the floriferous branchlets broader, longer, pubescent. *Stipules* lanceolate. *Flowers* three or four in a terminal raceme, without bractes; pedicels distant, hairy, and somewhat viscid towards the top, a little thicker under the flower; calyx hairy, somewhat viscous; inner leaves three-nerved, membranous between the nerves; outer ones lanceolate. Vahl. Vahl's plant came from Spain. According to La Marck, Tournefort's plant from the island of Candy differs from the preceding species only in being larger, less pubescent, with a little longer leaves; but he is dubious whether it be C. arabicus of Linnæus. 92. C. *racemosus*, Linn. Mant. 76. Mart. 42. Lam. 53. Willd. 69. Vahl. Symb. 1. p. 39. Cavan. Ic. 2. tab. 140. (C. lavandulæ folio, thyrsoides; Barr. ic. 293.) "Somewhat shrubby; leaves lanceolate-linear, tomentous underneath." Linn. "Somewhat shrubby; leaves lanceolate-linear, tomentous underneath; racemes terminal, unilateral; calyxes even-surfaced, angular. Lam. *Stem* nine or ten inches high. *Branches* numerous, erect, very slender, whitish, and slightly cottony towards the top. *Leaves* opposite, narrow, about an inch long, revolute, cottony and whitish underneath, green above, with a longitudinal furrow. *Stipules* awl-shaped. *Flowers* in long, terminal, upright racemes. Lam. A native of Spain. 93. C. *lavandulifolius*, Mart. 64. Lam. 54. Willd. 68. Vahl. Symb. 1. p. 39. Desfont. Fl. Atl. 1. p. 47. (C. folio spicæ; Bauh. Pin. 465. C. lavandulæ latifoliæ folio. Barr. ic. 288. Good. Helianthemum lavandulæ folio, Tourn. 249.) Somewhat shrubby, erect; leaves lanceolate, revolute, somewhat hoary; racemes terminal, incurved; flowers crowded." Lam. *Stem* about a foot high, woody. *Branches* opposite, upright, whitish near the top. *Leaves* opposite. *Stipules* four, small, villous, narrow, acute. *Flowers* yellow, small; racemes terminal, a little branched, at first short and curved; calyxes whitish, a little cottony; its leaves bordered with white silky hairs. When not in flower, the whole plant greatly resembles common lavender. A native of Spain, the south of France, Tunis, and Syria. According to La Marck, C. Syriacus of Jacquin and Martin, described above, n. 54. is only a variety of this species, with

with larger, lefs revolute, and not lefs white leaves. Willd. gives it as a fynonym, and not even a variety. 94. C. *appenninus*, Linn. Sp. Pl. 35. Mart. 47. Willd. 77. (C. hifpidus β. Lam. 55. Helianthemum faxatile, foliis & caulibus incanis oblongis, Apennini montis; Retz pug. tab. 8. Dill. Elt. 176. "Shrubby, fpreading; leaves lanceolate, hairy." *Stem* a foot high, branched. *Leaves* green and rough, with hairs on the upper furface, hoary underneath. *Flowers* white. 95. C. *hifpidus*, Lam. 55. (Chamæciftus folio thymi, incanus. Bauh. Pin. 466. Helianthemum flore albo, folio angufto, hirfuto. J. Bauh. 2. p. 17. Tourn. Inft. 248. "Somewhat fhrubby, erect; leaves oblong, hairy on the upper furface, tomentous underneath; calyxes hairy-hifpid." Lam. *Stems* near a foot high, diffufe, branched. *Branches* flender, whitifh, and villous near the top. *Leaves* oppofite, revolute. *Flowers* white, in terminal racemes. A native of Italy and the fouth of France, diftinguifhed from the next fpeci s by its very hifpid calyxes. 96. C. *pilofus*, Linn. 32. Allion. ped. n. 1672, tab. 45. fig. 1, 2. "Somewhat fhrubby, rather erect; leaves linear, two-furrowed, underneath hoary; calyxes fmooth and even." *Flowers* white; bractes folitary, at the fide of the pedicels. A native of Spain, Piedmont, and the fouth of France; cultivated by Miller in 1759. 97. C. *fœtidus*, Willd. 74. Jacq. ic. 1. tab. 98. Mifc. 2. p. 341. "Somewhat fhrubby, procumbent; ftipules lanceolate; leaves oblong, hirfute, fcabrous." *Flowers* white. The whole plant has the fœtid fmell of bryony. 98. C. *polifolius*, Linn. Sp. Pl. 36. Mart. 48. Lam. 56. Willd. 78. (C. humilis, Pluk. Alm. 107. tab. 23. fig. 6. Helianthemum foliis poli montani; Tourn. Inft. 249. Dell. Elt. tab. 145. fig. 172.) "Somewhat fhrubby, procumbent, with a ftarlike pubefcence; leaves oblong, revolute, tomentous-hoary underneath." Dr. Smith. The habit of C. helianthemum, but very diftinct. *Stems* from five to eight inches long, tomentous, with clofe-preffed hairs. *Leaves* green above, with fcattered ftarlike hairs, white underneath, and denfely cloathed with ftarlike down, marked with a very prominent nerve. *Flowers* white; calyx hairy, chiefly on the nerves; hairs bundled or ftarlike. *Capfule* obfoletely three-celled. Dr. Smith. A native of England and France. 99. C. *fplendens*, Lam. 57. (Helianthemum album Germanicum, Tabern. ic. 1002. Tourn. 248.) "Somewhat fhrubby, erect; leaves lanceolate, linear, green and fhining above, hoary underneath; calyxes fmooth and even." About a foot high. *Stem* branched from the bottom. *Branches* very flender, cylindrical, fmooth, chiefly erect. *Leaves* oppofite, petioled, a little revolute, near an inch long. *Flowers* white, fmall, peduncled, in terminal racemes; calyxes greenifh, with brown nerves; claws of the petals and ftamens yellow. A native of Germany and France.

(2.) *Stem herbaceous.*

100. C. *punctatus*, Willd. 46. "Erect, pubefcent; raceme terminal; leaves oppofite, oblong; lower ones inverfely egg-fhaped." *Root* annual. *Stem* about three inches high. *Branches* erect, ftiff, oppofite, fimple, fhorter than the ftem. *Leaves* opp fite, petioled; lower ones obtufe; upper ones rather acute. *Stipules* linear-lanceolate. *Flowers* in an elongated, terminal raceme; peduncles one-flowered, erect; bracte ovate-lanceolate, fmall, not at the bafe, but about the middle of the peduncle; outer-calyx-leaves linear, fpreading. Defcribed by Willdenow from a dried fpecimen; native country unknown. 101. C. *ledifolius*, Linn. Sp. Pl. 24. Mart. 28. Lam. 58. Willd. 47. (C. ledi folio, Bauh. Pin. 465. Lob. Ic. 2. 118. Helianthemum ledi folio, Tourn. 249.) "Erect, fmooth; flowers folitary, nearly feffile, oppofite to the ternate leaf." Linn. "Pubefcent; leaves lanceolate; peduncles erect, fhorter than the calyx." Dr. Smith. *Root* annual, fmall, a little branched. *Stem* from fix to nine inches high, rather erect, generally fimple, fometimes branched from the bottom, cylindrical, hirfute, leafy, few-flowered. *Leaves* oppofite, petioled, obtufe, quite entire, narrowed at the bafe, pubefcent on both fides. *Stipules* two, lanceolate, acute, three times fhorter than the leaf. *Flowers* yellow, oppofite to the leaves, erect, on fhort peduncles; calyx-leaves acuminate, nerved, hirfute; petals fhorter than the calyx, foon falling off. *Capfule* about the length of the calyx, fmooth, one-celled. Dr. Smith. According to La Marck, there are four ftipules, growing in pairs, and almoft as large as the leaves near the top of the plant. A native of England and France. 102. C. *niloticus*, Linn. Mant. 246. Mart. 30. Willd. 49. (C. ledifolius, β, Lam.) "Erect, fomewhat tomentous; flowers in racemes, folitary, feffile, oppofite to the leaves." *Root* annual. *Stem* a foot high, fomewhat woody, cylindrical. *Branches* next the root afcending, fhorter than the ftem; towards the top of the ftem alternate, erect, few. *Leaves* oppofite, petioled, elliptic, fpreading, fomewhat tomentous, veined, longer than the joints of the ftem. *Stipules* four, fword-fhaped, half the length of the leaf, permanent. *Flowers* yellow; in a terminal, erect, ftiff raceme, alternate, accompanied by a leaf and two ftipules, fimilar to thofe of the ftem-leaves; calyx five-leaved, erect; the three inner leaves three-nerved, acuminate, two outer ones linear, fhorter, fpreading. A native of Egypt. Linn. La Marck afferts that it is merely a variety of the preceding, only a little larger, and without any pretenfions to be received as a diftinct fpecies. 103. C. *falicifolius*, Linn. Sp. Pl. 25. Mart. 29. Lam. 59. Willd. 48. (C. folio falicis, Bauh. Pin. 465. Lob. Ic. ii. p. 118. Helianthemum falicis folio, Tourn. Inft. 249. H. annuum humile, foliis ovatis, flore fugaci, Seg. Ver. iii. tab. 6. fig. 3. good.) "Spreading, villous; flowers racemed, erect; pedicels horizontal." Linn. *Root* annual. *Stem* branched from the bottom. *Branches* fpreading, about five inches long, cylindrical, pubefcent. *Leaves* petioled, fmall, oppofite and alternate, oval-oblong, rather obtufe, flightly wrinkled, cloathed with a fhort fomewhat woolly down. *Flowers* fmall, pale yellow or whitifh; peduncles alternate, lateral, and terminal, longer than the calyx, one-flowered. *Capfules* fmaller than thofe of the preceding fpecies, fcarcely longer than the calyx. A native of Spain, Portugal, and the fouth of France. 104. C. *ægyptiacus*, Linn. Sp. Pl. 26. Mart. 31. Lam. 60. Willd. 50. Jacq. Obf 3. tab. 68. "Erect; leaves linear-lanceolate, petioled; calyxes inflated, larger than the corolla." Linn. *Stem* five or fix inches high, very flender, generally fimple, but fometimes branched from the bottom, pubefcent towards the top. *Leaves* about an inch long, oppofite, on fhort peduncles; ending in a weak point, fmooth above, almoft imperceptibly villous underneath. *Flowers* yellowifh, very fhort, peduncled, alternate, drooping, in a terminal raceme; two outer calyx leaves very fmall, half open; the three others converging into fomething like an inflated, tranfparent bladder, remarkable for its ftrong, ciliated, purplifh nerves. *Capfules* enclofed in the calyx. A native of Egypt. In this now very extenfive intricate genus, Linnæus has thirty-feven fpecies in the Species Plantarum, with the addition of fix others in the two Mantiffas; La Marck, fixty; Profeffor Martyn, in his edition of Miller's Dictionary. fixty-fix; and Willdenow, feventy-nine.

Cistus *indicus*, Herm. Lugb. Rai. Hift. See Azalea *indica*.

Cistus *virginiana, perclymeni flore ampliori minus odorato*, Pluk. See Azalea *nudiflora*.

Cistus *virginiana, flore & odore perclymeni*, Pluk. Alm. Catesby. See Azalea *viscosa*.

Cistus *humilis æthiopicus*, Pluk. Mant. See Diosma *uniflora*.

[illegible] *folio majoranæ*, Bauh. Pin. See Telephium [illegible]

Cistus *urticæ folio*, Sloan. Ray. See Turnera *ulmifolia*.

Cistus *chamærhododendros mariana laurifolia*, Pluk. Alm. See Kalmia *latifolia*.

Cistus *sempervirens laurifolia*, Pluk. Alm. See Kalmia *angustifolia*.

Cistus *ledon foliis rosmarini ferrugineus*, Bauh. Pin. See Ledum *palustre*.

Cistus *pumilus montis Baldi*, J. Bauh. —— *chamærhododendros foliis confertis*, Pluk. Alm. See Rhododendrum *chamæcistus*.

Obs. Ancient authors differ much from each other in their application of the terms Cissus and Cistus. Cissus, Κισσος, in the Attic dialect Κιττος, is the proper Grecian name for the common ivy, hedera helix of Linnæus. Theophrastus, as might be expected, gives it in its Attic form, and so clearly describes it, as to leave no doubt of the plant intended. Of the plants which constitute the present Linnæan genus Cissus, none of which are natives of Greece, he appears to have had no knowledge. They resemble the common ivy in nothing but in being climbers; and even in that single point the resemblance is not complete, as they attach themselves to other bodies for support in a very different manner.

The word Κιττος occurs twice in our present copies of the "Historia Plantarum, lib. 6. cap. 1." near the end, and in immediate connection with it, cap. 2. at the beginning. But the critics suppose, with great probability, that the text is corrupt, and that the genuine reading is Κιστος. For, to say nothing of the improbability, that the citizen of Athens should depart from his native dialect, which he had elsewhere constantly preserved, there is a moral certainty that he could not have meant the common ivy, no less from the place which he has assigned it in his system, than from the characters which he has attributed to it. He had already described the common ivy, κισσος, or, as he spells it, κιττος, in that part of his work which treats of trees; an arrangement to which he was led by its thick arboreous stem or trunk when it is grown old. He is now proceeding to shrubs and herbaceous plants, *καὶ γαρ κισσυ* (lege *κιστυ*) *δυο γενη διαιρετι, το μεν ἄρρεν, το δε θηλυ. τῳ το μεν μειζον καὶ σκληροτερον καὶ λιπαρωτερον φυλλον εχειν, καὶ το ανθος επιπορφυριζον, αμφω δε ὁμοια αγριοις (ροδοις)· πλην ελαττω καὶ ασσμα* "For there are two kinds of cistus, one male, the other female; the former having larger, firmer and more succulent leaves, and a purplish flower; but both resembling the wild rose, though smaller and without scent." This description cannot be applied to the common ivy, but corresponds exactly with those species of cistus which were most familiar to this venerable naturalist, and are both of the ladaniferous kind. It is not a little surprising that he makes no mention of the ladanum itself. Dioscorides has amply supplied the omission, and has given a particular account of its medical properties, and of the manner in which it was then collected. Bodæus a Stapel, in his notes on Theophrastus, labours hard to prove that a different position of the accent gives a different meaning to the same word; and that Κίστος with the accent on the penultimate is the proper cistus, on the last syllable the common ivy. But after much learned disquisition, he appears to us to have very honestly left the subject just as he found it, without taking away or diminishing any part of its difficulties. Dioscorides ascribes rose-coloured flowers to what was then esteemed the male, and white ones to the female; and in this he sufficiently agrees with Theophrastus, except that the latter has not noticed the colour of the flowers of the female. It appears from Dioscorides, Lib. i. cap. 126, that in his time κιστος was called by some κισθος, κισθαρον, or κιστιαρον; the last two diminutives, one of κισθος, the other of κιστος. From these variations the confusion which prevails in succeeding writers seems to have risen. Galen calls the ivy κιστος, and the true cistus κισθος. Hesychius in his lexicon does the same. *Κισθος; θαμνος δ' αρρεν και θηλυ εστιν. Κισσος; ειδος φυτυ, η βλαστημα ηλισσομενον.* The epithet ελισσομενον can be referred only to the ivy, in direct opposition to Theophrastus. Paulus Œgineta also expressly asserts that κιστος is the ivy. Pliny, the natural historian, confounds the κισσος and κιστος of the Greeks, considering both of them as species of ivy, and passing from one to the other, as if they were the same plant. See Lib. xvi. cap. 38. He begins with stating from Theophrastus, that the ivy will not grow in India, and that Alexander, on account of its rarity, and, in imitation of Bacchus, crowned his army with it, on their triumphant return from that country. He then adds, without any intimation of a transition to another subject, "Duo genera ejus prima, ut rel quarum mas et fœmina. Major traditur corpore, et folio duriori, etiam ac pinguiore, et flore ad purpuram accedente. Utriusque autem flos similis est rosæ sylvestri, nisi quod caret odore." This description is taken from Theophrastus, and can be applied only to cistus. He was doubtless deceived by the corrupt reading in the copies of that author; but it is evident that in this instance he wrote without any personal knowledge of the latter plant. He finally proceeds in the same unbroken kind of narrative, "Species horum genera tres. Est enim candida et nigra edera, tertiaque quæ vocatur helix;" and so goes on through the rest of the chapter, describing the cissus or ivy. The Arabian writers are said to have laboured under the same confusion of ideas. The earlier modern botanists partook of the embarrassment; and we cannot wonder that the disciples should be puzzled, when their revered masters were thus perplexed.

Cistus, in *Gardening*, comprehends different plants of the rock-rose, or shrubby evergreen kind; of which the species chiefly cultivated are the poplar-leaved cistus, or rock-rose (C. *populifolius*); the bay-leaved gum cistus (C. *laurefolius*); the Spanish gum-cistus (C. *ladaniferus*); the hoary rock-rose, or rose-cistus (C. *incanus*); the sea purslain-leaved cistus (C. *halimifolius*); the Montpelier gum-cistus (C. *monspeliensis*); the Cretan ladaniferous-cistus (C. *creticus*); the white-leaved cistus (C. *albidus*); the curled-leaved cistus (C. *crispus*); and the sage-leaved cistus (C. *salvifolius*). But there are others that may equally deserve cultivation. These are all plants that rise to considerable height in the stems, having a branching shrubby growth.

Of the third sort there are varieties with large white flowers, and a purple spot in the middle of the petal, and with entire white flowers. The fifth has also varieties with numerous leaves and sulphur-coloured flowers, and with yellow flowers, with purple spots in their bases. And in the sixth there is a variety with olive-shaped leaves, and sulphur coloured flowers.

Method of Culture.—All these different sorts are capable of being either raised by seeds or cuttings in the common earth, or on hot-beds; but the seed-method is mostly practised, as it produces the best plants. The seeds should be sown in the early spring season in a warm border near half an inch deep, and the plants will come up in six weeks: or, to render

der them more forward, in pots, and plunged in a moderate hot-bed. When the plants are of ſome growth, they ſhould have the full air admitted to them in the frames in mild weather, and frequent waterings, as well as occaſional ſhade from the ſun, while young; and when an inch or two high, ſome may be planted out ſeparately in ſmall pots, others in rich borders, occaſional ſhade and water being given during the ſummer-months. In autumn the potted plants ſhould be removed to a frame, to have ſhelter from froſt. Thoſe in the full ground ſhould alſo be carefully ſhielded in froſty weather with mats. In ſpring, when the weather is ſettled, thoſe remaining in the ſeed-bed ſhould be planted out, and thoſe in pots ſhifted into larger ones, to be continued another winter, and in the ſpring following be planted where they are to remain in the open ground.

When the latter method is practiſed, cuttings five or ſix inches long ſhould be planted the ſpring or ſummer ſeaſons in beds of rich earth, occaſional ſhade and water being given. When well rooted, they ſhould be removed into ſeparate pots; but by being planted in pots in the ſpring, and plunged in a hot-bed, they are rendered much forwarder. In other reſpects they require the ſame management as the ſeedling-plants.

They are all beautiful evergreen ſhrubs, effecting a fine variety at all ſeaſons, both from their leaves being of different figures, ſizes, and ſhades of green and white, and their being very profuſe in moſt elegant flowers, which, though of ſhort duration, there is a daily ſucceſſion of new ones for a month or ſix weeks on the ſame plant; and where the ſeveral different ſpecies are employed, they exhibit a conſtant bloom of near three months.

They are moſtly of a ſufficiently hardy nature to proſper in the open ground in any dry ſoil; and if they have a ſheltered ſituation, it will be an advantage, as in open expoſures they are rather ſubject to injury from very ſevere froſts; for which reaſon a plant or two of each ſort ſhould be conſtantly potted, to have ſhelter in winter in the green-houſe, or ſome other ſimilar place, where they are to be well protected in ſevere weather.

The ſecond and fifth are the moſt tender ſorts, and of courſe demand more attention.

In ſetting them out in ſhrubbery borders and clumps, they ſhould be placed towards the fronts, in aſſemblage with other choice ſhrubs of ſimilar growth. All the ſorts ſhould be ſuffered to aſſume their own natural growth, the ſtraggling branches being only cut in with a knife as there may be occaſion.

CITADEL, or CITTADEL, Fr. *Citadelle*, a diminutive of the Italian *citta*, city, and denoting little city, in *Fortification*, a kind of fort, or ſmall fortification, conſiſting of four, five, or ſix ſides, with baſtions, commonly joined to towns, and ſometimes erected on commanding eminences within them. It is diſtinguiſhed from a caſtle by its having baſtions.

When the inhabitants of any town or place in a country, particularly if it be newly conquered, are diſpoſed to revolt, citadels are built to overawe them, and prevent all attempts on their part to ſhake off their dependence, as well as to ſecure the garriſon againſt any treachery, which they might meditate, or enter into againſt them.

It frequently happens alſo, as in Italy, that when a town is large and wealthy, has but few or no fortifications; and when the fortifying of it regularly would be attended with too great an expence, a citadel is built both to ſecure it againſt the attempts of an enemy, and to ſerve as a place of ſafety for the effects of the inhabitants in time of danger.

As to the ſituation of a citadel, if a town lies in a cleared and open country, it ought to be erected on the higheſt part of the ground, in order to overlook and command all the other parts, if poſſible. If the town lies near a river or lake, that is navigable, the citadel ſhould be placed at the entrance thereof, to prevent the approach of an enemy with ſhipping. And if the place is a ſea-port, the citadel ſhould be placed near the harbour, and in ſuch a manner as to command it throughout its whole extent, both for the protection of the ſhipping in the ſame, and for the ſecurity of the town againſt a bombardment.

Due attention ſhould be paid in erecting a citadel to the placing of it in ſuch a manner, that its works may look along and ſcour the principal ſtreets of the town, in order to fire on and diſperſe the mob in caſe of any tumult, inſurrection, or ſedition, and alſo to prevent the approach of an enemy that way, ſhould the town be taken. An open ſpace, called an *eſplanade*, ſeveral hundred yards broad, ſhould be left between the works of the citadel and thoſe of the town, for the purpoſe of drawing up, muſtering, and exerciſing the troops or garriſon on, and for preventing any ſecret or hidden approach, that might be carried on from the town againſt the citadel.

Citadels may be rectangular, ſquare, pentagonal, hexagonal, or of any other figure. But the pentagonal is the form moſt commonly made uſe of. The hexagonal form is generally conſidered as too large for one, and as requiring too great an expenditure for its utility, or the advantages to be derived from it; whilſt a work of the quadrangular, or ſquare form, is regarded as too inconſiderable, and incapable of making a ſufficient defence. The citadels of Liſle, Arras, Tournay, Amiens, are pentagons; thoſe of Montpellier, Bayonne, St. Martin de Ré, Havre de Grace, and Cambray, are ſquares; that of Perpignan is hexagonal; that of Metz is nearly rectangular; thoſe of Belle Iſle and Calais are quadrangular; that of Verdun is irregularly heptagonal; that of Valenciennes is quite irregular. And ſometimes they are found in the form of a ſtar-fort.

Sometimes a citadel is erected on a hill or eminence, within the fortifications of a place. One ſo ſituated is well calculated for keeping the inhabitants in awe, if its garriſon be ſufficiently provided with neceſſaries for defending themſelves till relief can be ſent to them. But it is of little uſe againſt an enemy that once gets poſſeſſion of the town itſelf.

The exterior ſides of a citadel, when it is regular, are generally each of them about 150 toiſes, or fathoms. But they may be more or leſs at pleaſure, as occaſion or the nature of the ground requires.

The citadel ſhould be fortified in a ſtronger manner than the town itſelf, to prevent the enemy's attacking it firſt, and by means of it afterwards reducing the other. And care ſhould be taken to make the parts, where the citadel joins the town, ſufficiently ſtrong to prevent both of them from being attacked together.

There are, for the moſt part, two gates to a citadel, the one for a communication with the town, and the other with the country. The former ſerves for the garriſon of the place to retire into the citadel, in caſe of an inſurrection or ſedition, or after the town has capitulated, and the latter for receiving aſſiſtance and ſuccour, when either the town is taken, or the citadel is blockaded by the inhabitants.

The citadel generally extends along, or takes up the two ſides of the fortification of the place that adjoin it, and ſhould be conſtructed in ſuch a manner, that the ditch of the place may be defended as directly as poſſible, either by the faces of its baſtions, or by thoſe of its ravelins, and that the enemy may have no advantage wherever they commence their

their attacks; so that if they attack the citadel in the first instance, the attempt may occasion to them as much trouble and loss of time as their attacking of the town first and the citadel afterwards.

It is but seldom that a citadel is joined to a town in such a manner as to furnish a direct defence for the ditch. This is a material defect; and, when it exists, shews that the citadel is not properly joined to the works of the place. Among others that might be mentioned, the citadels of Lisle, Arras, Tournay, &c. are greatly deficient in this respect.

In addition to what has already been said respecting citadels, it may not be improper to observe, that in an extensively fortified place a citadel may be formed, by uniting parts of its works themselves, such as a couple of adjoining bastions, by a good retrenchment with flanking defences. Such a one will be sufficient for keeping the inhabitants, who may be disaffected to the government of the place, in awe, and for preventing and suppressing insurrections. And the expence of making it is very trifling, compared to that of adding another fortification to that of the place. And such additional works seldom add strength to the works of a place in proportion to the expence of erecting them.

CITADINESCA, in *Natural History*, a name given by some writers to the Florentine marble, which is supposed to represent towns, palaces, ruins, rivers, &c. These delineations are merely accidental, and are usually much assisted by the imagination, though the natural lines of a stone may sometimes luckily enough represent the ruins of some ancient building, or the course of a river. We have in England a kind of a septaria, or ludus Helmontii, which has sometimes delineations of this kind considerably beautiful, though very irregular. The Florentine marble, as we see it wrought up in the ornaments of cabinets, &c. owes a great deal to the skill of the workmen, who always pick out the proper pieces from the mass, and dispose them in the work so as to make them represent what they please.

CITAMUM, in *Ancient Geography*, a town of Asia, placed by Ptolemy in Greater Armenia, near the Euphrates.

CITERIUS, a mountain of Macedonia, according to Ptolemy. Strabo calls it *Titarus*, and says that one of its extremities touched Mount Olympus.

CITATION, formed from *cito*, of *cieo*, *I stir up*, in the *Ecclesiastical Court*, a summons to appear before an ecclesiastical judge, on some affair relating to the church.

In the civil and ordinary courts it is called *summoning*. The ecclesiastical courts proceed according to the course of the civil and canon laws, by citation, libels, &c. A person is not generally to be cited to appear out of the diocese or peculiar jurisdiction in which he lives, unless it be by the archbishop in default of the ordinary; where the ordinary is party to the suit, in cases of appeal, &c. And by law a defendant may be sued where he lives, though it be for subtracting tythes in another diocese, &c. 1 Nels. 449. By the stat. 23 Hen. VIII. c. 9. every archbishop may cite any person dwelling in any bishop's diocese within his province for heresy, &c. if the bishop or other ordinary consents; or if the bishop or ordinary, or judge, omits to do his duty in punishing the offence. Where persons are cited out of their diocese, and live out of the jurisdiction of the bishop, a prohibition or consultation may be granted; but where persons live in the diocese, if when they are cited they do not appear, they are to be excommunicated, &c. The above statute was made to maintain the jurisdiction of inferior dioceses, and if any person is cited out of the diocese, &c. where the civil or canon law doth not allow it, the party aggrieved shall have double damages. If one defame another within the peculiar of the archbishop he may be punished there; although he dwell in any remote place out of the archbishop's peculiar. Godb. 190.

CITATION is also used in speaking of military and monastic as well as ecclesiastical courts. Such a heretic was cited to Rome, to a general council, &c.

Knights are cited to the general chapters of their order. King Edward I. of England was cited by order of Philip IV. of France, to a court of his peers; the citation was published by the seigneur d'Arrablay, seneschal of Perigord and Querci; and was pasted up by his order, on the gates of the city of Libourne, which then belonged to king Edward. And for default in not appearing, all his domains and effects in France were confiscated.

CITATION is also an allegation or quotation of some law, authority, or passage.

CITELLUS, or CITILLUS, in *Zoology*, the name of a small quadruped of the marmot tribe, the *arctomys citillus* of Schreber and Gmelin, and *mus citillus* of Pallas. Citillus is the old name under which Ray and Gesner describe this little animal; Buffon calls it *le zizel* and *le souslik*; Güldenstadt, *mus suslica*; and Pennant, the *casan* or *earless marmot*.

The earless marmot, as its trivial appellation implies, is specifically distinguished from the rest of the *arctomys* genus by being destitute of ears, the tail is villous, and body variegated. The prevailing colour is brown spotted, or otherwise diversified with white; the under parts white, inclining to yellowish, the tail is of a brown colour above and ferruginous beneath. The length is about ten inches and a half including the tail, the body only, from the tip of the nose to the base of the tail, measuring six inches. According to Pallas this animal varies, however, considerably in size as well as colour, for he assures us there are some varieties scarcely larger than the common water-rat, while others are nearly equal in size to the alpine marmot. The earless marmot is an inhabitant of several parts of Europe, being found in Bohemia, Austria, and Hungary, the southern part of Russia, from the banks of the Volga to India and Persia; through Siberia and Great Tartary to Kamtschatka; it occurs also in China and America.

The writings of Pallas afford us an interesting history of the manners of this little animal. He observes that it delights in dry hilly places, where the herbage is of short growth, although it is sometimes found in woods; they form subterraneous burrows in which they deposit their winter food, which consists chiefly of grain, roots, or nuts, for they do not appear to sleep during the winter season like some others of this genus. They breed in the spring, and produce from five to eight at a litter; they are sometimes seen in considerable numbers basking in the sun-shine near the entrances of their burrows, and when disturbed utter the same kind of shrill whistle as the common marmot. In a state of nature they are quarrelsome and ferocious among themselves, though they may be more readily tamed than most other animals. Vegetables are their principal food, but they also prey on small birds and animals. They are of an extremely cleanly disposition, and after feeding wash their faces and lick their fur after the manner of cats. Like other domesticated animals, they are fond of being caressed and feed readily from the hand; their sleep, according to Pallas, is extremely profound; it commences early in the evening and continues during the whole night, and even during great part of the day, when the weather happens to be cold or rainy.

Gmelin expresses some doubts whether this may not be the *mus ponticus* of Aristotle and Pliny. Some other late writers conceive that the *zizel* and the *suslic* of Buffon are

 distinct,

diſtinct, and that of conſequence the hiſtory of two different animals has been erroneouſly confounded by thoſe who conſider them as varieties only of a ſingle ſpecies.

CITERIA, ſmall figures which were made to ſpeak like our puppets, and which were carried before a Roman general on the day of his triumph. Theſe puppets uttered every kind of ludicrous words to excite the laughter of the people at the expence of the captives.

CITHÆRON, in *Ancient Geography*, a mountain of Greece in Bœotia, near the city of Thebes. Pliny and Mela ſay that it was conſecrated to the Muſes; and Plutarch ſays, that it was called "Arterius," before it was named Cithæron.

CITHARA, in *Ancient Muſic*, a ſtringed inſtrument, of the harp or lute kind. The idea of producing ſound from a ſtring, aſcribed to Apollo, was, according to Cenſorinus, *De Die Nat.* cap. 22. ſuggeſted to him by the twang of his ſiſter Diana's bow. Ψαλλειν is ſtrictly to twang a ſtring, and Ψαλμος the ſound which the bow-ſtring produces at the emiſſion of the arrow. Euripides in Bacch. v. 782, uſes it in that ſenſe,

——————— ——————— τοξων χερι
Ψαλλουσι νευρας.

Who twang the nerve of each elaſtic bow.

Father Montfaucon ſays it is very difficult to determine in what the lyre, cithara, chelys, pſaltery, and harp, differed from each other; as he had examined the repreſentations of 600 lyres and citharas in ancient ſculpture, all which he found without a neck, and the ſtrings open as in the modern harp, played by the fingers. Antiq. Expl. tom. iii. lib. 5. cap. 3. But though ancient and modern authors uſually confound theſe inſtruments, yet a manifeſt diſtinction is made by Ariſt. Quintil. in the following paſſage, p. 101. After diſcuſſing the characters of wind-inſtruments, he ſays, "Among the ſtringed inſtruments, you will find the lyre of a character analogous to *maſculine*, from the great depth or gravity, and roughneſs of its tones; the *ſambuca* of a *feminine* character, *weak* and *delicate*, and from its great *acuteneſs*, and the ſmallneſs of its *ſtrings*, tending to *diſſolve* and *enervate*. Of the intermediate inſtruments, the *polypthongum partakes* moſt of the *feminine*; but the *cithara differs not much* from the *maſculine character* of the *lyre*." Here is a ſcale of ſtringed inſtruments; the *lyre* and *ſambuca* at the extremes; the *polypthongum* and *cithara* between; the one next to the *ſambuca*, the other next to the *lyre*. He afterwards juſt mentions that there were others between theſe. Now it is natural to infer, that as he conſtantly attributes the manly character to gravity of tone, the cithara was probably the more acute inſtrument of the two; leſs loud and *rough*, and ſtrung with ſmaller ſtrings. Concerning what difference there might be in the form and ſtructure of the inſtruments, he is wholly ſilent. The paſſage, however, is curious as far as it goes, and deciſive. The cithara may perhaps have been as different from the lyre, as a ſingle harp from one that is double; and it ſeems to be clearly pointed out by this multiplicity of names that the Greeks had *two* principal ſpecies of ſtringed inſtruments: one, like our harp, of full compaſs, that reſted on its baſe; the other more portable, and ſlung over the ſhoulder, like our ſmaller harp or guitar, or like the ancient lyres repreſented in ſculpture.

Tacitus, Annal. xvi. 4. among the rules of decorum obſerved by public performers, to which Nero, he ſays, ſtrictly ſubmitted, mentions, "That he was not to ſit down when tired." *Ne feſſus reſideret*. It is remarkable that he calls theſe rules, *citharæ leges*, "the laws of the cithara;" which ſeems to afford a pretty fair proof of its being of ſuch a ſize and form as to admit of being played on *ſtanding*.

The uſe of the *phorminx* in Homer leads rather to the rough, manly, harp-like character. But a paſſage in Orpheus (Argon 381.) ſeems to make *phorminx* the ſame as *chelys*, the lutiform inſtrument of Mercury. It is there ſaid of Chiron, that he "ſometimes ſtrikes the cithara of Apollo; ſometimes the *ſhell-reſounding phorminx* of Mercury,"

Αλλοτε δ' αυ Φοιβου κιθαρην μετα χερσιν αρασσων,
Ηλιγυεσσαν φορμιγγα χελυκλονον Ερμαωνος.

This paſſage is curious; for though the Argonautics were not written by Orpheus himſelf, they have all the appearance of great antiquity.

The belly of a theorbo, or arch-lute, is uſually made in the ſhell-form, as if the idea of its origin had never been loſt; and the etymology of the word guitar ſeems naturally deducible from cithara; it is ſuppoſed that the Roman C was hard, like the modern K, and the Italian word *chitarra* is manifeſtly derived from κιθαρα, *cithara*.

In the hymn to Mercury, aſcribed to Homer, Mercury and Apollo are ſaid to play with the cithara *under their arms*, ver. 507. ὁ δ' ὑπωλενιον κιθαριζεν, *ſub ulna Citharâ ludebat*, "played with the Cithara *under his arm*." So in ver. 432. επωλενιον, at his arm, ſhould, according to the critics, be ὑπωλενιον, as it is afterwards. This ſeems to point out a guitar more than a harp; but the ancients had lyres, citharas, and teſtudos of as different ſhapes from each other, as our harp, ſpinet, virginal, and piano-forte.

Theſe paſſages in old authors are a kind of antique drawings, far more ſatisfactory than thoſe of ancient ſculpture; for we have ſeen the ſyrinx, which had a regular ſeries of notes aſcending or deſcending, repreſented with ſeven pipes, four of one length, and three of another, which of courſe would furniſh no more than two different ſounds. The cymbals too, which were to be ſtruck againſt each other, are placed in the hands of ſome antique figures in ſuch a manner, that it is impoſſible to bring them in contact with the neceſſary degree of force, without amputating, or at leaſt violently bruiſing the thumbs of the performer. And it is certain that artiſts continue to figure inſtruments in the moſt ſimple and convenient form for their deſigns, long after they had been enlarged, improved, and rendered more complicated. An inſtance of this in our own country will confirm the aſſertion. In the reign of George the Second a marble ſtatue was erected to Handel, in Vauxhall gardens. The muſician is repreſented playing upon a lyre. Now if this ſtatue ſhould be preſerved from the ravages of time and accident 12 or 1400 years, the antiquarians will naturally conclude that the inſtrument upon which Handel acquired his reputation was the lyre; though we are at preſent certain that he never played on, or even ſaw a lyre, except in wood or ſtone.

In one of the ancient paintings at Portici, we ſaw a lyre with a pipe or flute for the croſs-bar, or bridge, at the top; whether this tube was uſed as a wind inſtrument to accompany the lyre, or only a pitch-pipe, we know not; nor, within the courſe of our inquiries, has any example of ſuch a junction occurred elſewhere.

CITHARÆDIST, a performer on the cithara or lute.

CITHAREXYLUM, in *Botany*, (from κιθαρα, a *harp*, and ξυλον, *wood*) fiddle-wood. Fr. Guittaren, or Bois de Guittarre, Cotelet. Enc. Linn. gen. 760. Schreb. 1019. Willd. 1158. Gært. 339. Juſſ. 108. Vent. vol. ii. 320. Lam. Ill. Pl. 545. Claſs and order, *didynamia angioſpermia*.

mia. Nat. Ord. *Perfonatæ,* Linn. *Vitices,* Juff. *Pyrenaceæ*, Vent.

Gen. Ch. *Cal.* Perianth one-leafed, campanulate, fhort, toothed or truncated, permanent. *Cor.* one-petalled, funnel-fhaped; tube longer than the calyx; border wheel-fhaped, five-cleft; fegments oblong, villous on the upper furface, almoft equal. *Stam.* Filaments four in moft fpecies, with the rudiment of a fifth from the middle of the tube, fhorter than the tube, two of them fomewhat longer than the others; anthers oblong, didymous, erect. *Pift.* Germ fuperior, roundifh; ftyle filiform, the length of the ftamens; ftigma with an obtufe head. *Peric.* Drupe roundifh, flightly compreffed, one-celled, containing two nuts, each nut two-celled, egg-fhaped, hard, plano-convex, with an obfolete furrow on the back. *Seeds,* one in each cell of the nut, but in one of the cells fometimes abortive.

Eff. Ch. Calyx toothed or truncate. Corolla funnel-wheel-fhaped; fegments villous above, nearly equal. Drupe with two nuts; nuts two-celled.

Sp. 1. C. *cinereum*, Linn. Sp. Pl. 1. Mart. 1. Lam. 1. Willd. 1. Brown. Jam. 264. Pluk. Alm. tab. 162. fig. 1. (C. teres, Jacq. Amer. tab. 118. Pict. tab. 178. Jafminum arborefcens racemofum foliis lauri, Plum. MSS. Burm. Amer. tab. 157. fig. 2.) " Branches cylindrical; calyxes toothed," Linn. " Branches cylindrical; leaves oblong, acuminate, quite entire; racemes pendulous; calyxes toothed." A tree from fifteen to twenty feet high, not more than a foot in diameter, with a handfome branched head. *Branches* cinereous, fmooth. *Leaves* commonly oppofite, oblong-oval, acuminate at both ends, entire, bright green, and fhining on the upper furface, a little veined underneath, with a few hairs on the axils of the nerves; petioles yellowifh, with two or three concave mellifluous glands near their infertion into the leaf. *Flowers* white, numerous, fmall, fweet-fcented, on fhort peduncles, racemed; racemes from feven to nine inches long, quite fimple, terminal, pendulous, folitary, or accompanied by two or three fmaller ones at the bafe; corollas bearded at the mouth. *Fruit* roundifh, fucculent, fhining, foft, firft green, then red, finally black. Jacq. and La Marck. According to the latter, the branches in the plants cultivated at Paris are not cylindrical, as Linnæus defcribes them, but truly tetragonal. A native of Jamaica, where it is called Old woman's bitter; and of Martinico and St. Domingo, where it is called by the French Bois Cotelet. 2. C. *quadrangulare*, Mur. Syft. 564. Jac. Amer. 186. Hort. tab. 22. (C. cinereum β Lam.) It appears to be only a variety of the laft fpecies, as La Marck confiders it, differing chiefly in having the berries red, or lefs black when ripe. The branches are round, but made apparently quadrangular, by having four ribs running down them. 3. C. *caudatum,* Linn. Sp. Pl. 2. Mart. 2. Lam. 2. Willd. 2.? Brown. Jam. 265. tab. 28. fig. 2. Swartz. Prod. 234. " Branches cylindrical; calyxes truncate," Linn. A fhrub ten or twelve feet high. *Leaves* inverfely egg-fhaped, lefs acuminate than thofe of C. cinereus. *Racemes* terminal. *Fruit* fmall. A native of Jamaica. Willdenow gives the caudatum of Swartz, as a fynonym of quadrangulare; but as Swartz's plant has truncate calyxes, we apprehend there can be no doubt of its being the caudatum of Linnæus, and the plant defcribed by Browne, which is exprefsly ftated to have truncated calyxes. The C. erectum of Swartz, Prod. 91. Jacq. Ic. Rar. 3. tab. 501. quoted by Willdenow as a fynonym of caudatum, appears to us a diftinct fpecies, with toothed calyxes. 4. C. *villofum*, Mart. 4. Willd. 3. Jacq. Ic. Rar. tab. 118. Collect. 1. p. 72. Hort. Kew. 2. 349. " Branches tetragonal; leaves inverfely egg-fhaped, pubefcent underneath, fomewhat toothed at the tip; racemes nodding." A fmall tree, about ten feet high. *Trunk* and older branches round and cinereous; younger branches quadrangular and green; young fhoots villous. *Leaves* three inches long, oppofite, on fhort petioles, acute, firm, fomewhat rugged on the upper furface, extremely foft and villous on the under, with an oblong deep-green glandular hole on each fide of the petiole at the top. *Flowers* white, numerous, on fhort peduncles, villous all over, fweet-fcented; racemes half a foot long, terminal, pendulous; calyx truncate; according to Willdenow, obfoletely toothed, fo as to be almoft truncate; but in this as well as in his fpecific character of C. caudatum, he feems biaffed by a refolution to have a five-toothed calyx part of the effential character of the genus. A native of St. Domingo. 5. C. *fubferratum*, Willd. 4. Swartz Ind. Occ. 2, p. 1043. Prod. 91. " Branches tetragonous; leaves oblong, rigid, tranfparent at the tip, fomewhat ferrated; racemes rather erect, calyxes toothed." *Leaves* veined. *Racemes* terminal, panicled. A native of Hifpaniola. 6. C. *melanocardium*, Mart. 5. Willd. 6. Swartz. Prod. 91. Flor. Ind. Occ. 2. p. 1046. Brown. Jam. 265. (C. paniculatum, Gært. tab. 56.) " Branches tetragonous; flowers panicled, tetrandrous; leaves fomewhat wrinkled, veined underneath, a little fcabrous." A tree forty or fifty feet high, producing hard excellent timber; bark thick, whitifh, winding, like the fibres of the wood, in a loofe fpiral form. *Leaves* rather long, flightly ferrated. *Flowers* in terminal panicled racemes, tetrandrous, and, as we prefume, without the rudiment of a fifth ftamen. *Drupes* fmall, yellow, egg-fhaped, black, fmooth. *Seeds* oblong, a little quadrangular, reddifh. A native of Jamaica.

Propagation and Culture. The fecond and fourth fpecies are cultivated in England; and as they do not produce feeds in this climate, they are chiefly propagated by cuttings; but when feeds can be procured from the Weft Indies, the plants which proceed from them are much better. They require the fame kind of treatment as other tropical plants.

CITHARISTA, Ceireste, in *Ancient Geography*, a town of Gallia Narbonnenfis, at fome diftance from the fea, in the fame gulf with " Tauroentum," about ½ of a mile from each other. Veftiges of edifices erected by the Romans are ftill vifible.

Citharista *Portus*, a harbour of Gallia Narbonnenfis, now called the port of " Ceirefte."

CITHARISTES Promontorium, *Cape Lician*, a promontory belonging to Gaul, between Tauroentum and Obbia.

CITHARISTIC, in *Ancient Mufic*, mufic and poetry fitted to the accompaniment of the cithara.

CITHARIZUM, in *Ancient Geography*, a fortrefs of Afia, in Aftianena, a country of Greater Armenia.

CITHAROEDUS, in *Antiquity*, the fame with citharifta. The citharoedi had the preference of all other muficians, from whom they were diftinguifhed by an embroidered cloak, which was peculiar to them.

CITHENI Juga, in *Ancient Geography*, a name given by Pliny to mountains of Afia, which he places in Parthia, near the country called *Choara.*

CITHIBEB, in *Geography*, a town of Africa, in the kingdom of Morocco, and province of Tedla.

CITHRUM, in *Ancient Geography*, a town of Greece, in Theffaly.

CITILLUS. See Citellus.

CITIUM, Chiti, in *Ancient Geography*, a town on the fouthern coaft of the ifland of Cyprus, near the river Tetius, N.E. of Amathus. Jofephus fays, that this city was built by Cittim, the fon of Javan, and from him was called Citium, or, as Pliny has it, Cetium. It was the birth-place of Zeno the Stoic; and the place where Cimon the Athenian died, after having reduced great part of the ifland. Citium was epifcopal.—Alfo, the name of an ancient town of Macedonia.

CITIUS, a name given by Livy to a mountain of Greece, which was fituated towards Ætolia.

CITIZEN, or Cittizen, a native or inhabitant of a city, vefted with the freedom and rights thereof.

The word comes from *civis*, which authors derive from *ceo*, becaufe the citizens live together; or rather from *cieo*, *I call together*.

Auguftus, upon numbering the Roman citizens, found they amounted to upwards of four millions.

To make a good Roman citizen, there were three things required: that he was an inhabitant of Rome; that he were inrolled in one of the thirty-five tribes; and that he were capable of dignities. Thofe ftrangers to whom were granted the rights and privileges of Roman citizens, were properly only honorary citizens. By the Porcian law it was ordained, that no citizen of Rome fhould be put to death. It was alfo a privilege of the utmoft confequence to a Roman citizen, to have none but the people for his judges. Were it not for this, he would have been fubject in the provinces to the arbitrary power of a proconful, or of a proprætor.

The feventh law, *de incolis*, makes a great deal of difference between a citizen and a mere inhabitant. Birth alone made a citizen, and intitled to all the privileges of burgeffes; time could not acquire it, but the emperor could beftow it; and it was often given to men and cities as a reward of fome fpecial merit or fervices. It is not improbable that the citizenfhip of St. Paul, mentioned in the book of Acts (ch. xxi. 37. 39), was of this kind, fome of his anceftors having obtained it for fervices they had done to the Roman commonwealth in the wars. (See Grotius ad Acts xxii. 28.) This privilege was alfo bought, and that at a very great price, as Dio Caffius informs us (l. lx.). "The Romans," he fays, "having the preference above ftrangers, there were many who begged the citizenfhip of the emperor, and others who bought it of Meffalina, or the freed-men. By which means this privilege, which had been formerly bought at a great price, became fo cheap, that many people would fay, a man might be made a Roman citizen for a few pieces of broken glafs," υαλινα σκευη συντετριμμενα.

The Romans were anciently fo particularly careful to preferve even their common citizens from any mixture of fervile blood, that they prohibited all marriages between them and freed flaves, or their children. And it was decreed, as a fpecial privilege and reward to one Hifpala, of libertine condition, for her difcovery of the impieties of the Bacchanalian myfteries, that a citizen might take her to wife without any difgrace and diminution of his rights. Thefe diftinctions, indeed, began to be difregarded towards the end of the republic, with refpect to the ordinary citizens, but were kept up to the laft with regard to the fenate. See Senator.

In order to have a right to the title of citizen by birth at Athens, it was fufficient to be born of a father and mother who were both citizens; but the child of an Athenian, who married a foreign woman, was entitled only to the condition of his mother. This law was made by Pericles, and he executed it with fo much rigour, that nearly 5000 perfons, excluded from the rank of citizens, were publicly fold by auction. At firft, when it was neceffary to encourage the population of Attica, the title of citizen was beftowed on every perfon who came to fettle in that country. When that neceffity ceafed, Solon granted it only to thofe who fhould bring with them their families, or to perfons who, exiled for ever from their country, came thither in fearch of a fecure afylum. At length it was permitted to thofe who fhould render fervices to the ftate. This honour was ardently fought even by fovereigns, as long as the Athenians rigoroufly obferved the laws to prevent its being too eafily obtained; afterwards it was held in lefs eftimation. According to Ariftotle, the privilege of citizen ought to be granted only to him, who, free from every other care, dedicates himfelf entirely to the fervice of his country; and hence it would follow, that the name of citizen is imperfectly applicable to children and decrepit old men, and cannot appertain to artifans, labourers, and freedmen. Among the advantages which eftablifh or deftroy the equality of citizens, Ariftotle mentions three which merit fome confideration; liberty, virtue, and riches. In all governments, he fays, individual citizens are and ought to be in fubjection; and liberty, he adds, does not confift in doing whatever we pleafe, as is maintained in certain democracies, but in only doing what is enjoined by the laws, which fecure the independence of each individual; and in this point of view all the citizens may enjoy equal liberty. As our citizens, he fays, participate in the fovereign authority, they fhould be all equally interefted to maintain it, and deeply imbibe the fame love for their country; and they will be more or lefs free, in proportion as they are more or lefs virtuous. With refpect to riches, he obferves, that ancient legiflators judged it neceffary, in the commencement of a reformation, to divide property equally among all the citizens; but he maintains that a difference in riches may have place among citizens; but as this difference can occafion none in the diftribution of employments and honours, it will not deftroy that equality which ought to fubfift among them. They fhall be equal, becaufe they fhall only be fubject to the laws; and they fhall be all equally occupied in the glorious employment of contributing to the tranquillity and happinefs of their country. Arift. de Republ. lib. 2, 3, 4, 5.

Citizens *in Parliament*. See Burgesses.

Citizens *of London*. See London.

CITOIS, Citesius, Francis, in *Biography*, a learned and ingenious phyfician of Poitiers in France. He ftudied medicine at Montpellier, where he took his degree of doctor in 1596; after practifing a few years in his native city he went to Paris, and was foon placed at the head of the profeffion, being in high repute with cardinal Richlieu, and made his phyfician. He diftinguifhed himfelf, among other things, for his treatment of the Colica Pictonum, on which he wrote a treatife, containing a portion of practical knowledge, much fuperior to the ufual productions of that age. "De Novo, apud Pictones, Dolore Colico Biliofo," 1616, 8vo. It paffed through feveral editions. He thought the difeafe either appeared for the firft time in the year 1572, or was attended with fymptoms not noticed before; particularly with paralyfis of the extremities. He wrote an account of a girl, twelve years of age, who, after a fit of ficknefs, by which fhe had been much reduced, loft the inclination and the power of taking fuftenance of any kind; fhe had lived in this ftate three years, when Citois publifhed his account. As the ftory was incredible, it was not without opponents, which produced from Citois, "Abftinentia Puellæ Confolantaneæ ab Ifraelis Harveti Confutatione Vindicata," 1602, 8vo. It was the next year tranflated into Englifh, and publifhed in London. Citois, to fhew his perfect belief of the fact, added to this edition ftories of long abftinence both in men and beafts. It appeared however to have been a fraud, for the girl being removed from the care of her mother, took milk, and afterwards broths and then folid aliments. "De tempeftivo Phlebotomiæ ac Purgationis

tionis usu, adversus Homophobos, in collectione Opusculorum," Paris, 1639, 4to. He defends the use of bleeding in the small-pox, measles, and in fevers of an inflammatory type; he ordered the operation to be repeated six or seven times. He died at Poitiers, to which place he had retired in 1652, being 80 years of age. Haller, Bib. Eloy. Dict. Hist.

CITOLE, an old musical instrument, mentioned by Gower, supposed to be derived from *cistella*, a small chest, probably a kind of dulcimer.

CITOW, in *Geography*, a town of Bohemia, in the circle of Schlan; 10 miles S.E. of Raudnitz.

CITRARO, a town of Naples, in the province of Calabria Citra, near the coast of the Tuscan sea; 18 miles W. of Bisignano.

CITREÆ MENSÆ, called *thyina* by the Greeks, in *Antiquity*, tables made of the wood of the citrum-tree, very beautiful, and greatly esteemed by the ancient Romans. See CITRUM.

CITRIC ACID, *Acid of Lemons*, *Zitronensaure*, Germ. Lemon juice is one of the sourest and most agreeable of all the vegetable acids. It is procured simply by squeezing the fruit and straining the juice through linen or any loose filter. This juice forms a considerable article of commerce in Sicily, Italy, Majorca, and other parts of the Mediterranean. It is obtained by peeling the fruit, slicing it, and putting it in a strong press with a cloth or hair strainer. The juice, which comes out very turbid, is then placed for a day in a cool cellar and then strained into jars with very narrow necks, which are then well cemented up. A little oil is often previously poured on the juice to keep it more completely from the air. These presses are sometimes so large as to squeeze six thousand lemons at once.

Lemon juice is a fluid of about the specific gravity of 1.034, and therefore heavier than water, composed chiefly of water, which holds in solution vegetable mucilage, extractive matter possessed of some astringency, a little malic acid, and lastly that peculiar acid which, from its being contained more copiously in this fruit than in any other, is called the citric acid. The proportion of these ingredients of course must vary as in all native vegetable juices, but on an average (according to professor Proust), 576 grains of the fresh juice lose by evaporation 528 grains, which is the watery part; of the remaining 48 grains about 30 are the pure citric acid, and the rest is malic acid, mucilage, and extract. It is to the presence of these two latter ingredients that we may attribute the change that takes place in the juice by keeping, by which it becomes mouldy, undergoes an imperfect fermentation, and, at last, totally loses its acidity, and acquires a flat musty taste.

To prevent this destruction of the acid, for which alone lemon juice is valuable, many methods of preserving the juice have been devised, all of which answer to a certain degree, but none of them completely; and the only way of keeping the acid for a great length of time is first to extract it from the juice in the way which will be presently described, and to bring it to a solid state of crystallization.

Lemon juice is clarified partly by remaining perfectly at rest in a cold cellar for a day or two. Much of the mucilage then subsides, together with any accidental mixture of the pulp of the fruit, and the juice poured off clear, bottled, and carefully corked, will then keep for a considerable time. It keeps better if boiled briskly for a minute or two before it is set by to clarify, but this somewhat impairs the flavour, and gives another which is less agreeable. In the Mediterranean countries the juice is covered with oil, which, by preventing the action of the air, assists in preserving it; but after a while the juice beneath becomes bitter, mouldy, and turbid, and besides acquires from the oil a rank flavour.

Concentration of the juice by freezing is another method which is sometimes used with considerable success. If the mucilage is first separated as much as possible by standing in a *cool* place for a day or two, and the clear juice is then exposed to a cold of from 23° to 26° Fahr.; the watery part alone freezes, and the remaining unfrozen liquor of course contains the acid in a proportionably condensed state. By continuing to remove the ice as it forms as long as it remains tasteless, when the adhering liquor is washed off, lemon-juice may be concentrated to about one eighth of its original bulk, and is then clear, intensely sour, and will keep for some years unaltered in a cool climate. Still, however, much extract and some mucilage remain in it, and therefore in tropical climates even this concentrated juice spoils in no very great length of time. Besides, the process itself is only adapted for the winter season, and in hot climates the juice would generally be spoiled before a sufficient cold for this purpose would occur.

Another mode of preserving this juice, often adopted, is, to make certain additions to it, which lessen the tendency to fermentation. Forster found, during Cook's voyage to the south pole, that the juice, mixed with a fifth part of brandy or rum, and put in very well-closed casks, kept good for thirty-two months. Bragnatelli proposes to clarify the fresh juice by alcohol. Fresh lemon juice was mixed with some strong alcohol and bottled; in a few days a slimy mucilage had subsided, and the liquor after filtration contained the purer juice and the alcohol. This last may be recovered by distillation. But it is obvious that this is only a very imperfect clarification, since this liquor, on evaporation to dryness, yields only a sour gummy extract, and no crystallized acid. Some persons are in the habit of adding sulphuric, or some other mineral acid to the juice, partly to preserve and partly to adulterate it. This does, indeed, preserve the juice for a considerable time; but unless the purchaser can depend on the quantity of addition made, he might be exposed to serious loss and inconvenience, particularly when the juice is used in calico-printing, as will be presently mentioned, along with the method of discovering such adulteration.

A further method of preserving the juice, which is certainly the best for hot climates, and can often be performed in the large way at a moderate expence, is, by evaporating it considerably, and thus concentrating the acid in a smaller compass. The citric acid is less volatile than water, and indeed cannot be made to rise at all in distillation, like vinegar, without suffering considerable decomposition, and an actual and great loss of the acid. Hence when the fresh juice, previously clarified by rest, is exposed to a gentle heat, never exceeding the boiling point of water, most of the mere water which it contains flies off, and the juice may safely be inspissated to the consistence of thick syrup, without much loss of the acid, care being taken to avoid burning it. It is then intensely sour, and will keep in bottles for many years without alteration, and even retaining much of its original flavour. This inspissated juice, or *rob of lemons*, as it is called, if intended for the table, may be immediately mixed with dry white sugar, which is one of the best preservers from corruption, and it will then keep in closed bottles for any length of time unimpaired, and forms an excellent and extemporaneous lemonade, by the addition simply of water, which is a very valuable store for sea-voyages.

In very hot countries this inspissation may be begun and carried

carried on to a confiderable degree by the mere heat of the fun.

But the pure *citric acid* cannot be obtained by any fimple infpiffation, for its adhefion to the mucilage or extract of the juice is fo ftrong, that, however well it be previoufly clarified, the acid will never cryftallize by mere evaporation, but only feparates in a four gummy mafs when all the water is diffipated. To procure the pure cryftallized acid, a double procefs of chemical affinity is required; firft, to add fome earthy fubftance with which the acid alone unites, and forms an infoluble falt, to the exclufion of the extract or mucilage; and next, to difplace this acid from the earthy falt by means of another acid of ftronger affinity to the earth than the citric, and then this latter acid may be obtained pure by due evaporation of the fupernatant liquor, and cryftallizing. This very ingenious procefs was difcovered by Scheele, and has been fince followed, with flight variations, by every fucceeding chemift. The earth which this admirable chemift employed was lime, in the form of chalk, the fame that he had before ufed in the preparation of the concrete acid of tartar.

The procefs given by Scheele is, in a few words, the following: Saturate boiling lemon juice with chalk in powder added gradually, till all effervefcence ceafes. A grey infoluble mafs fettles to the bottom, compofed of the citric acid united with the lime, leaving the mucilage and other ingredients of the lemon juice in the fupernatant liquor, which may be thrown away, and the citrat of lime is to be well wafhed with *cold* water till the latter comes away colourlefs. Then, add to the precipitate a quantity of fulphuric acid, equal to the weight of chalk employed, but previoufly diluted with about ten parts of water. Boil the whole for a few minutes, and a change of compofition takes place, the fulphuric acid engaging the lime, and the citric acid paffing into the fupernatant liquor. Strain off the latter, and evaporate it flowly to the confiftence of a thick fyrup, and by ftanding for fome days, moft of the citric acid will feparate in large cryftals. A fmall excefs of fulphuric acid is requifite to enable the citric acid to cryftallize, which otherwife would only concrete into a gelatinous mafs.

Such is the procefs of this excellent chemift, to which he adds feveral valuable obfervations, which will prefently be mentioned; but as the preparation of this acid is now become of confiderable importance, it will be proper to compare the feveral proceffes and improvements propofed by other chemifts, particularly by Dizé (fee "Journal des Phyfique,"); by Weftrumb (fee Leonhardi in Macquer Worterbuch, art. Citronenfaure); by profeffor Prouft (fee Journ. de Phyf.); by Richter (Gren's Handbuch), and others.

In preparing the citric acid in the great way, M. Dizé gives the following particulars: After the citrat of lime has been decompofed by the fulphuric acid, *cold* water, affifted by ftirring, is fufficient to wafh out all the citric acid adhering to the fulphat of lime, which fhould therefore be employed, and thefe wafhings added to the filtered liquor. Much fulphat of lime, however, remains in the clear liquor, which, in fact, is a mixture of citric acid, fulphuric acid, and fulphat of lime, and is of a clear light yellow. It may be evaporated at a boiling heat, and as the bulk of fluid leffens, the fulphat of lime falls down, fo that it is of ufe to fufpend the evaporation once or twice for fome hours, to give time for the fulphat of lime to feparate, which fhould be removed. Towards the end of the evaporation the liquor becomes blackifh, owing to the fulphuric acid remaining in it, becoming fo concentrated as to act partly on the acid itfelf, and partly, as this chemift fuppofes, on a portion of the original extractive matter which accompanies the citric acid, in its combination with lime, and feparation from it, and which appears to be the caufe of the difficulty found in getting the whole of the acid to cryftallize. This acid is fo very foluble that the evaporation muft be pufhed to a very thick fyrupy confiftence before it will cryftallize. The cryftals are at firft black and dirty; by a fecond folution in cold water, of which a fmall quantity will fuffice, filtration, and evaporation, the cryftals are obtained yellow and more regular; but a third operation of the kind feems neceffary to bring them to be perfectly tranfparent and colourlefs. As there is much wafte in thefe operations, all the wafhings and fouled parts fhould be referved for fubfequent purification.

Scheele remarked, (and other chemifts have found the fame,) that an excefs of fulphuric acid, beyond what the lime requires for faturation, is neceffary in this procefs. M. Dizé fuppofes the peculiar ufe of this excefs of acid to be that of deftroying the fmall portion of extractive matter that remains in the calcareous compound; the exiftence of which he endeavours to prove, by the proportions of ingredients required, compared with their products. He found 100 lbs. of lemon juice to require for faturation 6.25 lbs. of chalk, and to produce as much as 20 lbs. of citrat of lime. On the other hand, he found the cryftallized citric acid to require its own weight of chalk for faturation, and to produce a quantity of citrat of lime equal to three-fourths of the weight of the two ingredients, the lofs being chiefly carbonic acid. Hence he concludes that 100 lbs of frefh juice contain 6.25 lbs. of the pure acid (being equal in weight to the chalk required), and that the citrat of lime, thence refulting, ought, if pure, to be no more than 9.378 lbs. being three-fourths of the fum of the weight of the chalk, and the eftimated quantity of pure acid. But as he finds it to be really 20 lbs., even after wafhing, he fuppofes this great difference to be made up by extractive matter precipitated along with the citrat of lime, and adhering to it.

However, the experiments of other chemifts do not give this difference, though they agree tolerably well in other particulars. M. Dizé does not fpecify the quantity of cryftallized acid actually obtained from a given quantity of juice.

Weftrumb faturated 4 lbs. of ftrained lemon juice with 3 oz. of chalk, and obtained 5 oz. and 1 dram of citrat of lime, which, decompofed by 23 drams of ftrong fulphuric acid, diluted with ten times its bulk of water, gave, by due evaporation, $2\frac{1}{2}$ oz. of cryftallized acid, and a little foul, which loft one dram by a fecond cryftallization.

Profeffor Prouft has examined the fame procefs, with attention to the actual quantities employed and obtained. The whole of the above experiments may be given in the following tabular form:

Lemon Juice.		Chalk.		Citrat of Lime.		Citric Acid.		Citric Acid.	
100 lbs.	require	4.25 lbs.	which	7.51 lbs.	yield	4.38 lbs.	and contains	4.74 lbs.	Prouft.
——	for	4.65	produce	8.0	by	3.90	by	——	Weftrumb.
——	faturation	6.25		20.0	evaporation	——	eftimation	6.25	Dizé.
Cryftal. Citric A.									
6.25	-	6.25	- -	9.375					Ditto.

With

With regard to the proportions given by Prouft, it is to be obferved, that only 7.51 lbs. of citrat of lime were actually precipitated; but by evaporation of the liquor he obtained about .54 lb. additional. The cryftallized acid was obtained from a known quantity of the wafhed citrat of lime, fix ounces of the latter giving $3\frac{1}{2}$ oz. of the acid, and hence 7.51 lbs. would yield 4.38 lbs., to which the additional .54 lb. of citrat would add .315 lb.; and a fmall portion of acid is alfo left in the laft liquor after all the cryftals have been removed, which the author eftimates at about $\frac{1}{100}$th of the quantity obtained, or about .049 lb., which together make a total of 4.74 of folid acid in 100 lbs. of the frefh juice.

The quantity of fulphuric acid required for the decompofition of the citrat is varioufly eftimated, but it fhould not be lefs of the concentrated acid than a weight equal to the chalk employed, of which latter rather more fhould be ufed than will faturate the juice. If a portion of the fame chalk is feparately faturated with the *diluted* fulphuric acid intended to be employed, and the refpective quantities noted, it will be a ftill better guide for the quantity of fulphuric acid to be ufed in the fecond decompofition, obferving always that a fmall *excefs* of this acid is required. The clear liquor which ftands above the citrat of lime in the firft procefs contains, befides the mucilage and extract, a portion of *malat of lime* in folution, which may be precipitated by alcohol if the liquor is reduced by evaporation. A fmall portion of gallic acid alfo appears in lemon juice, as it turns of a brown red on the addition of a folution of iron, and exactly faturating the liquor with an alkali.

To feparate the citric acid completely from the citrat of lime by the fulphuric acid, it is better to boil the whole for about ten minutes. The difficulty of feparating all the fulphat of lime and extract from the difengaged citric acid in the procefs of cryftallization has been already mentioned. This is affifted by adding a little alcohol towards the end of the firft evaporation, and fubfidence for fome hours, interrupting the heat.

Richter gives another procefs for preparing the citric acid, which is fimilar to that of Scheele for procuring the malic acid. It is the following: faturate lemon juice with potafh, and then add a folution of acetited lead, as long as any precipitate, which is very copious, continues to fall down. This is chiefly citrat of lead. Wafh it, and digeft with dilute fulphuric acid, as in the former procefs, which unites with the lead, and fets at liberty the citric acid; then evaporate the liquor to a thick confiftence, add a few drops of nitric acid and cryftallize.

The theory of this operation is the fame as in the former procefs, fubftituting oxyd of lead for lime, but with this difference, that the lemon juice muft be previoufly faturated with potafh, that the acetited lead may be decompofed by the citrat of potafh by *double* affinity; and to prevent any excefs of acid, by which the citrat of lead is readily diffolved, though, without fuch excefs, it is hardly in any degree foluble. However, when this acid is ufed for the table, it is certainly better to prepare it by chalk in Scheele's method, than by fo dangerous a fubftance as lead is, particularly in its acid combinations.

Lemon juice, when fold out of the fruit, is fometimes adulterated with the fulphuric acid. This may be detected in the following way: put a little of it in a glafs, and add a folution of acetited lead as long as any precipitate falls down. This confifts of citrat of lead, mixed with fulphat of lead, if any fulphuric acid was contained in the juice; and of thefe the former is immediately foluble in moderately dilute nitric acid, but the latter not fo. Add, therefore, a quantity of this acid, and if, on ftirring the mixture, the precipitate entirely difappears, and the liquor becomes clear, the lemon juice will be proved to contain no fulphuric acid; but if any of it remains, it will be a pretty fure indication of this acid.

Pure *citric acid* cryftallizes (according to Lowitz) in alum-fhaped cryftals, confifting of two four-fided pyramids joined bafe to bafe, or fometimes in rhomboidal prifms. Its tafte is intenfely four, and, when diluted, very grateful to the palate; but it is fimply an acid tafte, and retains nothing of the aromatic fragrance of the frefh fruit. It is very foluble, one ounce of diftilled water diffolving at a moderate heat, $1\frac{1}{4}$ oz. of the cryftallized acid, and confiderable cold is produced during the folution. Boiling water diffolves twice its weight of the acid. Thefe cryftals are not deliquefcent when pure. Diftilled, *per fe*, the products are an acid empyreumatic phlegm, carburetted hydrogen gas, and carbonic acid. It feems to be compofed of carbon and hydrogen with oxygen in unknown proportions.

If this acid is boiled with a little nitric acid, much nitrous gas is evolved, and the liquor yields by evaporation cryftals of oxalic acid. A greater proportion of nitric acid converts the whole into acetous acid, without giving any indications of paffing through the intermediate ftate of oxalic acid. Thus, Weftrumb obtained 30 grains of oxalic acid, by treating 60 grains of citric acid with 200 grains of nitric acid; with 300 grains of the latter, only 15 grains of oxalic acid, and with 600 grains, not an atom.

Vauquelin afferts that this acid may be obtained by paffing oxymuriatic acid gas through gum-arabic in water for a confiderable time.

The domeftic ufes of citric acid and lemon juice are well known, but of late the concentrated juice and the cryftallized acid have been employed very largely in calico-printing, as difchargers of colour, in order to produce with more clearnefs and effect the white figured parts of coloured patterns dyed with iron colours. It is not abfolutely neceffary to cryftallize the acid for this purpofe, but only to concentrate it. The mineral acids anfwer equally well as difchargers, but when fufficiently concentrated to do this effectually, they injure the texture of the cotton.

The citric acid being extremely expenfive, there may fometimes be reafon to apprehend an adulteration of it even in the cryftallized ftate. The tartaric and oxalic acids refemble it the moft in fenfible properties, and fuch an adulteration could hardly be detected without chemical means. The oxalic is fo expenfive, that it would not, we apprehend, be worth while to employ it for this purpofe; but the tartareous is much cheaper. Any confiderable admixture of this latter acid might be difcovered by the following fimple method: make a faturated folution of fulphat of pot-afh in cold water, and add to it fome of a faturated folution of the acid to be tried; if the tartareous acid is contained, the mixture will depofit in a fhort time a number of minute grains of tartar; but if it confifts only of citric acid, it will remain clear.

Citrats. Thefe are falts formed by the union of the citric acid with alkaline, earthy, and metallic bafes. Only a few of them deferve particular notice. They are all decompofed by heat, which burns off the acid.

Citrat of Pot-afh. This has long been known in medicine under the name of *Riverius's falt.* When ufed medicinally, it is prepared merely by faturating falt of tartar with lemon juice. About 12 to 16 parts of the latter will faturate one part of the common carbonat of pot-afh, or *kali præparatum.* This is fometimes taken in the act of effervefcence; but when this is the intention, the cryftallized carbonat

of

of pot-ash is by far preferable, on account of the large quantity of carbonic acid which it contains. To prepare it more accurately, according to Vauquelin, 36 parts of the cryftallized citric acid diffolved in water require for faturation 61 parts of cryftallized carbonat of pot-afh. This falt cryftallizes, though with difficulty, and is very deliquefcent; 100 parts contain about 55.5 of acid and 44.5 of alkali. It is decompofed by barytes and lime.

Citrat of Soda. This is a very foluble and cryftallizable falt. According to Vauquelin, 36 parts of citric acid require 42 of dry carbonat of foda, fo that 100 parts of this falt confift of 60.7 of citric acid and 39.3 of foda.

Citrat of Ammonia. This falt is employed in medicine as well as the citrat of pot-afh, and then is made extemporaneoufly by faturating lemon juice with carbonat of ammonia. When the folid acid is ufed, 36 parts of it will faturate 44 of carbonat of ammonia. Hence 100 parts of the falt, when dry, will contain 62 of acid and 38 of ammonia. It is very foluble, and difficult of cryftallization.

Citrat of Barytes. This falt confifts of equal weights of citric acid and barytes. When barytic water is poured into a folution of citric acid, a precipitate is formed which is immediately re-diffolved. But when it approaches the point of faturation, the barytic citrat is depofited in quantity, at firft pulverulent, afterwards in fine cluftered cryftalline needles.

Citrat of Magnefia. Thirty-fix parts of the acid require for faturation 40 parts of carbonate magnefia and 100 parts of the falt contain $33\frac{1}{2}$ of magnefia and 66 of real acid. This cannot be cryftallized, but when nearly evaporated to drynefs, the falt rifes in mufhroom-like knobs, white and opake.

Citrat of Lime. This falt, from being the intermede whence the acid is obtained from lemon juice, is by far the beft known. In its neutral ftate, it is but fparingly foluble in water, and the folution has but little tafte. But any excefs of acid renders it extremely foluble. An hundred parts of citric acid mixed with water, and boiled, diffolve 50 parts of citrat of lime. According to Vauquelin, 24 parts of the acid are faturated by 18 of calcareous fpar. Hence 100 parts of the citrat of lime contain 37.34 of lime and 62.66 of acid. Prouft found that 100 parts of the citrat wafhed and dried left by calcination 31.5 of lime, and hence the remaining 68.5 muft be acid and water. Dizé found that the acid required an equal weight of chalk for faturation; hence, fuppofing the chalk to contain 53 per cent. of lime, 100 parts of the dry citrat, quite pure, will confift of 65.4 of acid and 34.6 of earth. This falt kept under water in a warm place foon grows mouldy, the acid is decompofed, and the water is covered with a cruft of carbonat of lime. Citrat of lime is decompofed by the oxalic acid.

Metallic Citrats. Thefe have been but little examined. This acid diffolves zinc and iron readily, and moft of the other metallic oxyds with more or lefs eafe. The acid decompofes acetite of lead, and the citrat of lead is infoluble in water. Citrat of mercury is formed by adding this acid to the nitrat or acetite of this metal. The falt is a flaky precipitate of a brick duft red.

The affinities of this acid appear to be in the following order: barytes, lime, pot-afh, foda, ftrontian, magnefia, ammoniac, and alumine. The comparative affinities of the metallic oxyds have not yet been determined.

CITRIL, in *Ornithology.* See the next article.

CITRINELLA, in *Ornithology*, the citril finch, *citrinella* of Gefner, *Verzellina* of Olina, and *Venturon de Provence* of Buffon. This bird bears fome refemblance to the linnet, it is of a greenifh colour, with the back fpotted with brown, and the legs flefh-colour; its note is delightful, and it is for this reafon kept in cages in many parts of Italy. See FRINGILLA *citrinella.* The common yellow-hammer is alfo named fpecifically *citrinella*, but is of the *emberiza* genus. See EMBERIZA *citrinella.*

CITRINUS, in *Natural Hiftory*, the name of a peculiar fpecies of fprig cryftal, which is of a beautiful yellow. Many of the common cryftals, when in the neighbourhood of lead mines, are liable to be accidentally tinged yellow, by an admixture of the particles of that metal; and all thefe, whether finer or coarfer, have been too frequently confounded together, under the name *citrine.* It is never found colourlefs, like the other cryftals, but has a great variety of tinges, from that of deeper ochres to a pale lemon-colour. It is very plentiful in the Weft Indies, and is found in fome parts of Bohemia. Our jewellers have learnt from the French and Italians, who are very fond of it, to call it *citrine*, and often cut ftones for rings out of it, particularly out of the pyramid, which is always finer than the column, and thefe, after they have paffed through two or three hands, are generally miftaken for topazes.

CITRON, in *Botany.* See CITRUS.

CITRON-*water*, a well known ftrong water, or cordial, which may be thus made: take of fine thin lemon-peel eighteen ounces, of orange-peel nine ounces, perfect nutmegs one quarter of a pound, alcohol perfect, that is, the fineft and beft rectified fpirit of wine, two gallons and a half; digeft in balneo mariæ for one night; draw off with a flow fire; then add as much water as will juft make the mixture milky (which will be about feven quarts or two gallons) and add alfo about two pounds of fine fugar-candy.

This compofition may be improved by frefh elder flowers hung in a cloth in the head of the ftill, fprinkled with ambergrife in powder, or its effence. Otherwife; citron-water may be made, by taking dry yellow rinds of citrons three pounds; two pounds of orange-peel; three quarters of a pound of bruifed nutmegs; ten and a half gallons of clear proof fpirit, and one gallon of water, digefting them with a gentle heat, drawing off ten gallons in balneo mariæ, and dulcifying with fine fugar.

CITRON-*wood*, the wood of an American tree, called by the natives candle-wood, becaufe, being cut into fplinters, it burns like a candle. The tree is frequent in the Leeward Iflands, and grows to a confiderable fize; the leaves are like thofe of the bay tree, but of a finer green; the flower is fweet, and much like thofe of the orange; the fruit fucceeding thefe is black, and of the fize of a peppercorn. The trunk is fo like the yellow faunders in colour, that there was an opinion that it was the fame tree, and much of it was imported into Europe, and fold as fuch; but they were foon found to be different, the true faunders being of a fweet fcent, and but moderately heavy and refinous, but the citron-wood is confiderably heavy, very oily, and of a ftrong fmell. It is of no known ufe in medicine, but is ufed in France and Germany by the turners, being a firm fine-grained wood, and taking a fine polifh, and with age becoming of a very beautiful brown.

CITRONVOGEL, in *Ornithology*, one of the fynonymous names of the crefted oriole, *oriolus criftatus.* Gmelin.

CITROSINA, in *Botany*, Bofc. Nouv. Dict. Flor. Peruv. Pl. 29. Clafs and order, *diæcia icofandria.*

Gen. Ch. *Cal.* Perianth campanulate or pitcher fhaped; border four or eight-toothed. In the *male*, filaments from feven to fixty, petal-fhaped, ovate, flattened. In the *female*, germs fuperior, from three to ten; ftyles tubular; ftigmas fimple. *Peric.* Berry egg-fhaped, flefhy, umbilicate, covered by the calyx and crowned with its border, one-celled, opening unequally, and with elafticity, for the difperfion of the feeds.

 Seeds

Seeds from three to ten, egg-ſhaped, oſſeous, half enveloped in a fleſhy aril. Seven ſpecies, all ſhrubs, with the ſmell of the citron, are mentioned in the Flora Peruvienſis. Boſc.

CITRULLUS, in *Botany*, J. Bauh. See CUCURBITA *citrullus*.

CITRUM. The *citreæ menſæ* have been ſuppoſed by ſome to be made of the citron tree, and by others of the cedar; but it appears plainly that they were made of neither, but of a wood peculiar for its fineneſs, and very different from both. The ancient Greeks have deſcribed the ceder under the name κεδρ☉-, and the citron tree under the name *malus medica;* and beſide theſe, they have deſcribed another tree under the name of *thya*.

CITRUS, in *Botany*, (derivation unknown), Linn. Gen. 901. Schreb. 1218. Willd. 1391. Gært. 705. Juſſ. 261. Vent. vol. iii. 155. Claſs and order, *polyadelphia icoſandria*. Nat. Ord. *Bicornes*, Linn. *Aurantia*, Juſſ. *Heſperideæ*, Vent.

Gen. Ch. *Cal.* Perianth one-leafed, five-cleft, ſmall, withering. *Cor.* Petals five, oblong, ſpreading. *Stam.* Filaments about twenty, forming a cylinder, united at the baſe in ſeveral ſets or brotherhoods, awl-ſhaped, compreſſed, erect. *Piſt.* Germ ſuperior, roundiſh; ſtyle cylindrical, the length of the ſtamens. *Peric.* Berry with a fleſhy rind, many-celled; cells ſeparated from each other by a thin tranſparent membrane, filled with a mucilaginous pulp, in numerous ſeparate bladder-like veſicles. *Seeds*, cartilaginous, from one to four in each cell, attached to the interior angle.

Eſſ. Ch. Calyx five-cleft. Petals five. Stamens about twenty, polyadelphous. Berry many-celled.

Sp. 1. C. *medica*, Linn. Sp. Pl. 1. Mart. 1. Poir. 1. Willd. 1. (Malus medica, Bauh. Pin. 435.) "Petioles linear; leaves egg-ſhaped, acuminate." Willd. Citron. Miller mentions two kinds of the proper citron, one ſweet, with a thick rough-rinded fruit, which he calls C. medica; the other ſour, with a rough knobbed-rinded fruit, which he calls tuberoſa. *β*. C. Limon. Common lemon. Black tab. 362. Brown. Jam. 309. n. 6. Sloan. Jam. 2. 178. Lam. Illuſt. tab. 639. fig. 2. Woodv. Medical Botany, vol. iii. Pl. 184.) "Leaves ovate-lanceolate, acuminate, ſomewhat ſerrated." Miller. *γ*. C. acris. Lime. "Leaves egg-ſhaped, entire; branches ſomewhat entire." Miller. Miller has another variety which has ovate-lanceolate, ſomewhat ſerrated leaves, and the fruit in cluſters. All theſe varieties have linear petioles, and are therefore referred to one ſpecies by all botaniſts: but as, in popular language, they are known by different names, it were to be wiſhed that, upon minute inveſtigation, they might be found to poſſeſs diſtinct ſpecific characters. The fruit of the proper citron is oblong, with a very thick rind; that of the lemon oblong, with a nipple-like protuberance at the end; and that of the lime egg-ſhaped, without the protuberance, with a very thin rind, and about the ſize of the egg of a bantam hen, not half ſo large as a lemon; but theſe characters are not quite conſtant. According to Miller, the bark of the citron is ſmoother, and the wood leſs knotty, than that of the lemon. In their wild ſtate, ſome of them are ſaid to attain to the height of ſixty feet; in our greenhouſes they are neceſſarily reſtrained to a more moderate ſize. The citron is a native of all the warmer regions of Aſia. It was firſt introduced into Europe from Media, whence it obtained the name of malus medica. It ſeems to have been brought into Italy after the age of Virgil and Pliny, but before that of Palladius, who cultivated it with ſucceſs. Its fruit is ſeldom eaten raw, but preſerved as a ſweet-meat, in which form it is now ſent to North America and Europe from the Weſt Indies, where it has long been propagated. The lemon is alſo a native of the Eaſt, but, as well as the orange, has long been naturalized in the ſouth of Europe. Its juice is much uſed in England as an ingredient in the liquor called punch; mixed with ſugar and water, it affords a cooling beverage in hot weather, and is alſo introduced at the table as a condiment to different kinds of meat. Its virtues as an antiſcorbutic are well known; and on that account it is now generally carried on board ſhips deſtined for long voyages; but even when well depurated of its mucilage, it is found to ſpoil by long keeping. To preſerve it in purity, it is neceſſary that it be brought to a highly concentrated ſtate. See CITRIC *Acid*. Its rind is employed various ways in cookery, as a grateful aromatic bitter, not ſo hot as that of the orange. The lime is a native of the Eaſt, but has long been cultivated in the Weſt Indies and the warmeſt parts of North America. In what are called the ſea iſlands of South Carolina and Georgia, it is produced in great perfection. Its juice is eſteemed a much more grateful acid than that of the lemon, which is there in little repute, and comparatively ſeldom ſeen. A plate of limes is a conſtant diſh at entertainments in the Weſt Indies and the ſouthern ſtates of North America, and the juice is ſqueezed into ſoups, turtle, &c. by the gueſts. The lime in Jamaica, according to Brown, is a buſhy ſhrub ſeldom leſs than twelve or fourteen feet high, and by its ſpreading prickly branches affords an impenetrable fence to the ſugar cane plantations. Numerous varieties of all the kinds have been produced by cultivation, but the enumeration and deſcription of theſe are more properly within the province of the gardener than of the botaniſt. From one of them the perfume called BERGAMOT is obtained, which is ſaid to have derived its name from Bergamo in Italy, where the variety was firſt cultivated in Europe, and where it is ſtill preſerved. 2. C. *angulata*, Willd. 2. (Limonellus anguloſus; Rumph. Amb. 2. tab. 32.) "Petioles naked; leaves egg-ſhaped, acute; fruit angular." Certainly a diſtinct ſpecies. *Fruit* ſmall, glutinous, four or five-angled. *Peduncles* ſolitary, axillary. *Spines* two, ſtipular. Willd. 3. C. *madurenſis*, Lam. 8. Lour. Flor. Cochin. p. 570. n. 4. (Limonellus madurenſis, Rumph. Amb. vol. ii. tab. 31.) "Without thorns; branches diffuſe, angular; petioles linear; fruit globular; flower very ſmall." A ſhrub not more than three feet high. *Branches* crooked, often without ſpines. *Leaves* large, egg-ſhaped, rather acute, almoſt entire, quite ſmooth. *Flowers* near the extremities of the branches, almoſt ſolitary, ſweet-ſcented. *Fruit* globular, ſmall, even-ſurfaced, yellowiſh green, half an inch or more in diameter, eight or nine-celled, filled with a veſicular bitter pulp. A native of China and Cochinchina, where it is cultivated for its beauty. 4. C. *buxifolia*, Poir. Encyc. 6. "Leaves nearly ſeſſile, ovate-retuſe; flowers in racemes, very ſmall." *Branches* ſpreading, thorny; thorns ſtiff, erect, yellowiſh at the point. *Leaves* ſcattered, alternate, reſembling thoſe of box, but twice as large, obtuſe, often emarginate, narrowed at the baſe, coriaceous, entire, nerved; nerves near together, ſtrongly marked, parallel; petioles very ſhort, ſimple. *Flowers* white, in ſmall racemes near the extremity of the branches. In its ſhort ſtiff branches, thorns, and the form and firmneſs of its leaves, it has much of the habit of rhamnus pyracantha. A native of China, deſcribed by Poiret from dried ſpecimens without fruit, ſent to La Marck by Sonnerat. 5. C. *margarita*, Poir. 9. Lour. Flor. Cochin. p. 570. n. 5. "Branches aſcending, thorny; petioles linear; berries five-celled, oblong." A ſhrub, four feet high. *Leaves* lanceolate, quite entire. *Flowers* white, ſweet-

ſweet-ſcented, ſcattered on the branches, few together on a common peduncle. *Fruit* not more than eight lines long, ſmooth, yellowiſh red, with a very thin rind, and a ſweet veſicular pulp. A native of China, in the neighbourhood of Canton, remarkable for the ſmallneſs of its fruit. 6. C. *nobilis*, Poir. 7. Lour. Flor. Cochin. p. 569. n. 3. Rumph. Amb. tab. 34. "Without thorns; branches aſcending; petioles linear, ſtiff and ſtraight; fruit tubercled, ſomewhat compreſſed." A tree of a moderate ſize. *Leaves* ſcattered, lanceolate, quite entire, dark green, ſhining, very odorous. *Flowers* white, ſweet-ſcented, in terminal racemes. *Fruit* roundiſh, a little compreſſed, about nine-celled, red within and without, about twice the ſize of a China orange; rind thick, ſucculent, ſweet. It has the fruit of an orange, but the petioles of a citron or lemon, and ſeems a connecting ſpecies between C. medica, and C. aurantium. Loureiro's deſcription agrees exactly with Rumphius's figure. A native of Cochinchina. 7. C. *aurantium*, Linn. Sp. Pl. 2. Mart. 2. Poir. 2. Willd. 4. Lam. Ill. tab. 639. fig. 1. orange. "Petioles winged; leaves acuminate; ſtem arboreous," Willd. α. Seville or ſour orange (Thunb. Flor. Jap. p. 293. Lour. Flor. Cochin. p. 569. Rumph. Amb. tab. 33. (malus aurantia major, Bauh. Pin. 436. Blackw. tab. 349. Ferr. Heſp. tab. 377. β. China or ſweet orange, (malus aurantia cortice eduli, Bauh. Pin. 436. Ferr. Heſper. tab. 433.) "Leaves lanceolate, acute, ſmooth," Mil. A middle-ſized tree, with a greeniſh brown bark. *Branches* generally ſpinous. *Leaves* thick, ſhining, ſmooth, ovate-lanceolate, alternate, not at all, or very little toothed; ſprinkled with ſmall, reſinous, tranſparent tubercles, reſembling thoſe in ſome ſpecies of hypericum. *Flowers* white, very odorous, in ſhort racemes towards the end of the branches; filaments united at firſt by an entire membrane, which afterwards becomes torn, and forms ſeveral ſets of ſtamens. *Fruit* round, compreſſed into the ſhape of an oblate ſpheroid, yellow; rind fleſhy, rather thick, containing a number of veſicles, filled with a volatile or eſſential oil, which ſpirts out when the rind is preſſed by the finger nail. A native of the Eaſt Indies, but naturalized in the ſouth of Europe, as well as in the Weſt Indies, and the ſouthern part of North America. The China orange flouriſhes only on the ſea iſlands of South Carolina and Georgia, intermingled with the lemon and lime. The Seville orange is hardier, and is found in the upper part of the country. Evelyn informs us, that the firſt China orange, which appeared in Europe, was ſent for a preſent to the old Conde Mellor, then prime miniſter to the king of Portugal; but of the whole caſe ſent to Liſbon, there was only one tree which lived, and became the parent of all the flouriſhing trees ſince cultivated by the gardeners. Biſhop Gibſon, in his additions to Cambden's "Britannia," ſays, probably from Aubrey, that the orange trees at Beddington in Surrey, introduced from Italy by Sir Francis Carew, were the firſt that were brought to England; that they were planted in the open ground, under a moveable covert during the winter months; and that they had been growing there more than a hundred years, *i. e.* before 1595. Theſe trees all periſhed in the great froſt of 1739-40. It has alſo been ſuppoſed to be a native of the Heſperides, or Canary Iſlands, and its fruit to be the golden apples which the daughters of Heſperus cauſed to be ſo ſtrictly guarded by a dragon. Under this idea, Ventenat has changed the name of the natural order to which it belongs, from Aurantia to Heſperideæ. There are more varieties of this ſpecies than of C. medica. Poiret enumerates and deſcribes eighteen of the citron, eleven of the lemon, and forty-four of the orange, all cultivated in the Paris gardens; but obſerves, that with reſpect to ſome of them, it is not eaſy to determine whether they ought to be referred to C. medica, or C. aurantium. The ſmell of the orange flower is almoſt univerſally eſteemed. Du Tour, in "Nouveau Dictionaire d'Hiſtoire Naturelle," is quite eloquent in its praiſe. "The ſcent of the orange flower," expatiates that lively writer à la mode Françoiſe, "is regarded as a ſtandard of perfection in its kind. It has not, like that of many flowers, a deceitful ſweetneſs, which pleaſes only to injure. It is not faint, like the ſcent of jaſmine or reſeda; it does not affect the head like narciſſus or tuberoſe; it does not weaken the nerves, but rather ſtrengthens them; it is a ſalutary odour, which refreſhes the ſenſes and enlivens the brain. In fine, it has no rival, and is as ſalutary as it is delicious." Theſe flowers are much uſed in perfumes and ſcented waters, yielding their flavour by infuſion to rectified ſpirit, and in diſtillation both to ſpirit and water. An oil diſtilled from them is brought from Italy under the name of oleum, or eſſentia neroli. The juice of the fruit is a grateful liquor, which, by allaying heat, quenching thirſt, and promoting various excretions, proves of conſiderable uſe in febrile and inflammatory diſeaſes. It is only that of the Seville orange which has a place in the materia medica of our Britiſh pharmacopœias; but that of the China orange, having a larger quantity of ſaccharine matter, is more agreeable to the taſte, and may be uſed more freely. Theſe acids, by uniting with the bile, are ſaid to take off its bitterneſs; but if they are in greater quantity than can be properly corrected by the bile preſent, they ſeem, by ſome union with that fluid, to acquire a purgative quality, that gives a diarrhœa, and the colic pains, that are ready to accompany the operation of every purgative. The outer yellow rind of the fruit is a grateful aromatic bitter; by the union of theſe qualities, it warms the ſtomach, promotes appetite, and gives tone and ſtrength to the viſcera; but Dr. Cullen obſerves, that its virtues are not ſufficiently experienced, becauſe we employ it chiefly in its dried ſtate, and in too ſmall a proportion, as we take with it part of the white inert ſubſtance that compoſes the inner rind. Its flavour is likewiſe ſuppoſed to be leſs periſhable than that of the lemon; hence the London college employ orange-peel in the ſpirituous bitter tincture, which is deſigned for keeping; whilſt in the bitter watery effuſion, lemon-peel is preferred. A ſyrup and diſtilled water are for the ſame reaſon prepared from the rind of oranges in preference to that of lemons. See Woodville's "Medical Botany." 8. C. *fuſca*, Poir. 10. Lour. Flor. Cochin. p. 571, n. 6. Rumph. Amb. 2. tab. 33. "Much branched, thorny; leaves lanceolate, egg-ſhaped; petioles with heart-ſhaped wings; berries globular, rough." A large tree. *Branches* numerous, crooked, almoſt erect, furniſhed with long ſtout ſpines. *Leaves* quite entire, dark-green, ſtrong-ſcented. *Flowers* white, not very odorous, in nearly terminal racemes. *Fruit* greeniſh brown, eight or nine celled, of a diſagreeable, bitter flavour. A native of Cochin China, where it is one of the moſt common kinds. Poiret regards it as a mere variety of C. aurantium, differing in its nearly ovate-leaves, and the colour of its fruit. It ſeems moſt allied to the Seville orange. 9. C. *humilis*, Poir. 4. (C. aurantium, δ. Mart.) Dwarf or nutmeg orange. "Leaves egg-ſhaped; flowers ſeſſile." A low ſhrub. *Leaves* ſmall, growing in bundles. *Flowers* near together, ſweet-ſcented. Poiret agrees with Miller in regarding this as a diſtinct ſpecies. Profeſſor Martyn makes it a variety of C. aurantium. 10. C. *japonica*, Poir. 5. Mart. 4. Willd. 3. Thunb. jap. 292. Icon. Pl. 15. (Kin Kan. Kæmp. amen. 801.) "Petioles winged; leaves acute, flowers axillary, moſt frequently ſolitary; ſtem ſhrubby." *Stem* ſcarcely a foot high, compreffed-angular, erect. *Branches* and *Branchlets* alternate, compreffed-angular, fpinous, fmooth, erect, green; fpines folitary, axillary, erect, fpreading. *Leaves* fcattered, egg-fhaped, rather acute, quite entire, a little concave, fmooth, deep green above, paler underneath. *Flowers* fnowy-white, rarely two together, peduncled, nodding; peduncles a line long, fmooth, drooping; calyx fmooth, very fmall, five-toothed; petals oblong, a little concave, fpreading; filaments nineteen, awl-fhaped, compreffed, erect, in five fets, forming a cylinder fhorter than the corolla, nearly equal, white; anthers oblong, minute, yellow; germ roundifh, fmooth, ftyle cylindrical, a little fhorter than the ftamens, greenifh white; ftigma globular, yellow, ftriated. *Fruit* with a thick rind, about the fize of a cherry, nine-celled, very fweet and grateful to the tafte. Thunb. Poiret does not venture to pronounce it fpecifically diftinct from the preceding. 11. C. *decumana*, Murray, Syft. Veg. 580. Mart. 3. Poir. 3. Willd. 5. (C. aurantium γ; Linn. Sp. Pl. Limo decumanus; Rumph. Amb. 2. tab. 24. fig. 2. Malus aurantia fructu caput humanum excedente; Sloane Jam. 212. Hift. 1. tab. 12. fig. 2, 3. Thunb. Flor. Jap. 293. Lour. Cochin. 571.) Shaddock. "Petioles winged; leaves obtufe, emarginate." Mur. "Leaves ovate-lanceolate, thick, fhining; fruit very large," Mill. A middle-fized tree, with fpreading, fpinous branches. *Leaves* egg-fhaped, a little acute, feldom obtufe, very feldom emarginate, toothed, petioles with remarkably large heart-fhaped wings. *Flowers* white, very odorous, in long flightly tomentous racemes; petals reflexed; ftamens about twenty, nearly the length of the petals, collected into a many-cleft tube. *Fruit* eight inches in diameter, yellowifh green, even-furfaced, twelve-celled or more, containing fome a red, others a white pulp; the juice in fome fweet, in others acid; rind very thick, of a difagreeable bitter flavour, not efculent. *Seeds* egg-fhaped, fomewhat acute, two or three in each cell. A native of China, Cochin-China, Japan, and the Friendly Iflands. It derives its vulgar name from a captain Shaddock, who firft brought it from the Eaft to the Weft Indies. In England it was cultivated by Miller in 1739. Murray's fpecific character appears to have been very carelefsly formed; and it is rather extraordinary that it fhould have been copied without alteration or addition by Martyn, Poiret, and Willdenow. 12. C. *trifoliata*, Linn. Sp. Pl. 3. Mart. 5. Poir. 11. Willd. 6. (Tfi. f. Karatas bauna; Kæmpf. Amen. tab. 802. Thunb. Fl. Jap. 294.) "Leaves ternate." A fhrub. *Stem* near fix feet high; branches alternate, compreffed-angular, crooked, green, fhining, fpinous; fpines near an inch long, alternate, dilated, and compreffed at the bafe, fpreading, ftiff and fharp, yellow at the end. *Leaves* diftant from each other; leaflets oval, crenulate; petiole with a crenulate wing. *Flowers* white, axillary, feffile, folitary; petals concave, roundifh, clawed; filaments not united at the bafe, much longer than the petals. *Fruit* globular, the fize of a fmall orange, feven-celled; pulp glutinous, with an unpleafant fmell, and bad flavour. *Seeds* oval. A native of Japan, where it is employed for fences, which its crooked thickfet branches and ftiff fharp thorns render impenetrable.

Obf. Loureiro imagined that he found Kempfer's Tfi. v. Karatas, in Cochin China, and as his plant did not accord with the generic character of citrus, he formed for it a new genus, which he has called *triphafia aurantiola*; but a bare infpection of Kempfer's figure is fufficient to fhew that his and Loureiro's plant cannot be the fame. The Cochin-China plant is probably *limonia trifoliata* of Linnæus.

Citrus, in *Gardening*, comprehends plants of the citron, lemon, and orange tree kinds, of which the forts ufually cultivated are, the citron tree, (C. *medica*), the orange tree (C. *aurantium*), and the fhaddock orange (C. *decumana*).

The firft, in its wild ftate, is a tree that grows to the height of about eight feet, erect and prickly, with long reclining branches. The leaves are ovate-oblong, alternate, fubferrate, fmooth, pale green; the flowers white, odoriferous, on many-flowered, terminating peduncles; the fruit a berry, half a foot in length, ovate, with a protuberance at the tip, nine-celled or thereabouts; the pulp white, commonly acid; the rind yellow, thick, hardifh, odoriferous, irregular. The fruit is efculent both in the raw and preferved ftate. It is a native of the warmer parts of Afia.

Of this fort, Martyn obferves, that there are feveral varieties which are procured from Genoa, the great nurfery of this as well as lemons and oranges; the cultivators of them there being, he fays, as fond of introducing a new variety into their collections as nurferymen are here of obtaining a new pear, apple, or peach. There are the citron tree with fweet fruit; with four fruit; and the common lemon, and the lime. But the firft of the two latter varieties, or the lemon tree, differs, according to the fame writer, from the orange, both in the naked foot-ftalks of the leaves, and in the fhape and colour of the fruit; while there is fcarce any diftinction between it and the citron.

It is obferved that the moft remarkable fub-varieties cultivated in this climate are, the fweet lemon, plain and variegated; the pear-fhaped; the imperial; the lemon called Adam's apple; the furrowed fruited; the childing; and the lemon with double flowers.

The fecond, or four lemon or lime, grows in its native climate to the height of about eight feet, with a crooked trunk and many diffufed branches, which have prickles on them. It is a native of Afia, and common in the Weft Indies.

There is another fub-variety, the fweet lime, which, the fame writer fays, is generally a more upright tree, and bears a fruit, which in fize and form feems to hold a mean between the lime and the lemon. But thefe two laft fub-varieties are but little cultivated in this country.

The fecond fpecies is a middle-fized evergreen tree, having a greenifh brown bark, and dividing upwards into a branchy regular head, the leaves broad lanceolated, and the fruit fubglobular, flat, of a golden colour. It is a native of India. Of this fort there are numerous varieties, but thofe moft known in garden culture are, the Seville; the China; the willow-leaved or Turkey; the yellow and white ftriped-leaved; the curled-leaved; the horned; the double-flowering; the hermaphrodite; and the dwarf or nutmeg orange. The firft of which affords a large, rough-rinded, four fruit, of excellent quality for culinary ufes. It is a handfome grower, and the hardeft of the orange tribe, as it fhoots freely in this climate, producing large and beautiful leaves; and flowers ftronger and more abundantly, and generally bears a greater quantity of fruit than any other fort, and arrives to greater perfection.

The fecond has moderate-fized leaves, and a fmooth, thin-rinded, fweet fruit; of which there are feveral fub-varieties in warm countries, where they grow in the open ground. And the willow-leaved orange tree has narrow fpear-fhaped leaves, and a ftriped willow-leaved orange.

In refpect to the horned orange, it is a common-fized tree, producing oblongifh fruit, which divide at the end, the rind running out into divifions like horns. The hermaphrodite orange is a common-fized tree, producing fruit partly like an orange, and partly citron-fhaped. And the dwarf or nutmeg orange has a low ftem, and fmall bufhy head, growing

growing two or three feet high, with ſmall oval leaves in cluſters, and numerous flowers in bunches, covering the branches, ſucceeded by very ſmall fruit. When in flower it is proper to be placed for ornament in rooms or other places, which it perfumes with its flowers; but it requires care, and is ſeldom in a perfect ſtate of growth in this climate.

It is ſaid that the ſtriped and double-flowered varieties are the moſt curious and intereſting.

The third ſpecies is a tree above the middle ſize, in its native place, having ſpreading prickly branches, the leaves ovate, and the flowers white, very ſweet-ſcented, in copious, upright, terminating bunches; the fruit ſpheroidal, of a greeniſh yellow colour. It is a native of India, but introduced into the Weſt Indies by captain Shaddock.

And of this ſort, according to Martyn, there are many varieties, " one of which, ſuperior to the reſt in the flavour and ſmell of the fruit; has a ſmaller trunk, and ſub-globular fruit, five inches in diameter, yellow on the outſide, white and very ſweet within."

Method of Culture. In regard to the method principally practiſed in this climate for raiſing all theſe ſorts of trees, it is that of budding them upon ſtocks raiſed from the ſeeds; but they are likewiſe ſometimes increaſed by the operation of inarching. And new varieties are conſtantly raiſed from the ſeed of the different ſpecies.

Method of raiſing new Varieties and Stocks. With this view ſome ſeed ſhould be provided from the moſt perfectly ripened fruits of the different ſorts that are wanted, early in the ſpring, at which time it ſhould be ſown in pots filled with good light earth, being covered to the depth of about half an inch, plunging them in a tan hot-bed, giving them ſlight ſprinklings of water and a free admiſſion of air. When the plants have attained a tolerably ſtrong growth, which is moſtly in about eight or ten weeks, they ſhould be gradually hardened to bear the full air, in which they may be continued till the weather renders it neceſſary to remove them into the green houſe for protection during the winter.

With ſome, however, in order to get them forward more rapidly, it is the practice to prick them out ſingly, when about two inches in height, into other pots, and plunge them into a ſecond tan hot-bed, watering and giving them freſh air occaſionally, and gradually hardening them as in the preceding manner. In this way they are ſaid to become much larger plants the following year.

But in caſes where the firſt mode is practiſed, the plants ſhould, in the following ſpring, about the middle of March or the beginning of the following month, be ſhaken carefully out of the ſeed-pots, ſo as to preſerve the roots as entire as poſſible, and planted ſeparately in ſmall pots, made about half full with a compoſt of mellow loamy earth, and afterwards filled up with the ſame ſort, ſo as to ſupport the plants well; ſhade and water being occaſionally given, till they become perfectly eſtabliſhed. It is the cuſtom with ſome gardeners, in order to have the plants more forward, as well as more ſtraight and upright, to plunge the pots, as ſoon as the plants have been placed in them, in a tan hot-bed, covered by frames and glaſſes, freſh air and water being duly ſupplied.

In theſe modes of management, the plants are capable of furniſhing good ſtocks for budding upon the ſecond or third year. And where two hot-beds are made uſe of, many of them will be in a proper ſtate for the purpoſe the ſecond year, if proper care be taken of them. See BUDDING.

It is obſerved, that for the purpoſe of ſtocks, the citron, lemon, and Seville orange, are the beſt, as being the ſtrongeſt ſhooters, eſpecially the laſt.

Where any of the plants appear particularly handſome and of a healthy growth, they may be let remain, for the purpoſe of affording new varieties; but they are long in this way of raiſing them before they produce fruit; and when that happens, there is great uncertainty of their poſſeſſing any valuable qualities. After the plants have been thus propagated, they only require the ſame ſort of management as other exotics of the green-houſe kind, to be employed in preſerving them in a healthy ſtate.

Method of Budding them on the Stocks. Theſe plants, when they have acquired twelve or fifteen inches growth, and are about the thickneſs of a large gooſe quill, or rather more, are in a proper ſtate for the purpoſe. The buds ſhould be procured from ſound, plump, young ſhoots, of ſuch trees as have a free growth, and are in a ſtate of bearing, and the operation ſhould be performed about Auguſt, upon ſtocks of the ſame kinds and varieties, the buds being inſerted from ſix to ten or more inches from the bottom, in proper parts of the ſtocks, and only one bud in each of them. See BUDDING.

As ſoon as this has been done, the plants ſhould be removed into the green-houſe, a frame, or old tan hot-bed, in order to guard them from the wet, and promote the inoſculation of the veſſels, and the healing of the parts; due ſhade and air being occaſionally given; and when the union is perfectly accompliſhed, the ligatures be removed, to permit the ſwelling of the plants, without injury being done by their pinching them.

There is nothing more neceſſary afterwards, than the application of proper ſupplies of moiſture and air, with ſuitable protection from rain and all ſorts of dampneſs. When the heads of the ſtocks have been removed in the early part of the following ſpring, the buds begin to ſhoot with vigour, eſpecially where the aid of a tan hot-bed can be had recourſe to. The plants ſhould now be enured by degrees to the full air, for the latter part of the ſummer, and in the autumn and winter have the protection of a green-houſe given them.

Method of raiſing by Inarching. When this mode is employed, which is now but ſeldom the caſe, as the budding practice is much more convenient, and the trees more ornamental, the young ſhoots of the trees raiſed in the above modes, which are nearly of the ſame ſize as the ſtocks, ſhould be joined with them in the early ſpring months, ſo as to conſtitute a ſort of arch; and in the latter end of ſummer they are moſtly in a ſtate to be taken off from the parent-tree. See INARCHING.

By this mode, the trees may be raiſed to a bearing ſtate in a very ſhort time, as the young bearing branches may be made uſe of for the purpoſe, by which a new bearing tree is at once produced. And different ſorts may be connected, and produced on the ſame tree. But the trees furniſhed in this way are never ſo beautiful as thoſe produced by that of budding, in the manner deſcribed above.

Method of Culture in the trained Trees. It is the cuſtom, in order to have trees of this ſort at once, to purchaſe ſuch as are brought from Italy, &c. in cheſts in the ſpring. They are of different ſizes, and, when properly managed, produce as good trees in two years, as thoſe raiſed in the above modes can in a great many. It is neceſſary to obſerve, that in chooſing theſe trees, thoſe which ſhoot the moſt vigorouſly are moſtly of the citron or ſhaddock kind, as the orange rarely grows with ſuch luxuriance. The laſt, therefore, as being more valuable, ſhould be attended to. And as ſome are only furniſhed with one bud, while others have two, the latter ſhould be preferred, as they will produce the moſt regular headed plants in moſt caſes.

And theſe trees, after having had their roots cleaned, trimmed,

med, and well soaked in water for some time, as well as the stems and branches cleaned, should be planted separately in tubs or pots of suitable sizes, filled with earth of the same sort as mentioned above, watering them at the time, and plunging them in the tan-bed of the stove to the tops of the plants, &c. They should continue in this situation some time, and be well watered, both at the bottom and over their heads, shade being given when necessary, and a due proportion of air when they begin to shoot in the heads. These should likewise be cut occasionally, in order to induce them to throw out lateral branches, and form full handsome heads, air now being more freely admitted, to render the plants hardy, and capable of being preserved in the green-house during the following winter, being managed as other plants of the exotic green-house kind.

General Method of Management in all the Sorts. As it is necessary that these trees should be moved into different situations, it is mostly proper to have them in pots or large tubs; and where there are suitable glass frames for protecting them in winter, a few may be planted out against walls which have flues that can be heated as there may be occasion. None of the sorts can be preserved in the open air except during a few of the summer months. The management in which cases is that of placing them in some warm public situation, at first washing their heads well with water, to remove dust or other substances, supplying them frequently with a little water when the season is hot, and preserving the moisture in the earth of the pots, by covering it with new cut-short grass. When they are removed to the green-house, on the approach of the autumn or winter, they should be deposited in a regular order, the largest to the back parts, proper supplies of fresh air and water being given when the weather is suitable, and due protection provided against frost. It is occasionally necessary also to water them over head, to remove all sorts of insects and other substances that may be upon their leaves, when all the decayed parts should be wholly removed and dressed away. And as often as the earth in the pots or tubs begins to bind or become stiff, it should be loosened to the depth of a few inches; and in the spring, it is useful to remove a little of the surface, re-placing it by such as is fresh, as by these means the plants thrive better and continue more healthy. It becomes necessary in most cases to shift the plants into larger pots or tubs of fresh earth every second or third spring, about April, removing them with the balls of earth entire, the outside matted mouldy roots being pared off close, and part of the old earth at the top, sides, and bottom taken away; then the tubs or pots being cleaned out, or new larger ones provided, some crooked pieces of tiles should be laid over the holes at bottom, and some earth put in, placing the trees in the pots or tubs, and filling them up with more compost, pressing it down on the sides, giving a moderate watering at the tops, and retaining the plants in the green-house till the weather becomes sufficiently fine for their being set out. And such trees as have thin, straggling, or irregular heads, should now be pruned, so as to have the branches moderately short, and to form better heads.

But it is advised, that when they appear in an unhealthy state, with weak shoots, irregular heads, and small ill-coloured leaves, they should be pruned pretty close, and shifted into entire fresh earth, the roots being soaked and washed well with water. When they have been again planted, they should have a little water given immediately, and be plunged in a bark hot-bed, to remain until July, when they will have made strong shoots, and have formed new, full, and regular heads in a handsome manner.

When such of the trees as are in pots have attained a large size, they should be shifted into tubs hooped with iron hoops, having strong hooked iron handles at the tops, to receive poles to lift the trees by in removing them.

As there is often an abundance of flowers on these trees, when they appear in June and the following months, it may be proper to thin them a little by taking off the smallest; and as the trees continue blowing and setting fruit for some time, when a full crop is set, it is of benefit to the trees and fruit to gather off the superabundant blossoms as they are formed on the trees.

And in planting trees of this kind in the full ground, there must be frame-erections for the support of glass or other coverings, to defend the plants in inclement weather: in these situations, the trees, from their having full scope for their roots, generally shoot strong, and produce large fruit, being trained within as wall or standard trees. But the walls for this purpose should have a southern aspect, and be in a dry situation; and for the greater protection of the trees in severe frosts, there should be a fire-place with a flue carried along a low wall in the front and ends, the trees being planted in the full borders against the back walls, and their branches trained to them five or six inches distance, air and occasional water being given, as for those in the green-house, and the glasses put on in nights in bad weather, the flues being only made use of in sharp frosts, and then with very moderate fires, so as just to prevent their injurious effects.

Having managed them in this way during the autumn, winter, and spring seasons, they should about the beginning of June have the glasses removed, and the borders raised a little where the soil is wet, and be slightly dug over two or three times a year, necessary supplies of manure being given. And for standard trees, a more capacious and lofty glass covering should be erected against the wall somewhat in the manner of hot-houses, only higher, a border being made the whole width and length, planting one or two rows of trees lengthways in it, suffering them to run up as standards, only giving a little pruning, just to preserve regularity in their heads.

With some it is the custom to have for this use lofty moveable glass frames, so that two or three rows of trees can be planted in some conspicuous part of the pleasure-ground, the frames being taken wholly away in summer, so as to appear a little orange grove. And when the trees are well protected by the glasses and other occasional coverings, &c. in winter, they grow in this way to a much greater height than those planted in tubs, or other methods.

It is necessary to observe, that the citron trees should have warmer situations than those of the orange kind during the winter, and be retained in the house later in the summer, at which period they should also have rather more water given them.

And the common lemon trees, as being more hardy than the orange, should of course have more air in the winter season, when the weather is suitable for its being admitted.

CITTA, in *Botany*, Bosc. Nouv. Dict. Loureir. Flor. Cochin. (Lobus littoralis, Rumph.) Class and order, *diadelphia decandria*.

Gen. Ch. *Cal.* bilabiate, humped, coloured, hispid; upper lip entire; lower lip three-cleft; segments awl-shaped, the middle one the longest. *Cor.* papilionaceous; standard almost naked, humped at the base; wings oblong, connivent; keel recurved. *Stam.* Filaments ten, nine united at the base, five alternate ones larger; anthers oblong. *Pist.* Germ superior, oblong, villous; style filiform; stigma almost round. *Peric.* Legume oval, oblong, thick, compressed, hispid, hollowed externally into square cavities. *Seeds* three, large, compressed, arilled.

Sp.

Sp. C.—A climbing ſhrub. *Leaves* ternate, petioled; leaflets egg-ſhaped, acute, quite entire, ſmooth. *Flowers* almoſt black, ſpotted with white, in axillary corymbs. A native of Cochin China.

CITTA, in *Medicine*, κίττα, is ſynonymous with *pica*, a term generally uſed to denominate a depraved appetite, which craves for indigeſtible ſubſtances, ſuch as chalk, earth, &c. See PICA.

CITTA CASTELLANA, in *Geography*, a town of Italy, in the ſtate of the church, and patrimony of St. Peter; once the ſee of a biſhop united with Orta; 23 miles N. of Rome.

CITTA DI CASTELLO, a town of Italy, in the province of Umbria, ſeated on the Tiber, the ſee of a biſhop; containing 10 churches, and a great number of convents; 23 miles S.W. of Urbino, and 97 N. of Rome.

CITTADELLA, a ſea-port town of the iſland of Minorca, with a good harbour, on the N.W. coaſt, ſurrounded with walls and baſtions; it contains two churches, four convents, and 600 houſes. N. lat. 40° 2′. E. long. 4° 3′.—Alſo, a town of Italy, in the Paduan; 19 miles N.N.W. of Padua.—Alſo, a town of the Paduan, near the Brenta, between Vicenza and Trevigno.

CITTA DUCALE, a town of Naples, in the province of Abruzzo Ultra, founded in 1308, by Robert, duke of Calabria, and almoſt ruined by an earthquake in 1703; the the ſee of a biſhop; 18 miles W. of Aquila.

CITTA DELLA PIEVE, a town of Italy, in the province of Perugia; the ſee of a biſhop; 18 miles W. of Perugia, and 68 N. of Rome.

CITTA DEL SOLE, a town of Italy, in the duchy of Tuſcany, built in the year 1565, by Coſmo I. duke of Tuſcany; 16 miles S.S.W. of Ravenna.

CITTA NUOVA, a town of Iſtria; 7 miles S. of Umago.

CITTADINI, PIER-FRANCESCO, called *Il Milaneſe*, in *Biography*, a painter very much eſteemed for his ſmall pictures. He was born at Milan in the year 1626; but at a very early period ſettled in Bologna, where he is ſaid to have been inſtructed by Guido: he ſoon became admired for the univerſality of his genius, and the beauty and freedom of his painting; and it is thought he would have proved one of the greateſt artiſts of his ſchool, had he not ſo entirely devoted himſelf to painting in ſmall. His little pictures, whether repreſenting rural feaſts, dances, ſpectacles, or landſcapes, are equally admired; and his repreſentations of fruit, flowers, and ſtill life, are conſidered ſuperior to thoſe of any of his Bologneſe cotemporaries. Many of his works are in the collections at Bologna, where he died, in the year 1681. Lanzi, Storia Pittorica. Orlandi. Creſpi.

CITTADINI, CARLO, GIO. BATISTA, and ANGIOL MICHELE, three ſons of Pier-Franceſco Cittadini, were all of them painters of ſome note, in the ſtyle of their father. Carlo and Gio. Batiſta, like him, excelled equally in figures and in ſtill life; but Angiol Michele principally confined himſelf to pictures of fruits and flowers. Carlo had two ſons, GAETANO, a good landſcape painter, and GIO. GIROLAMO, who, like his uncle Angiol Michele, ſatisfied himſelf with the more humble province of dead game, flowers, and other ſtill objects. Gio. Batiſta died in 1692. Gio. Girolamo was living towards the latter part of the 18th century. Lanzi. Orlandi. Creſpi.

CITTERN, or GETERN, corrupted from the Spaniſh, *citara*, a guitar, and *citron*, a guitar-maker.

CITTOWIANY, in *Geography*, a town of Samogitia; 10 miles N. of Roſienne.

CITULA, in *Ichthyology*, the name given by Paulus Jovianus, and others to the common dory, or doree, *zeus faber* of modern naturaliſts. Pliny calls it *zeus*; and hence Artedi adopted the ſame as a generic name for this and ſeveral other fiſhes of the ſame natural family.

CITUS, is the name given by Salvian (*aquat.*) to the *cottus gobio* of later naturaliſts; and *river bull-head* of Engliſh writers.

CITY, or CITTY, *Urbs*, a large town incloſed with a wall; or a town incorporated, which is or hath been the ſee of a biſhop.

It is hard to give any juſt definition of a city; becauſe cuſtom has reſerved the appellation of towns, to many places which ſeem to have every thing requiſite to conſtitute cities. Formerly city, according to ſome, was only underſtood of ſuch towns as were biſhops' ſees: which diſtinction ſeems ſtill to hold in England, though no-where elſe. See BISHOP and DIOCESE.

According to Cowel, city, or civitas, is a town corporate, which hath a biſhop and cathedral church, which is called *civitas, oppidum*, and *urbs*; *civitas*, becauſe it is governed by juſtice and order of magiſtracy; *oppidum*, as it contains a great number of inhabitants; and *urbs*, becauſe it is in due form begirt about with walls. But Crompton, in his Juriſdictions, where he reckons up the cities, omits Ely, although it has a biſhop and a cathedral church, and inſerts Weſtminſter, though it hath not now a biſhop: and ſir Edward Coke makes Cambridge a city, and yet there is no mention of its ever having been an epiſcopal ſee. It appears, indeed, by the ſtat. 35 Hen. VIII. c. 10, that Weſtminſter had a biſhop; ſince which time, in ſtat. 17 Eliz. c. 5, it is denominated a city or borough: and notwithſtanding the obſervation of Coke with reſpect to Cambridge, in the ſtat. 11 Hen. VII. c. 4, Cambridge is called merely a town. We learn, however, from Burnet's Reformation (Appendix), that Weſtminſter retained the name of city, not becauſe it had been a biſhop's ſee, but becauſe it was expreſsly created ſuch in the letters-patent by king Henry VIII., erecting it into a biſhopric. There was a ſimilar clauſe in favour of the other five new created cities, *viz.* Cheſter, Peterborough, Oxford, Glouceſter, and Briſtol. Mr. Hargrave, in his Notes to 1 Inſt. 110, proves, that although Weſtminſter is a city, and has ſent citizens to parliament from the time of Edward VI., it never was incorporated: and this is a ſtriking inſtance in contradiction to the learned opinion there referred to; *viz.* that the king could not grant, within time of memory, to any place the right of ſending members to parliament, without firſt creating that place a corporation. Lord Coke ſeems anxious to rank Cambridge among the cities; and Mr. Woodeſon, late Vinerian profeſſor (ſee his Lectures, i. 302.), has produced a deciſive authority that cities and biſhop's ſees had not originally any neceſſary connection with each other. It is that of Ingulphus, who relates, that at the great council aſſembled in 1072, to ſettle the claim of precedence between the two archbiſhops, it was decreed that biſhops' ſees ſhould be transferred from towns to cities. The above authority derives ſtrong confirmation from the fact, that the ſame diſtinction was not paid to biſhops' ſees in Ireland.

The term city had its riſe, among us, ſince the Conqueſt; for in the time of the Saxons there were no cities, but all great towns were called burghs. Thus, London was called London burgh; as the capital of Scotland is now called Edinburgh.

And for a long time after the Conqueſt, city and burgh were uſed promiſcuouſly. Thus, in the charter of Leiceſter, that place is called both *civitas* and *burgus*; which ſhews that lord Coke and other writers are miſtaken, who tell us that every city was, or is, a biſhop's ſee. Hence it ſhould ſeem, that though the term city signifies with us such a town corporate as hath usually a bishop and a cathedral church, yet it is not always so.

However, Chassanæus, "De Consuetud. Burgund." says, France has within its territories 104 cities; and gives his reason, because it has so many archbishops and bishops.

Cities and villages held formerly, in the time of the feudal government, of some great lord, on whom they depended for protection; and to whose arbitrary jurisdiction they were subject: and the inhabitants were deprived of the natural, and most unalienable rights of humanity.

They could not dispose of the effects, acquired by their own industry, either by will, or by any deed executed during their life. They had no right to appoint guardians for their children, whilst they were minors. They were not permitted to marry without purchasing the consent of the lord on whom they depended. If once they commenced a law-suit, they were not allowed to terminate it by an accommodation, because the lord in whose court they pleaded would thus have been deprived of the perquisites due to him in passing sentence. Services of various kinds, equally disgraceful and oppressive, were exacted from them without mercy or moderation. The spirit of industry was checked in some cities by absurd regulations, and in others by unreasonable exactions; nor would the narrow and oppressive maxims of a military aristocracy have permitted it ever to rise to any degree of height or vigour. But as soon as the cities of Italy began to turn their attention to commerce, and to conceive some idea of the advantages which they might derive from it, they became impatient to shake off the yoke of their insolent lords, and to establish among themselves such a free and equal government as would render property secure, and industry flourishing. Concurring circumstances encouraged the inhabitants of some of the Italian cities, towards the beginning of the 11th century, to assume new privileges, to unite more closely together, and to form themselves into bodies politic, governed by laws established by common consent. The rights which many cities acquired by bold or fortunate usurpation, others purchased from the emperors, who deemed themselves gainers when they received large sums for immunities which they were no longer able to withhold; and some cities obtained them gratuitously from the generosity or facility of the princes on whom they depended. The great increase of wealth, which the crusades brought into Italy, occasioned a new kind of fermentation and activity in the minds of the people, and excited such a general passion for liberty and independence, that before the conclusion of the last crusade, all the considerable cities in that country had either purchased or extorted large immunities from the emperors. As soon as their liberties were established, and they began to feel their own importance, they endeavoured to render themselves masters of the territory round their walls; which, under the Romans, belonged to each town, but which under the prevalence of the feudal policy had been seized and shared among the conquerors. The barons, to whom the circumjacent lands were granted, erected their castles almost at the gates of the cities, and exercised their jurisdiction there. Many of the cities in Italy attacked their troublesome neighbours, and dispossessing them, annexed their territories to the communities, and thus acquired a very considerable addition of power. Several instances of this kind occur in the 11th, and the beginning of the 12th century. As increasing power enlarged the prospects of ambition, the cities proceeded to attack several barons at a greater distance, and compelled them to become members of their communities; to take the oath of fidelity to their magistrates, to subject their lands to all burdens and taxes imposed by common consent, to defend the communities against all their enemies, and to reside within the respective cities during a specified time in each year. This state, into which some nobles were compelled to enter, others embraced from choice, with a view to their security and credit. Accordingly they voluntarily became citizens of the towns to which their lands were most contiguous, and, abandoning their ancient castles, took up their residence in the cities, at least for some part of the year. This privilege was deemed so important, that not only laymen, but ecclesiastics of the highest rank, condescended to be adopted as members of the great communities, in hopes of enjoying the safety and dignity which that conferred. Hence cities not only became more populous, but were filled with inhabitants of better rank; and a custom which still subsists in Italy, was then introduced, that all families of distinction reside more constantly in the great towns than is usual in other parts of Europe.

Whilst cities were thus acquiring new dignity by the accession of such citizens, they became more solicitous to preserve their liberty and independence. The emperors, as sovereigns, had anciently a palace in almost every great city of Italy; in which they occasionally resided, and at this time the troops that accompanied them were quartered in the houses of the citizens. This, however, they deemed both ignominious and dangerous, and they combined to resist and abolish the practice. With this view they required the emperors to erect them in the suburbs. By degrees these encroachments of the Italian cities alarmed the emperors, and schemes were meditated for restraining them. In this enterprise Frederick Barbarossa engaged with great ardour. Upon this the free cities of Italy joined together in a general league, and stood in their defence; and after a long contest, carried on with alternate success, a solemn treaty of peace was concluded at Constance, A. D. 1183, by which all the privileges and immunities granted by former emperors to the principal cities of Italy were confirmed and ratified. This treaty secured very important privileges to the confederate cities; and though a considerable degree of authority and jurisdiction was reserved by it to the empire, yet the cities persevered so vigorously in their efforts for extending their immunities, and they enjoyed such favourable conjunctures for this purpose, that, before the conclusion of the 13th century, most of the great cities in Italy had shaken off all marks of subjection to the empire, and were become independent sovereign republics.

This innovation on the part of cities was not long known in Italy, before it made its way into France, and also into other countries of Europe, from A. D. 1108 to A. D. 1137. In less than two centuries, servitude was abolished in most of the towns of France, and they became free corporations, instead of dependent villages, without jurisdiction or privileges. Much about the same period, the great cities in Germany began to acquire like immunities, and laid the foundation of their subsequent liberty and independence. The ancient Germans, it should be recollected, had no cities. They considered it as a badge of servitude to be obliged to inhabit a city surrounded with walls. (Tacit. de Mor. Germ. c. 16. Id. Histor. l. iv. c. 64.) The Romans built several cities of note on the banks of the Rhine; but in all the extensive countries from that river to the coasts of the Baltic, there was hardly one city previous to the 9th century of the Christian æra. Under Charlemagne, and the emperors of his family, several cities were founded in Germany, and men became accustomed to associate and live together in one place. Charlemagne founded two archbishoprics and nine bishoprics in the most considerable towns of Germany. His successors increased

increased

increafed their number; and as bifhops fixed their refidence in thefe cities, and performed religious functions there, many people were thus induced to fettle in them. However, Henry, furnamed the Fowler, who began his reign A. D. 920, muft be confidered as the great founder of cities in Germany; which he eftablifhed in order to counteract the incurfions of the Hungarians and other barbarous people. He thus encouraged his fubjects to fettle in thefe cities, furrounded with walls and towers, and by enjoining or perfuading fome of the nobility to fix their refidence in the towns, he rendered the condition of citizens more honourable than it had formerly been. From this period the number of cities continued to increafe, and thus became more populous and more wealthy. Various circumftances contributed to their increafe. The eftablifhment of bifhoprics, and alfo the building of cathedrals, induced many people to fettle there. Befides, it became the cuftom to hold councils and courts of judicature of every kind, ecclefiaftical as well as civil, in cities. In the 11th century many flaves were enfranchifed, and many of them fettled in cities. Several mines were difcovered and wrought in different provinces, which, drawing together a great concourfe of people, gave rife to feveral cities. In the 13th century the cities began to form leagues for their mutual defence, and for repreffing the diforders occafioned by the private wars among the barons, as well as by their exactions. This rendered the condition of thofe who inhabited cities more fecure than that of any other order of men, and allured many to become members of their communities.

Although the cities of Germany did not acquire liberty at fo early a period as thofe in France, they extended their privileges much farther. All the imperial and free cities, of which the number is confiderable, acquired the full right of being *immediate, i. e.* of being fubject to the empire alone, and poffeffing, within their own precincts, all the rights of complete and independent fovereignty. The practice of eftablifhing cities, which was adopted in Italy, France, and Germany, fpread quickly over other parts of Europe, and prevailed in Spain, England, Scotland, and all the other feudal kingdoms. It appears from Mariana, that in 1350, 18 cities had obtained a feat in the Cortes of Caftile. In Aragon cities feem to have acquired at an early period extenfive immunities, together with a fhare in the legiflature. In 1118, the citizens of Saragoffa had not only obtained political liberty, but were declared to be of equal rank with the nobles of the fecond clafs; and many other immunities were conferred upon them. In England, as we have already obferved, the eftablifhment of communities or corporations was pofterior to the Conqueft; and the practice was borrowed from France. Lord Lyttelton, however, fuggefts, in his "Hiftory of Henry II. (vol. ii. p. 317.) that fome of the towns in England were formed into corporations under the Saxon kings, and that the charters granted by the kings of the Norman race, were not charters of enfranchifement from a ftate of flavery, but a confirmation of privileges which they already enjoyed. However this be, the Englifh cities were very inconfiderable in the 12th century.

The inftitution of cities was interefting and beneficial. Its influence on government, as well as manners, was no lefs extenfive than falutary. It was the means of releafing a great body of the people from flavery, and of promoting the interefts of general liberty and of general fecurity. It contributed alfo to the revival of a fpirit of induftry; to the profperity of commerce; to the increafe of population; to the diffufion of wealth, and to a greater degree of refinement in the manners, and in the habits of life. Together with this improvement in manners, a more regular kind of government and police was introduced, ftatutes and regulations became neceffary with the increafing populoufnefs of cities, and all became fenfible that their common fafety depended on obferving them with exactnefs, and on punifhing fuch as violated them with promptitude and vigour. Laws and fubordination, as well as polifhed manners, took their rife in cities, and infenfibly diffufed themfelves through the reft of the fociety. When the inhabitants of cities had obtained perfonal freedom and municipal jurifdiction, they foon acquired civil liberty and political power. In procefs of time the reprefentatives of cities gained a place in the legiflature; and this event had great influence on the form and genius of government. It tempered the rigour of ariftocratical oppreffion, with a proper mixture of popular liberty; it fecured to the great body of the people, hitherto unreprefented, active and powerful guardians of their rights and privileges; and it eftablifhed an intermediate power between the king and nobles, to which each had recourfe alternately, and which at fome times oppofed the ufurpations of the former, and on other occafions checked the encroachments of the latter. After the inhabitants of towns had been declared free by the charters of communities, the other part of the people which refided in the country, and was employed in agriculture, began to recover liberty by enfranchifment. Accordingly, the enfranchifment of flaves became more frequent in France, Italy, Germany, and England. In our own country more efpecially, as the fpirit of liberty gained ground, the very name and idea of perfonal fervitude, without any formal interpofition of the legiflature to prohibit it, were totally banifhed. Upon the whole we may obferve, with Dr. Robertfon, that the eftablifhment of communities contributed more perhaps than any other caufe, to introduce regular government, police, and arts, and to diffufe them over Europe. Hift. Ch. V. vol. i. *paffim.* See CHARTERS *of Community.*

CITY, CIVITAS, in fpeaking of antiquity, fignifies a ftate, or people, with all its dependencies, conftituting a particular republic. Such are ftill feveral cities of the empire, and the Swifs cantons.

Though the ancient Gauls were, in effect, only one nation; they were yet divided into feveral people, which formed as may different ftates: or, to fpeak with Cæfar, as many different *civitates, cities.* Befides that each city had its peculiar affemblies, it fent deputies too, from time to time, to the general affemblies held on affairs relating to their common intereft.

CITY is particularly ufed to exprefs the heart of the place. At Paris they have the *city* and the *univerfity;* at London we have the *city* and the *fuburbs.*

It has been obferved that large cities are more liable than other places to peftilential and putrid diforders, which is owing to the ftagnation and corruption of the air. This is always the cafe in thofe which are low and unprovided with common fewers; where the ftreets are narrow and foul, the houfes dirty, water fcarce, and jails and hofpitals crowded; alfo, when in fickly times the burials are within the walls, or when dead animals and offals are left to rot in the kennels, or on dunghills; when drains are not provided to carry off any large body of ftagnating water in the neighbourhood; when flefh-meats make the greateft part of the diet, without a proper mixture of greens, bread, wine, or fermented liquors; from the ufe of old mouldy grain. In proportion to the number of thefe and the like caufes concurring, a city will be more or lefs fubject to peftilential difeafes, or to receive the leaven of the true plague, brought into it by any merchandize. An excellent writer emphatically calls them the graves of the human ſpecies. See *Bills of* MORTALITY.

However, as great cities furniſh many materials for vitiating the air, they likewiſe afford two conſiderable antidotes; the firſt ariſes from the circulation of the air, by means of the conſtant motion of people and carriages, and of the draughts made by fires; the other depends on the great quantity of an acid produced by fuel, the ſtrongeſt reſiſter of putrefaction.

CITY, *Advocate of the.* See ADVOCATE.

CITY, *Capital.* See CAPITAL.

CITIES, *College of.* See COLLEGE.

CITIES, *Foreſt.* See FOREST.

CITY, *Freedom of a.* See FREEDOM.

CITY, *Honours of the.* See HONOURS.

CITIES, *Imperial.* See IMPERIAL.

CITIES, *Municipal.* See MUNICIPAL.

CITY, *Provoſt of the.* See PROVOST.

CIVES, in *Botany* and *Gardening.* See ALLIUM.

CIVET, a kind of perfume, bearing the name of the animal whence it is taken.

The word comes from the Arabic *zibet* or *zebed, ſcum, froth.*

The animal, commonly known by the name of the *civet*, or *civet-cat*, is the "Viverra civetta" of Linnæus, the "Meles faſciis et maculis albis, nigris et rufeſcentibus variegata" of Briſſon, the "felis zibethi" of Geſner, the "civette" of Buffon, and the "aſh-coloured weeſel, ſpotted with black, with cheſnut-coloured mane, and duſky tail ſpotted towards the baſe" of Dr. Shaw. Its general length, from noſe to tail, is ſomewhat more than two feet, and the tail meaſures 14 inches. The ground-colour of the body is yellowiſh aſh grey, marked with large blackiſh or duſky ſpots, diſpoſed in longitudinal rows on each ſide, with ſometimes a tinge of ferruginous; the hair is coarſe, and along the top of the back ſtands up, forming a ſort of mane; the head is of a lengthened or ſharpiſh form; with ſhort rounded ears; the eyes are of a bright ſky-blue; the tip of the noſe black; the ſides of the face, chin, breaſt, legs, and feet are black; the remainder of the face, and part of the ſides of the neck, are of a yellowiſh-white; from each ear are three black ſtripes, terminating at the throat and ſhoulders; the tail is generally black, but ſometimes marked with pale or whitiſh ſpots on each ſide of the baſe. Some naturaliſts, and particularly Belon, will have it to be the ſame with the hyæna of the ancients, and calls it "hyæna odorifera." But Buffon obſerves, that it has nothing in common with the hyæna, except the fiſſure or ſac, under the tail, and the mane along the neck and ſpine. It differs from the hyæna in the figure and ſize of the body, being one-half ſmaller. Its ears are ſhort, and covered with hair, while thoſe of the hyæna are long and naked. Beſides, it has ſhorter limbs, and five toes on each foot; but the legs of the hyæna are long, and it has only four toes on each foot. Neither does the civet dig the earth in queſt of dead bodies. Theſe animals, therefore, are eaſily diſtinguiſhed. The civet is an animal of a wild diſpoſition, and lives in the uſual manner of others of this genus, preying on birds, the ſmaller quadrupeds, &c. It is a native of ſeveral parts of Africa and India; but not of America, as ſome have erroneouſly aſſerted; though it has been tranſported thither from the Philippine iſlands, and the coaſt of Guinea. This animal, as well as the "zibet," though originally natives of the warm climates of Africa and Aſia, are capable of ſubſiſting in temperate and even in cold countries, provided they are defended from the injuries of the weather, and fed with ſucculent nouriſhment. Numbers of them are kept in Holland for the ſake of procuring and ſelling the perfume which they yield, called *civet*, and ſometimes erroneouſly confounded with muſk. There is a conſiderable traffic of civet from Baſſora, Calicut, and other places, where the animal that produces it is bred; though great part of the civet among us is furniſhed by the Dutch, who rear a conſiderable number of the animals. That which is obtained from Amſterdam is preferred to that which comes from the Levant or India, becauſe the latter is generally leſs pure. That brought from Guinea would be the beſt, if the negroes, as well as the Indians and Levanters, did not adulterate it with the juices of plants, or with labdanum, ſtorax, and other balſamic and odoriferous drugs. This perfume is gathered from time to time; and ſtill abounds in proportion as the animal is fed. Before any of theſe animals were ſeen in Europe, or it had been obſerved how the perfume had been gathered, the common opinion, founded on the relations of travellers, was, that it was the ſweat of that animal, when irritated and provoked into rage. To this effect, it was ſaid, that the animal was incloſed in an iron cage, and, after having been a long time beaten with rods, they gathered with a ſpoon, through the bars of the cage, and between the thighs of the animal, the ſweat or foam, which the rage and agitation had produced; and that, without this precaution, the animal would yield no perfume at all; which is undoubtedly falſe. This ſubſtance is a ſecretion formed in a large double glandular receptacle, ſituated at ſome little diſtance beneath the tail, and which the animal empties ſpontaneouſly. When the civet-cats are kept in a ſtate of confinement (as is uſually the caſe with the perfumers at Amſterdam and other places), they are placed, from time to time, in ſtrong wooden cages or receptacles, ſo conſtructed as to prevent the creature from turning round and biting the perſon employed in collecting the ſecreted ſubſtance; this operation is ſaid to be generally performed twice a week, and is done by ſcraping out the civet with a ſmall ſpatula or ſpoon. The ſubſtance is of a yellowiſh colour, and of the conſiſtence of an unguent; of an extremely ſtrong, and even unpleaſant odour when freſh, ſo as ſometimes to cauſe giddineſs and head-ach; but becomes more agreeable by keeping, though this is denied by the French academicians of the laſt century; the quantity obtained each time amounts to about a dram. The quantity ſupplied depends much on the quality of the nouriſhment, and the appetite of the animal, which always produces more in proportion to the goodneſs of its food. Boiled fleſh, eggs, rice, ſmall animals, birds, young poultry, and eſpecially fiſhes, are the beſt kinds of food, and they ought to be ſo varied as to preſerve the health and excite the appetite. He requires very little water; and though he drinks ſeldom, he diſcharges urine frequently; and in this operation, the male is not to be diſtinguiſhed from the female. When the ſecreted ſubſtance becomes incommodious to the animal on account of its quantity, or when the reſervoirs are too full, it is provided with proper muſcles for ſqueezing it out. The perfume of the animals is ſo ſtrong that it infects all parts of the body: the hair and the ſkin are ſo thoroughly penetrated with this odour, that they retain it long after death; and, during life, it is ſo violent as to be quite inſupportable, eſpecially if a perſon be ſhut up in the ſame apartment with the animal. When heated with rage, the odour becomes more highly exalted; and if the animal be tormented till he ſweats, the keeper collects the ſweat, which has likewiſe a ſtrong ſcent, and ſerves for adulterating,

adulterating, or, at leaſt, augmenting the quantity of the perfume.

Beſides the India and Dutch civet, there is alſo a civet from Braſil, Guinea, &c. like that of India.

There is another animal, *viz.* the "Viverra zibetha," (which ſee) or zibet of Buffon, that agrees in diſpoſition and manners with that above deſcribed; and which yields a ſecretion of perfume that is collected in the ſame manner.

Civet, though an article in the more ancient Materia Medica, and though ſtill employed by the oriental phyſicians, is uſed with us chiefly in perfumes. It has a very fragrant ſmell, and a ſub-acrid taſte; it unites readily with oils, both expreſſed and diſtilled; in watery or ſpirituous menſtrua, it does not diſſolve, but impregnates the fluids ſtrongly with its odour. It may, however, be made to unite with, or be ſoluble in water, by means of rubbing with mucilages. Civet has been ſometimes uſed medicinally in a thickneſs of hearing ariſing from cold; in which caſe, a grain or two being put in a little cotton or wool, and the ears ſtopped with it, is ſometimes of ſervice. Shaw's Zool. vol. i. part 2. Buffon by Smelly, vol. v.

CIVIC Crown, among the Romans, was a garland made of oak-leaves and acorns, or of ground oak, and was given as a reward to ſuch as had ſaved a citizen's life in battle, or reſcued him after being taken priſoner. This crown was highly eſteemed; and was given as an honour to Auguſtus Cæſar, who on that occaſion cauſed coins to be ſtruck, inſcribed OB CIVES SERVATOS. It was alſo given to Cicero, after his diſcovery of Catiline's conſpiracy. See Crown.

CIVIDAD das Palmas, in *Geography*, a ſea-port town of the Grand Canary iſland, called alſo *Canary*, which ſee.

Cividad *Real.* See Chiapa.—Alſo, the capital of the province of Guaira, in the eaſtern diviſion of Paraguay.—Alſo, a town of Spain, and capital of La Mancha, famous for a manufacture of leather gloves. It has three churches, ſeven convents, and three hoſpitals; 7 miles from Toledo.

Cividad *de los Reyes*, a town of South America, in the country of Terra Firma, and province of St. Martha. The heat is moderated in ſummer by the eaſt wind; but frequent rains and chilling blaſts from the mountains produce coughs and fevers. The adjacent land is fertile, and abounds in paſtures. The inhabitants are numerous, warlike, and hitherto unſubdued.

Cividad *del Rey Felippe*, a town built in 1585 on the continent of South America, near the ſtraits of Maghellan, but ſoon abandoned.

Cividad *del Rio del St. Pedro*, a town of South America, in Braſil, ſituated at the mouth of the river St. Pedro. S. lat. 32°. W. long. 34° 15′.

Cividad *Rodrigo*, a town of Spain in Leon, ſeated on the river Aguada, the ſee of a biſhop, ſuffragan of Compoſtella; built by Ferdinand II. as a rampart againſt Portugal, from which it is about 8 miles diſtant; 45 miles S.S.W. from Salamanca. N. lat. 40° 52′. W. long. 6° 15′ 24″.

CIVIERE, a ſmall hand-barrow carried by two men, and much uſed in the artillery, particularly at mortar batteries.

CIVIL, Civilis, in its general ſenſe, denotes ſomething that regards the policy, public good, or peace of the citizens, or ſubjects of a ſtate. In this ſenſe we ſay, civil government, civil law, civil rights, civil war, &c.

Civil, in a *Legal Senſe*, is alſo applied to the ordinary procedure in an action relating to ſome pecuniary matter, or intereſt. In which ſenſe it is oppoſed to criminal.

Civil *Action.* See Action.

Civil *Architecture.* The hiſtory of architecture, in a general ſenſe, would require an account of all the modes of building practiſed at different times among the various nations of the earth; but as it is not conſiſtent with the plan of the preſent work to include in one treatiſe the entire conſideration of any ſcience, we ſhall follow the ſubdiviſion which the ſubject naturally preſents, and treat of architecture as an uſeful and as a fine art. The former has been already conſidered under the article Building; and the preſent article will be devoted to the inveſtigation of the latter, in which we ſhall confine our attention to the architecture of Greece, and its imitators, the only ſtyle of building which, proceeding on a reaſoned ſyſtem of imitation, and regular proportions, has a title to be ranked among the fine arts.

Greece, which, after the decline of Egypt, became ſo eminent, pretended to no high antiquity, or remote origin. Her hiſtory reaches not many centuries back from that era which beheld her flouriſhing in arts and letters beyond all that the world had known before. The perſon to whom ſhe attributes the invention of the common conveniencies of life, exiſted long after Egypt had become a powerful and enlightened kingdom. Prometheus, whoſe ſuppoſed age is not more than 1600 years prior to the Chriſtian epoche, is introduced by Æſchylus, in his tragedy, as enumerating the various benefits which he had conferred upon mankind: amongſt the reſt he taught them (he ſays) to conſtruct houſes with bricks and timber; for till then they knew nothing of building, but dwelt in holes and caverns.

This perſonage (like many others to whom the invention of uſeful arts is attributed) is probably nothing more than factitious: or perhaps the Greeks might deſign, by this appellation, to preſerve the character, when they had forgotten the name, of their benefactors. Prometheus, which ſignifies prudence, is a term juſtly applicable to the ſagacity of all thoſe who made the diſcoveries that are aſcribed to that perſon. And the age which is aſſigned to him, the time when he is ſuppoſed to have lived, whatever be repreſented under his ſtory, will determine the period which the Greeks acknowledge for the origin of their civilization.

The priority of Homer to all other Grecian authors, his extenſive acquaintance with the arts, and his faithful and animated deſcription of the manners of his age, impart a ſingular value to whatever information he conveys upon thoſe topics. It may be amuſing to collect, from his poems, what was the ſtate of architecture at his time in that country, where it was deſtined, within a few generations afterwards, to attain to a pitch of excellence unequalled either in ancient or modern annals.

The houſes (the only ſpecies of edifices of which Homer has given any detail) had a court in front, which was fenced around, ſometimes with ſtone. An altar to the ſupreme deity (Jupiter) ſtood in the middle of the court, and one or more ſides of it were ornamented with a portico, where it was a cuſtom to lodge the gueſts. Dogs were kept here for a guard to the houſe; and ſometimes pictures of them were placed here: here alſo were the ſtables. This particular, *viz.* the ſituation of the ſtables, was obſerved by the Greeks in later ages, when, as Vitruvius relates, they built their houſes without any court in front. In the houſe itſelf the ground-rooms were lofty, and ſupported either by one or more columns. The upper ſtory was appropriated to the women; who were not, however, in that age, ſecluded from the common apartment, or the company of ſtrangers. We learn that the roofs of the houſes were flat, by an accident which befel one of the companions of Ulyſſes; who having got intoxicated at the houſe of Circé, fell from the roof and was killed. From time immemorial the ſame kind of roofs has been common in the ſouthern and eaſtern countries, and the ſame kind of accidents has attended them: ſo that the

Jews had a law reſpecting roofs, Deut. c. 22. v. 8, by which they were obliged to ſurround the top of their houſes with a baluſtrade, to prevent men from falling off.

In the Iliad few particulars of architecture are to be found. We read there little more than that Priam's palace contained 50 chambers; and that Paris lived in a ſeparate houſe adjoining, which he had built for himſelf with the aſſiſtance of ſome architects. It had a hall, a chamber, and a court. But it is in the Odyſſey, that intereſting narrative, and pleaſing delineation of manners, that the architecture of Homer's age is to be traced; and eſpecially in the palace (if it may be ſo called) of Ulyſſes. This edifice was diſtinguiſhed from all the reſt, in his town of Ithaca, by having the wall of the court built of ſtone with θριγκοι (ſome crowning ornament), and a gate with folding doors. There appears to have been but one room or hall for the reception of the company; the entrance to which was from the court. It muſt have been of great dimenſions; for it was not only large enough to entertain above 50 perſons at ſeparate tables, but alſo ſerved for ſeveral other purpoſes. The columns (if they were more than one), that ſtood within it, ſeem to have been as much for uſe as ornament. They were lofty; and the room probably roſe to the height of two ſtories. The floor was paved with ſtone; but rather ſunk than raiſed above the level of the natural ſoil; or, at leaſt, it was lower than the ſtone threſhold at its entrance. Two ſtaircaſes led from the hall; one to the roof, as it ſhould ſeem, and the other to certain ſtore-rooms, whither Ulyſſes conveyed away the armour from the hall, leſt the ſuitors ſhould avail themſelves of it when he came to attack them. The windows muſt have been at a great height from the floor; for the ſuitors when they were aſſaulted and ſaw themſelves without any means of defence, neither attempted to eſcape out of them, nor to call for aſſiſtance through them; notwithſtanding that they propoſed to raiſe the town in their behalf; but they knew no other way to do this than by getting to the roof, and the ſtaircaſe which led to that was guarded againſt them. On the night before they were ſlain they entertained themſelves with muſic and dancing; when the hall was lighted up by fires made upon three moveable hearths or braziers; and during that time Ulyſſes, in the character and dreſs of a beggar, attended in the room, to ſupply the cleft wood which was burnt upon them for a light. The total neglect of cleanlineſs is a feature which marks, as ſtrongly as any, the condition, perhaps the riot and licentiouſneſs, of Ulyſſes' houſe. For to omit other particulars, ſuch as the dunghill lying by the path way from the court-gate to the hall-door, the hall itſelf was the place where they killed, or at leaſt cut up and dreſt their beaſts; and they held the feaſts in the midſt of the ſkins and offal. When, upon the diſcovery of Ulyſſes, the ſuitors were incloſed and deſtroyed in the hall, the herald, who was among them, ſaved his life by hiding himſelf under a ſkin, that was newly taken off and left there; and when one of the ſuitors deſigned to inſult Ulyſſes while he was ſitting at meat near Telemachus, he found a bullock's foot lying cloſe by him, which he took up and threw at his head.

Within about four centuries from this era of coarſe manners in Greece did the ſame people arrive at the higheſt excellence in the polite arts that had ever been attained. And though that ſpace of time may appear ſufficiently long for the acquiſition of any ſcience, according to modern ideas, it is to be remembered that thoſe ages wanted our means of communicating knowledge; for writing and books were then almoſt unknown. By what ſteps they made ſuch a progreſs is not related; but that the varieties in architecture, the Ionic and Corinthian orders and all the ornaments, were invented within the period, is juſtly inferred from Homer's ſilence concerning them. Had architecture, at that time, been diſtinguiſhed by its ſeveral orders, or decorated with an entablature of carved work, we ſhould have heard from the Grecian, as we have from our own bard, *of Doric frize and cornice;* for he evidently takes a delight in deſcribing all the arts which then exiſted, and he was fond of diſplaying his learning.

The progreſs of improvement in Grecian architecture appears to have occupied a period of about three centuries, from the age of Solon and Pythagoras beginning with the year, before Chriſt, 600, when the temples of Jupiter, at Olympia and in the capitol of Rome, thoſe at Samos, Priene, Epheſus, and Magneſia, were begun, to the time when, under the adminiſtration of Pericles, the ornamental ſtyle of Grecian architecture attained its utmoſt beauty and perfection, in the temple of Minerva in the acropolis of Athens, built after the model of that of Jupiter at Olympia, and finally concluding this firſt period with the completion of the temple of Diana at Epheſus, in the time of Alexander, which, as Pliny informs us, had been 220 years in building, one of the columns being the work of Scopas. The ancient temple of Minerva, at Tegea in Arcadia, having been deſtroyed, a ſecond edifice was erected under the direction of Scopas, far exceeding in ſplendour and magnificence every building of the kind in the Peloponneſus. In this ſtructure the three Grecian orders of architecture were employed. Within the encloſure were galleries ſupported by Doric and Corinthian columns ſurrounding the hypæthros or open area of the cella. On the outſide of the temple were porticos of the Ionic order. The facades were enriched with ſculpture. (Pauſanias, l. viii.) To theſe examples may be added the temples in Sicily, as far as Gelo or Hiero may have contributed to their conſtruction, though many of them, as well as thoſe of Pæſtum, may poſſibly have had an earlier date.

Of all the phenomena in the political hiſtory of mankind, there is none more curious and wonderful than the great comparative degree of ſtrength and power, both internal and external, acquired by thoſe little ſtates whoſe only territory was a petty iſland, a narrow iſthmus, or a rocky promontory, from which they ſent out their piratical fleets to every part of the Mediterranean, and planted colonies on all its coaſts, in defiance of the proud monarchs who ruled the extenſive and populous plains of Aſia and Egypt, or the rude and hardy barbarians who inhabited the no leſs fertile regions of Sicily and Italy. Not only the leading ſtates, ſuch as Athens, Corinth, and Syracuſe, but Pæſtum, Segeſta, and Selinus, little obſcure republics, whoſe names alone can be gleaned from hiſtory by the diligence of the antiquary, have erected public works which would be a conſiderable enterprize for the greateſt nations of modern times. The portico of the great temple of Selinus in Sicily, which is one of ſix ſtill remaining, though proſtrate and in ruins on the ſite of that city, conſiſted of a double periſtile of eight columns in front and ſeventeen in depth, each of which was ten feet diameter and fifty feet high.

In conſidering the buildings of antiquity, and particularly of Greece, the firſt circumſtance that ſtrikes us is their extreme ſimplicity and even uniformity of plan; the temples of Greece were invariably quadrilateral buildings, differing only in ſize, number of columns, and diſpoſitions of the porticos, which either ornamented the front alone or ſurrounded every ſide. Prior to the Macedonian conqueſt all the temples of Greece and its colonies, in Sicily and Italy, appear to have been of one order, the Doric, and one general form, though ſlightly varied in particular parts, as oc-

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cafional convenience or local fafhion might chance to require. Their general form was an oblong fquare of fix columns by thirteen, or eight by feventeen, inclofing a walled cell, fmall in proportion, which in fome inftances appears to have been left open to the fky, and in others covered by the roof which protected the whole building.

The fyftem of Grecian architecture is founded on the fimple principles of wooden conftruction; a quadrangular area is furrounded with trunks of trees placed perpendicularly with regular intervals; thefe fupport lintels, upon which reft the beams of the ceiling, and an inclined roof covers the whole. Such was the model in which, when touched by the hand of tafte, the poft and lintel were transmuted into the column and entablature, and the wooden hut into the temple.

It appears probable that the earlieft Greek temples were really of wood, fince fo many of them were confumed during the invafion of Xerxes; and that large and magnificent edifices were fometimes compofed principally of this material, is rendered evident by the example of the temple of Jerufalem, which was furrounded with columns of cedar. But builders foon adopted the more noble and durable material of ftone, and though the general fyftem of architecture was already eftablifhed, its forms received fome modification by being thus, as it were, tranflated into a new language.

A wooden lintel, from its fibrous texture, poffeffing confiderable tenacity and ftrength, in proportion to its weight, it was practicable to form very wide intercolumniation; thus we are told by Vitruvius, that the ancient Tufcan temples were conftructed with wooden architraves. Stone, on the other hand, of a granular compofition, and of great fpecific gravity, would break by its own weight in a bearing where a timber beam would be perfectly fecure. When, therefore, porticos were erected of ftone, it was neceffary, in order to enfure folidity, to contract the diftance between the columns to very narrow limits. A wooden edifice, never fecure from the injuries of accident or violence, prefented no motive for any great folidity in its conftruction. But in ftone it is poffible, as the energetic induftry of the ancient Egyptians has fhewn, to defy the injuries of time, and almoft the violences of rapine. The architect who builds in ftone may build for eternity, and this idea will give a motive for that grand and maffy folidity fo effential to the fublime of architecture. Thefe circumftances led to the perfection of the Grecian ftyle; the original model fecured fimplicity of form and conftruction, while a fuperior material preferved it from the meagrenefs attendant on wooden building.

Thus arofe the Doric, or, as it might be emphatically called, the Grecian order, the firft born of architecture; a compofition which bears the authentic and characteriftic marks of its legitimate origin in wooden conftruction transferred to ftone.

In contemplating a capital example of this order, as, for inftance, the Parthenon of Athens, how is our admiration excited at this nobleft as well as earlieft invention of the building art. What robuft folidity in the column—what maffy grandeur in the entablature—what harmony in its fimplicity; not deftitute of ornament, but poffeffing that ornament alone with which tafte refines and dignifies the conceptions of vigorous genius. No foliage adds a vain and meretricious decoration, but the frieze bears the achievements of heroes, while every part, confiftent in itfelf, and bearing a juft relation to every other part, contributes to that harmonious effect which maintains the power of firft impreffions and effects with increafing admiration in the intelligent obferver. Other orders have elegance, have magnificence, but fublimity is the property of the Doric alone.

Fluting the fhafts of a column is a practice never omitted in any great and finifhed Grecian work, and which appears to be mentioned by Homer, who, in defcribing the column of Ulyffes' hall, ufes the expreffion δουροδοχη, or *fpear-holder*, which we conceive can only mean flutes or channels cut in the fhaft. It therefore feems probable that this ornament had fome relation to the original type; perhaps the furrowed trunk might fuggeft the idea; it is, however, a beautiful decoration, which is applied with equal happinefs to break the otherwife heavy mafs of a Doric fhaft, or, in the other orders, to obviate an inconfiftent plainnefs. The invention of the Ionic and Corinthian orders enlarged the bounds of architectural compofition, and completed its powers of expreffion.

The Ionic order was, doubtlefs, invented in that country whofe name it bears, and where its beft models are ftill to be found. Vitruvius fuppofes this order to have been founded upon the imitation of the female form, as he alfo fuppofes the proportions of the Doric order to have been fettled upon thofe of men. The Greeks in Ionia having formed the Doric order according to the proportions of a man, followed the fame traces to obtain a new order that fhould imitate the gracefulnefs of women, and to that end they made a flenderer column whofe thicknefs was only one-eighth part of its height. To this order they gave a bafe by which they defigned to reprefent a fhoe, and the capital had a curling ornament, called a volute, faid to refemble the treffes of the hair dropping to the right and left. The channels and flutings of the fhaft were the plaits of the matron's garment. Thus arofe the invention of two orders, one of a mafculine appearance and unadorned, the other imitating the fine proportions of the female fhape.

The hiftory of the origin of the Corinthian order, which might poffibly be contrived either to give an intereft to the invention or to difguife the fource from whence it came, though fo often repeated and fo well known, may, neverthelefs, be here told once more as a pleafing anecdote of ancient manners. A young maiden of Corinth having died, her mother or nurfe collected in a bafket the toys which fhe had been fond of while alive, and carried them to her grave, where fhe left the bafket covered with a tile to preferve its contents from the weather. The bafket happened to be fet upon the root of an acanthus. The plant being thus depreffed in the middle, its leaves and ftalk fpread outwards, and grew up around the fides of the bafket till they were bent down by the tile, which lay projecting over its top.

At that time Callimachus, the fculptor, chanced to pafs by the grave, and being pleafed with the agreeable appearance of the foliage, and novelty of the form, he converted it to the purpofes of architecture; and having made fome columns of a more delicate proportion than had been ufed before, he adopted the bafket and leaves of the acanthus for the capital; and thus eftablifhed the fymmetry and ornaments of the Corinthian order.

The Egyptian capitals, which are ftill to be feen decorated with palm and other leaves, throw great doubt upon this ftory. Yet Callimachus might claim great merit from the Corinthian capital, and even fome fhare of the invention. He might be the firft who conceived the idea of fubftituting the leaf of the acanthus; and certainly the capital was improved in Greece, efpecially in the happy adjuftment of its ftalks and foliage, and this too was probably due to Callimachus.

machus. It is unfortunate for the fame of that architect, that no relic of this order exifts in the city which gave name to it.

About the fame time that Grecian architecture was rifing to eminence, the Tufcans, by whofe name one of the five orders is ftill diftinguifhed, began to fignalize themfelves in Italy by their fuperior fkill in building. The tomb of Porfenna, king of Etruria, which he founded in the city of Clufium, is recorded by Pliny (Nat. Hift. b. 36) as a wonderful, but idle, fpecimen of their art. Their works at Rome were lefs oftentatious, but much more important and ufeful. In that city they were employed in conftructing its walls of hewn ftone, and in raifing the Capitol. To them alfo muft be attributed the cloaca maxima, that extraordinary piece of architecture, which has always been ranked with the chief monuments of Roman greatnefs, and which remains to this day an object of admiration. Rome was fortified and adorned with thefe ftructures at an early period, while fhe was advancing to power and dominion under the government of her kings. The Tarquins, in whofe reigns thefe great works were undertaken, were of Tufcan origin.

But while a ftyle of grandeur was difplayed in the public edifices of that city, its private buildings were mean and poor. The life and manners of an ancient Roman citizen were not of a nature to difpofe him to the ftudy of architecture; and when the Gauls, in the 366th year of Rome, facked and burnt it, they deftroyed but a parcel of forry huts. Neither was the city after their departure rebuilt in any good or improved manner. Expedition alone feems to have been required, but order and propriety altogether neglected. For Livy afferts (b. 5.) that, without ftaying to have the ftreets fet out, every perfon feized upon the ground which he found vacant, fo that in many parts they built their houfes over the common fewers *(cloacæ)*; and that the public gave permiffion to dig ftones and cut timber at free coft, and fupplied roofing, that is fhingles, for all thofe who would give fecurity to complete their houfes within a year.

Their connection with Greece afterwards introduced the Romans to the knowledge of a more elegant ftile of architecture; and long before the period when Vitruvius compofed his treatife, they could boaft of many good architects, and fome authors upon the fubject. Of thefe, one of the earlieft and the moft eminent was Coffutius. This artift was engaged by king Antiochus about 200 years before the Chriftian æra, in the temple of Jupiter Olympus, which Pififtratus had begun; and then was feen the novel fpectacle of a Roman citizen conducting the architecture of the principal edifice in Athens.

We are not to conclude from hence that the art had fo far declined in Greece as to need the affiftance of foreigners; nor to eftimate its progrefs at Rome by the folitary inftance of Coffutius. The Greeks, who might efteem the age of Pericles as the period of their higheft excellence in architecture, about that time poffeffed three orders, either invented or improved by themfelves, which were refpectively applicable to every fpecies of building where ftrength, or elegance, or lightnefs was requifite. The fpoils of the eaft enabled them, under Alexander and his fucceffors, to increafe the number, and enrich the ftile, of their edifices; but the influx of that wealth was not fo abundant as to corrupt their tafte, or fupply the extravagancies of luxury; and architecture, among that people, underwent little or no change for the worfe. The Romans as yet cultivated few arts but that of war. Greece, and afterwards Afia, had the misfortune to fall under their dominion. The conqueft of the firft gave them fome tafte for the fine arts; the poffeffion of the latter furnifhed them with the means of indulgence. The return of Sylla from the Mithridatic war was the æra which was marked by the firft excefs of architecture in Rome. It was then that Scaurus, the fon-in-law of Sylla, raifed a temporary theatre, with fuch extravagance of decoration, that Pliny (Nat. Hift. b. 36.), who charges him as the firft who corrupted the Roman morals by luxury, affirms, "that the example was more pernicious to the city, than even the profcription of Sylla."

About fifty years before this period, an edifice of marble was erected in Rome, the earlieft of its kind; that edifice was a temple. The ufe of marble in private buildings was yet hardly known there; within a little time, however, it was introduced; firft, in door-cafes, then in columns: afterwards Mamurfa, an inferior officer in Julius Cæfar's army, incrufted his whole houfe with marble, and his example led the way to the ufe of marble in that manner with ftill greater profufion. But Mamurfa will appear moderate and fober if the expences and mode of his building be compared with thofe which took place under the emperors. The extent, the materials, the decorations of the Roman dwellings were then fuch as almoft exceed the limits of credibility. An author of the age of Tiberius fays, "The man thinks himfelf confined in his habitation now whofe houfe is not as large as the farm of Cincinnatus was," *(viz. 4 acres.)* This is not the language of one writer only; Pliny fays the like. "Thofe to whom the greatnefs of this empire is owing, had not fo much fpace for their farm, as fome now have for their cellars." The golden houfe of Nero was upon a fcale much larger ftill; it extended from the Palatine hill to the Efquiline. A defcription of it may be feen in the life of that emperor by Suetonius. When this pile of unparalleled extravagance was completed, Nero condefcended to exprefs his approbation of it, fo far as to fay, "that at laft he had got a houfe fit for a man to live in."

Auguftus diftinguifhed himfelf by his love for building. It was his boaft, that he had left a city of marble which he had found of brick. Inftigated by his example, and with a defire to pay him court, his relations, his wealthy fubjects, the governors of his provinces, princes, tributary or allied to him, all engaged in fome enterprize of architecture; and the general tranquillity of his reign was favourable to their operations; fo that not only in Rome and Italy, but alfo in the reft of his wide empire, grand and fumptuous edifices were erected. The colonies too which he fent out diffufed a knowledge of their architecture in the countries where they fettled; and Spain, Africa, and Germany exhibited to their rude inhabitants many fabrics in the Greek and Roman ftyle.

But none that courted the favour of Auguftus by extenfive and coftly buildings could, in that refpect, be compared with Herod the Great, king of Judea. The architectural defigns of this monarch were conceived and executed upon a fcale which furpaffed all others of his age. The re-building of the temple of Jerufalem, though a magnificent and wonderful undertaking, which occupied for eight years the labour of ten thoufand artificers, was yet but a fmall part of what he performed: other parts of his dominions were adorned by him, not merely with fingle edifices, but with entire cities. And if it be any excufe in an arbitrary governor, who burdens his people with heavy exactions, that they are expended liberally, it may be alleged in favour of Herod, that he raifed many ftructures of great fplendor and utility. The city and port of Cefarea, perhaps the chief of his enterprizes, was eminently fo. A full account of this, and a long catalogue of his other buildings, will be found in Jofephus, in the 16th book of his Antiquities of the Jews.

Whatever might be the efteem in which architects were held at Rome, there is reafon to think that the profeffion

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was lucrative; a sufficient inducement to make practitioners. And if we should hesitate to give full credit to the assertion of Vitruvius, "that many professed to be architects who wanted sufficient knowledge to be masons," we may yet believe that many were so ignorant as to commit gross errors, and many so disingenuous, as to follow the caprices of their employer, rather than their own better judgment. The emperor Domitian, who was not of a temper to bear controul, engaged much in architecture; and the ruins of his superb palace are still remaining. The style of building is good, though not without evident faults. These, however, are not attributed so much to the architect, as to the caprice of the master, of whose bad taste this signal instance is upon record. Domitian had plundered the temple of Jupiter in Athens of some of its marble columns, and brought them to Rome, to be erected in the Capitol. Before they were set up, he cut them anew, and, by so doing, he destroyed their just proportion, and made them too slender. Such is the account and judgment of Plutarch. That author says farther, "Whoever should admire the costliness of the Capitol, and afterwards survey a portico in Domitian's palace, or a hall, or bath, or the apartments of his concubines, might apply what Epicharmus observed of a profuse man: 'You have not a taste, but an itch, for building; and, like Midas, you desire to make every thing about you gold and precious stones." (Life of Poplicola.)

Soon after the time of this emperor flourished Apollodorus, an architect, whose merits and unfortunate end entitle him to an honourable distinction among those of his profession.

He was a native of Damascus, who, by his eminent talents, recommended himself to the patronage of the emperor Trajan. Under his direction was constructed the celebrated bridge over the Danube; a work surpassing, in its kind, every thing that the architecture of Greece or Rome had produced. He executed many other considerable buildings, which were esteemed the best of their age; and in all the noble edifices that were raised by Trajan he was employed, or consulted. The stately column in Rome, which is yet standing entire, and distinguished by the name of Trajan's pillar, is a monument of the abilities of Apollodorus. But while he enjoyed the favour of the reigning emperor, he neglected to ingratiate himself with the presumptive heir. Adrian was not only fond of architecture, but also made some pretensions to a skill in that science, which, it is reported, Apollodorus was so impudent as to ridicule. When the empire devolved to Adrian, he built, after a design of his own, a temple dedicated to Rome and Virtue; whose statues, in a sitting posture, were placed within the cell. After the fabric was completed, he sent a representation of it to Apollodorus, as a tacit vindication of his architectural skill, and a proof of what he was able to perform. If the emperor was a bad architect, the architect was certainly no good courtier: for upon seeing the statues, sitting, as they were, in the temple, (which, it seems, wanted much of its due proportion in height) he said, if the goddesses should ever attempt to stand upon their feet they would assuredly break their heads against the ceiling. For this sarcasm, upon his disproportioned room, the emperor took that unjustifiable revenge, into which the excess of power may sometimes betray the mildest characters: Apollodorus was shortly after put to death.

But, notwithstanding this cruelty exercised against the best architect of his time, Adrian encouraged architecture equally with any of his predecessors, and certainly more than all those who succeeded him; nor does antiquity record any person whose buildings are so numerous and widely spread. Much of his reign was spent in visiting the various provinces of his empire: and throughout all the vast extent he raised monuments of architecture beyond the scale of ordinary edifices. Such, in the south of Egypt, was the city of Antinoopolis, and in the north of England, the wall of defence, 80 miles long; the ruins of which are still called after his name. He rebuilt, or repaired, various ancient cities. Athens was particularly distinguished by his liberality; where he, at length, completed the temple of Olympian Jupiter: more than 600 years had elapsed since the commencement of that renowned fabric. His villa at Tivoli (the extensive ruins of which are beheld with surprize), was the private retreat of this emperor, where he had combined, it is said, the different stiles of architecture of every country which he had visited: another instance of false taste, somewhat resembling what we have seen in England, by the introduction of Italian villas and Chinese bridges.

Here, if it be asked concerning these structures, so many, so great, and some of them so excellent, after whose designs they were built, or by whom they were conducted in Egypt, or Greece, or Italy, no satisfactory answer can be given. For while the munificence of the founder was recorded upon every frontispiece, and the name of Adrian was engraved upon the walls in so many places, that he was therefore denominated the wall-flower, the memory of one architect alone has been preserved. Of all those who were employed in the course of his reign, the name of Detrianus only is known, a proof of the little consideration that was then paid to the merit of architects.

The period of the Antonines, that golden age of Rome, produced some good works in architecture, of which the column yet standing, commonly called Antonine's, is one example. But that period was followed by such unsettled times, and desolating wars, that the arts never recovered from the confusion which then filled the empire.

Several succeeding emperors, as Severus Alexander, and particularly Dioclesian, engaged in building, and encouraged that art, which, however, speedily declined; and with the erection of the vast palace of the last mentioned prince at Spalatro, may be placed the final corruption of good architecture in the Western empire.

The removal of the seat of empire to Constantinople, taking place after the fine arts had received their mortal wound, that city was never illustrated by any public works of a pure and noble taste. The numerous structures of Justinian, which fill two volumes of description in Procopius, were more signalized by their richness than their proportions. The church of St. Sophia, though a grand effort of construction, is of barbarous architecture; the columns are of no established order or just proportion, and the outside is heavy and deformed by buttresses. The size and magnificence of the pile however commanded general admiration, and moved its founder, Justinian, upon a view of it when first completed, to exclaim, "that he had surpassed Solomon in his temple."

The Romans borrowed their architecture from Greece, but practised it with some peculiarities of manner and taste. In reviewing the most favoured period, and the best examples of Roman architecture, we find, in addition to the square plans of the Greeks, circular temples crowned with domes. The Corinthian was the favourite order at Rome, and as far as existing examples enable us to judge, the only order well understood and happily executed.

Thus practising the art as imitators, and further removed from the original type, with less severity of taste than the Greeks,

Greeks, the Romans formed a ſtile of magnificence which always poſſeſſed grandeur, and in their beſt works was combined with taſte and ſimplicity.

In conſidering the architecture of the period under contemplation (*viz.* of Greece and the beſt ages of Rome), one circumſtance remarkably attracts attention: that while ſuch is the variety of general and particular proportions of the forms of mouldings and members, that it is impoſſible to name any two examples of an order which agree in all reſpects, ſo that it is evident that the fancy of each artiſt directed theſe particulars: this exuberant fancy was ſo well reſtrained within reaſonable limits, that the whole collection of columns may be reſolved into three characteriſtic orders. Having three expreſſions, the ſtrong, the elegant, and the rich, they knew that this was all that architecture could ſay diſtinctly, and any intermediate ſhade would but weaken and confuſe her language. The character of the three orders being firmly eſtabliſhed, and clearly marked by ſtrong and general features, the details were ordered by the taſte of each practitioner, and in thoſe happy taſte was the birthright of almoſt every artiſt.

Of what nature were the ſyſtems of architecture of the Greeks, is a queſtion which naturally preſſes on curioſity, when we read of the written works of a long liſt of architects, whoſe names alone ſurvive, in the works of Vitruvius. The authority of the laſt mentioned author we are not inclined to rank very high, as his precepts are in general contradicted by thoſe extant; it may, however, be concluded from his manner of teaching the art, that the ancients proceeded on very different principles in the execution of the orders from the moderns. Thus Vitruvius directs us to vary the proportion of the members, according to the magnitude, ſituation, purpoſe, and other circumſtances of the building; while modern authors offer no rules of that kind, but preſcribe a certain fixed modulation of the parts of each order, to be uſed in all edifices, however circumſtanced; each author recommending ſuch as his peculiar ſtudies have cauſed to make a favourable impreſſion on his mind. The columns of areoſtyle temples, ſays Vitruvius, are eight diameters in height; thoſe of a diaſtyle intercolumniation, eight and a half; thoſe of ſyſtyle, nine and a half; of pycnoſtyle, ten; and of euſtyle, eight and a half; and this he directs without any modification for the different orders, though, in a ſubſequent part of the work, each order has its particular proportions aſſigned. The columns of public porticos are directed to be made half a diameter higher than thoſe in temples. That the ancients were alſo guided by minute optical conſiderations, is rendered probable by another paſſage reſpecting the diminution of columns, which is directed to be varied according to their altitude; thus, in a column of fifteen feet high, the diameter at the bottom is to be divided into ſix parts, and five given to the diameter at the top; if the column is from forty to fifty feet in height, the bottom diameter is to be divided into eight parts, and ſeven given to the top. Several intermediate proportions are mentioned, and if it is ſtill higher, the ſame principle is to be obſerved. The reaſon aſſigned for this is, that as a greater height cauſes the column to appear more diminiſhed, this appearance is to be corrected by an additional thickneſs, "beauty being the province of the eye, which, if not ſatisfied by the due proportion and augmentation of the members, correcting apparent deficiencies with proper additions, the aſpect will appear coarſe and diſpleaſing." The columns at the angles of the porticos are alſo directed to be made $\frac{1}{50}$ part of a diameter thicker than the others, becauſe they being more ſurrounded by the air will appear ſlenderer. This laſt practice is confirmed by the example of the temple of Minerva at Athens. In another part, Vitruvius gives an extraordinary direction, for which it is not eaſy to conceive a reaſon; that the columns of the ſide porticos of a temple ſhould be ſo placed, that the inner line of the ſhaft may be perpendicular, thus leaving all the diminution on the outſide. Columns thus formed are obſerved in the temple of Veſta at Tivoli, and perhaps in no other antique example.

In examining the progreſs of Roman building, it will be found that the introduction of arches operated an eſſential change in the forms and principles of architecture. This was the nobleſt improvement in the art of conſtruction, an invention which enabled man to bridle the mighty river, to raiſe in the ſkies the ſelf-balanced pile, and cover with the penſile vault the vaſt area of a temple of all the gods. But it may be doubted, whether the arch, though enlarging the powers of conſtruction, has not in fact been injurious to architecture, conſidered as a fine art. Grecian architecture, as it has been before obſerved, is founded on the forms and proceedings of wooden conſtruction, by which it acquired that ineſtimable ſimplicity which ſatisfies the judgment, and attracts, with increaſing admiration, the eye of taſte. The arch, on the other hand, may be ſaid to be the natural ſtyle of ſtone building, and thus this invention introduced a new and inconſiſtent principle of imitation, cauſing a confuſion of ideas both in ſyſtem and practice.

Some of the Roman buildings which exhibit marks of the deterioration of taſte alluded to are the following. Veſpaſian's temple of Peace, where a vault of ground arches, a figure in itſelf ugly and ignoble, is ſupported at the ſpringing of each groin by a ſingle Corinthian column, a ſupport as meagre and inadequate, in conſideration of the vault, as the application of it is contrary to ſyſtem. In the theatre of Marcellus, and the Coliſeum, we find ſeveral ſtories of arcades, while the intermediate piers are ornamented with engaged columns; thus the order, inſtead of forming an eſſential part of the conſtruction, is degraded to an idle and oſtentatious ornament. The Coliſeum, though impoſing, from its maſs and general ſimplicity of form, is very deficient in detail; and the theatre of Marcellus, though erected in the Auguſtan age, exhibits an example of the Doric order entirely deprived of its characteriſtic grandeur. The triumphal arches rather belong to ſculpture than architecture, and are therefore ſcarcely amenable to the rules of the latter art, otherwiſe they would be liable to ſimilar objections.

Together with the other fine arts, though not exactly with equal ſteps, architecture declined in the Roman empire; while the principles of the art were neglected or forgotten, the execution progreſſively barbarized. The palace of Diocleſian, at Spalatro, ſhews the ſenility of architecture; diſproportionate intercolumniations, pediments of which the horizontal cornices are ſuppreſſed; arches ſpringing immediately from columns, fantaſtic corbels, which, in defiance of the rules of ſolidity, ſupport columns; in theſe abuſes we trace the final degradation of Grecian architecture.

From this time commences the age of ſpoliation; impudent compilers of fragments, the barbarous builders of that period have but perpetuated their own ignominy. Conſtantine was the firſt of theſe depredators; he ruined the arch of Trajan to decorate his own with its appropriate ornaments, and erected his baſilicas with columns from the mauſoleum of Adrian. In this confuſion of ideas and practice, we may obſerve a certain characteriſtic ſtyle which marks the age. The builders, deficient in ſkill and ability, adopted a certain haſty and compendious mode of conſtruction, which influenced the forms of architecture. The columns which they had taken from other edifices, were placed with wide

wide intercolumniations; and therefore the original entablatures became ufelefs; to thefe were fubftituted arches, which, fpringing from the capitals, fupported the fuperftructures. The ornamental parts, being either wholly or in part the workmanfhip of former ages, prefented great incongruities, and difgraced the rude imitations of that period. Tafte in decoration and execution, was a quality wholly wanting; but yet, whether it were the example of antient edifices, the want of fancy, or real judgment, the plans and general forms preferved fomewhat of a grand and venerable fimplicity. The moft complete example remaining of this ftyle is to be feen at Rome, in the church of Saint Paul, without the walls; a building attributed to Conftantine, and which preferves fome antique columns of fingular beauty.

Thus the art lingered till the arrival of the Goths in Italy, when it may be faid to have expired by a violent death, efpecially in the repeated facking and burning of Rome, which had for fo many ages been the miftrefs of the univerfe.

Having thus traced the progrefs, decline, and extinction of Grecian architecture, our next tafk will be to defcribe its revival in modern times, leaving the ftyles of building prevalent in the middle ages to be treated of under the articles of NORMAN, SAXON, and GOTHIC *Architecture.*

Brunellefchi, born in 1377, may be regarded as the founder of modern architecture. After having exercifed his talents in various arts, and formed his mind by the ftudy of ancient authors, he undertook to revive the maxims of ancient architecture, and to difinter them from the ruins in which they had been enveloped by time and barbarity. For this purpofe he examined and meafured the ruins of Rome with extreme diligence; he difcovered the orders, and having recognized the rules of the art, was the firft who made a proper application of them in his works. He allied theory to practice, and the profound ftudy of ancient monuments led him to the true principles of fimple and folid conftruction.

The vaft cathedral of St. Maria dei Fiore, at Florence, begun by Arnolfo Lafii in 1298, remained unfinifhed; the original architect had died only two years after the beginning of the building; and to erect a cupola which he had intended as a termination of the edifice, was an undertaking beyond the power of the builders of that age. It was ever regarded as chimerical, and in a convocation architects from various countries affembled in 1420; the moft extravagant plans were propofed without coming to any determination. At length Brunellefchi was entrufted with the enterprize, and he executed it with that facility which, in caufing the difficulties to difappear, is too apt to conceal the merit of an original defign, which none could difcover, but all can imitate.

The dome of St. Maria dei Fiore, which is only inferior in fize to that of St. Peter's, is of an octangular fhape, with a great elevation; it is double, being formed by two vaults which leave an interval between them. It was erected without centering, and it is the only dome which is fupported by the fpringing wall alone, without any kind of counterforts.

This edifice, and many others which Brunellefchi erected, did as much honour to the architect as to the art, and awakened in Italy a general tafte for the true principles of architecture; which was further confirmed by the ftudy of Vitruvius, whofe writings began to excite the attention of the learned.

Alberti, born in 1398, fucceeded to the talents and enterprizes of Brunellefchi, but his great reputation is principally founded upon his treatife "De Re ædificatoria," a profound and valuable work, which has acquired him the title of the modern Vitruvius.

While the principles of conftruction were advancing towards perfection, Bramante, following the example of Brunellefchi in the fedulous ftudy of the remains of antiquity, reftored to architecture the tafte and beauty which had been fo long abfent from her works. Julius II. having formed the project of rebuilding the bafilica of St. Peter on a plan of unequalled magnificence, entrufted the execution to Bramante in 1513. This artift conceived the impofing idea of raifing in the air a cupola as large as that of the Pantheon, or, as he expreffed it, of raifing the Pantheon upon the Temple of Peace; and, in fact, we may trace a great refemblance to thefe two antique edifices in his plan. It is to be lamented that this artift did not poffefs the practice as well as the theory of his art, and the works which he began with fuch carelefs rapidity at St. Peter's have been almoft obliterated by his fucceffors. This vaft undertaking was carried on by Raphael, San Gallo, and Michael Angelo, to whom the final defign of the edifice is principally due.

Under the great names of Vignola, Serlio, Palladio, and Scamozzi, architecture continued to flourifh in the 16th century. Thefe diftinguifhed artifts made the ancient edifices of Rome their fchool, and all ferved their art by their writings as well as by their buildings.

The lift of good Italian architects clofes with Bernini, the moft eminent artift of the 17th century. His contemporary, Boromini, was the corruptor of architectural tafte: of an ungoverned fancy, and tormented with envy of the talents and fuccefs of Bernini, he abandoned every principle of propriety in the wild purfuit of novelty, and buried the forms of art under the moft abfurd and incredible caprices.

Pierre Lefcot is the firft French architect who abandoned the Gothic for the revived antique ftyle. He flourifhed in the beginning of the 16th century. Philibert de Lorme, of the fame age, contributed to the reftoration of the principles of architecture. This architect had ftudied the Roman antiquities, and was a great writer as well as builder.

Francois Manfart, born in 1598, is perhaps the greateft architectural genius that France has produced, but he is reproached with a want of ftability in his ideas, which caufed him to make frequent alterations during the execution of his works, and prevented him from being employed in fome of the greateft undertakings of his age. The Chateau de Maifons, near St. Germain, is one of the chef-d'œuvres of Francois Manfart.

Jules-Hardouin Manfart, a nephew of the preceding, was the chief architect of Louis XIV. and executed the principal works of that magnificent reign: the palace of Verfailles, St. Cyr, and, above all, the place and church of the Invalids.

The façade of the Louvre, one of the moft beautiful examples of modern architecture, was the work of Claude Perrault, who alfo diftinguifhed himfelf by feveral other buildings, and a tranflation of Vitruvius.

Blondel, born in 1617, is celebrated for his knowledge of the fciences and the theory of architecture. His moft celebrated building is the Porte St. Denis. The diftinguifhed name of Soufflot, the architect of the church of St. Genevieve, the prefent Pantheon of Paris, brings down the lift of French architects to our own times.

Gothic architecture had declined in England during the reign of Henry VIII.; and Inigo Jones, the reftorer of ancient architecture, may be regarded as the greateft as well as the earlieft Englifh architect. He was born in 1572, and died 1651. His works are too familiarly known to require defcription in this place, but Greenwich, Whitehall, and Covent-

Covent-Garden, will for ever secure him a name among the most eminent of his profession. It might have been sufficient to the fame of sir Christopher Wren to have erected the second religious edifice of Europe, but innumerable other monuments attest his talent and scientific skill. These two distinguished names form our list of architectural worthies; of the rest who, with various success, have pursued the art, none can be said to have attained any historical eminence.

Civil *Corporation*. See Corporation.

Civil *Day*. See Day.

Civil *Death*, any thing that retrenches or cuts off a man from civil society: as a condemnation to the gallies, perpetual banishment, condemnation to death, outlawry, and excommunication; all which make a man cease to be looked on as a citizen.

The term is likewise applied to those who are no longer capable of acting in temporal concerns; as those who renounce the world, who retire and make vows in a monastery, &c.

Civil *Fruits*. See Fruits.

Civil *History*. See History.

Civil *Injuries*, or *Private Wrongs*, in *Law*, denote those which are an infringement or privation of the private or civil rights belonging to individuals, considered as individuals; in contradistinction to *public wrongs*, which are a breach and violation of public rights and duties, which affect the whole community, considered as a community, and are distinguished by the harsher appellation of *crimes* and *misdemesnors*, which see.

Civil *Law*, *Lex Civilis*, is defined in the Institutes, to be the laws peculiar to each city, or each people; now more properly distinguished by the name of "Municipal Law." But in the modern use, it properly implies the Roman law, contained in the *Institutes*, the *Digest*, the *Code*, and the *Novels*; (which see respectively); otherwise called *lex scripta*, or the *written law*. The Roman law, at its commencement, was very inconsiderable. Under the kings, the people were governed by certain laws prepared by the senate, passed by the kings, and confirmed in an assembly of the people. Romulus, Numa, and Servius Tullus, are celebrated as the most ancient legislators; and each of them claims his peculiar part in the three-fold division of jurisprudence. The laws of marriage, the education of children, and the authority of parents, which may seem to draw their origin from *nature* itself, are ascribed to the untutored wisdom of Romulus. The law of *nations*, and of religious worship, which Numa introduced, was derived from his nocturnal converse with the nymph Egeria. The *civil* law is attributed to the experience of Servius; he balanced the rights and fortunes of the seven classes of citizens; and guarded, by fifty new regulations, the observance of contracts, and the punishment of crimes. The state, which he had inclined towards a democracy, was changed by the last Tarquin into lawless despotism; and when the kingly office was abolished, the patricians engrossed the benefits of freedom.

Papirius, who flourished somewhat before or after the "Regifugium," was the first who made a collection of the regal laws; which took its name from its author, and was called *jus Papirianum*.

The republic, after abolishing the regal government, still retained the royal laws. For, though they were become odious or obsolete, the mysterious deposit was silently preserved by the priests and nobles; and, at the end of 60 years, the citizens of Rome still complained that they were ruled by the arbitrary sentence of the magistrates. Nevertheless, the positive institutions of the kings had blended themselves with the public and private manners of the city. To these they added the laws of the Twelve Tables, drawn by the decemviri, from the laws of twelve of the principal cities of Greece; and the more equitable among the laws hitherto practised at Rome. See Decemvirs and Twelve Tables.

During the time of the republic, and even under the emperors, there were jurisconsulti; who, making public profession of the study of the law, were consulted on the different senses of the laws, and gave answers to the questions proposed to them hereon; which were called *responsa prudentum*, and by Justinian, the *jurisprudentia media*.

The law of the Twelve Tables was at length found so severe, and conceived in such obscure terms, that it was judged proper to moderate, restrain, and ascertain it, by other laws, proposed to the senate by the consuls, and passed at general assemblies of the people; according to the practice that had obtained under the kings themselves: and these were called by way of emphasis *leges*, or the *laws*. Afterwards, the common people differed with the nobility, and during their secession enacted laws of their own, which were called *plebiscita*; and, upon their subsequent reconciliation, these were admitted and universally enforced. The senate was likewise intrusted with a legislative authority; and new laws were made by them, and called *senatus consulta*, and incorporated with the Roman civil law. The prætors, likewise, in the absence of the consuls, had a power of supplying and correcting the civil law of the Twelve Tables, and of proposing edicts, which, when approved by the people, were incorporated into the civil law, under the title of *jus prætorium*. And the ædiles curules did also in some cases enact and establish laws. These several parts, which have been enumerated, composed the Roman civil law during the republic.

In the time of Julius Cæsar, Offilius, a lawyer, began a collection of the edicts of the prætors; but this was not finished till the time of Adrian, by another lawyer; who also digested the edicts of the ædiles curules, which were made perpetual by the Cornelian law. Accordingly, the design which had been conceived by the genius of Cæsar was accomplished by Adrian; and the prætorship of Salvius Julian, an eminent lawyer, was immortalized by the composition of the "perpetual edict." This well-digested code was ratified by the emperor and the senate; the long divorce of law and equity was at length reconciled; and instead of the Twelve Tables, the perpetual edict was fixed as the invariable standard of civil jurisprudence. See Edict.

In the year of Rome 723, B. C. 31, the republic expired; and the whole power of the people was transferred to Augustus, who was contented to publish his new laws in the assembly of the people; to keep up some image of the republic by this formality. Tiberius abolished these occasional assemblies, on pretence of their being too numerous; and in lieu thereof offered his laws to the senate, who never failed to confirm them; insomuch that the laws of Tiberius and his successors, who kept the same measures with the senate, were esteemed *senatus consulta*. They were also called *imperial constitutions*, and sometimes *placita principum*. The *responsa prudentum*, obtained from those to whom the emperors gave commission, and to which the judges were obliged to conform, constituted a part of the *jus scriptum*, or written law. The *imperial constitutions* were digested into four codes, after they were become very numerous under succeeding emperors; their bulk being so great, or, as Livy expresses it, (l. iii. c. 34.) "tam immensus aliarum super alias acervatarum legum cumulus," that they were computed to be many camels' load by an author who preceded Justinian.

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This was in part remedied by the collections of three private lawyers, Gregorius, Hermogenes, and Papirius; and then by the emperor Theodofius the Younger, by whofe orders a code was compiled, A. D. 438, being a methodical collection of all the imperial conftitutions then in force; which Theodofian code was the only book of civil law received as authentic in the weftern part of Europe till many centuries after; for Juftinian commanded only in the eaftern remains of the empire.

Mr. Gibbon (Hift. Decl. and Fall of the Roman Empire, vol. viii.) divides the interval of almoft 1000 years that elapfed from the Twelve Tables to the reign of Juftinian, into three periods, almoft equal in duration, and diftinguifhed from each other by the mode of inftruction, and the character of the Civilians.

During the firft period, A. U. C. 303—648, pride and ignorance contributed to confine within narrow limits the fcience of the Roman law. On the public days of market or affembly, the mafters of the art were feen walking in the forum, ready to impart needful advice to the meaneft of their fellow-citizens, from whofe votes, on a future occafion, they might folicit a grateful return. As their years and honours increafed, they feated themfelves at home on a chair or throne, to expect with patient gravity the vifits of their clients, who, at the dawn of day, from the town and country, began to thunder at their door. The duties of focial life, and the incidents of judicial proceeding, were the ordinary fubject of thefe confultations, and the verbal, or written opinion of the "jurifconfulti," was framed according to the rules of prudence and law. The youths of their own order and family were permitted to liften; their children enjoyed the benefit of more private leffons; and the Mucian race was long renowned for the hereditary knowledge of the civil law.

The fecond period, A.U.C. 648—988, the learned and fplendid age of jurifprudence, may be extended from the birth of Cicero to the reign of Severus Alexander. A fyftem was formed, fchools were inftituted, books were compofed, and both the living and the dead became fubfervient to the inftruction of the ftudent. The "tripartite" of Ælius Pætus, furnamed Catus, or the Cunning, was preferved as the oldeft work of jurifprudence. Cato the cenfor derived fome additional fame from his legal ftudies, and thofe of his fon; the kindred appellation of Mucius Scævola was illuftrated by three fages of the law; but the perfection of the fcience was afcribed to Servius Sulpicius, their difciple, and the friend of Tully; and the long fucceffion, which fhone with equal luftre under the republic and under the Cæfars, is finally clofed by the refpectable characters of Papinian, of Paul, and of Ulpian. Their names, and the various titles of their productions, have been minutely preferved, and the example of Labeo may fuggeft fome idea of their diligence and fecundity. That eminent lawyer of the Auguftan age, divided the year between the city and country, between bufinefs and compofition; and 400 books are enumerated as the fruit of his retirement. Of the collections of his rival Capito, the 259th book is exprefsly quoted; and few teachers could deliver their opinions in lefs than 100 volumes.

In the third period, A.U.C. 988—1230, between the reigns of Alexander and Juftinian, the oracles of jurifprudence were almoft mute. The meafure of curiofity had been filled; the throne was occupied by tyrants and barbarians; the active fpirits were diverted by religious difputes, and the profeffors of Rome, Conftantinople, and Berytus, were humbly content to repeat the leffons of their more enlightened predeceffors. From the flow advances and rapid decay of thefe legal ftudies, it may be inferred, that they require a ftate of peace and refinement. From the multitude of voluminous civilians, who fill the intermediate fpace, it is evident, that fuch ftudies may be purfued, and fuch works may be performed, with a common fhare of judgment, experience, and induftry. The genius of Cicero and Virgil was more fenfibly felt, as each revolving age had been found incapable of producing a fimilar or a fecond; but the moft eminent teachers of the law were affured of leaving difciples equal or fuperior to themfelves in merit and reputation.

In the 7th century of the city, the jurifprudence, which had been grofsly adapted to the wants of the firft Romans, was polifhed and improved by the alliance of Grecian philofophy. The Scævolas had been taught by ufe and experience; but Servius Sulpicius was the firft civilian who eftablifhed his art on a certain and general theory. The logic of Ariftotle and the Stoics introduced the light of order and eloquence.

After the example of Plato, Cicero, though he declined the reputation of a profeffed lawyer, compofed a republic; and for its ufe, a treatife of laws; in which he labours to deduce from a celeftial origin the wifdom and juftice of the Roman conftitution. Plato, Ariftotle, and Zeno, he reprefents as the only teachers who arm and inftruct a citizen for the duties of focial life. Of thefe, the armour of the Stoics was found to be of the firmeft temper; and it was chiefly worn, both for ufe and ornament, in the fchools of jurifprudence. Auguftus and Tiberius were the firft to adopt, as an ufeful engine, the fcience of the civilians; and their fervile labours accommodated the old fyftem to the fpirit and views of defpotifm. Under the fair pretence of fecuring the dignity of the art, the privilege of fubfcribing legal and valid opinions was confined to the fages of fenatorian or equeftrian rank, who had been previoufly approved by the judgment of the prince; and this monopoly prevailed till Adrian reftored the freedom of the profeffion to every citizen confcious of his abilities and knowledge. The difcretion of the prætor was now governed by the leffons of his teachers; the judges were enjoined to obey the comment as well as the text of the law; and the ufe of codicils was a memorable innovation, which Auguftus ratified by the advice of the civilians. Two fages of the law, Ateius Capito and Antiftius Labeo, adorned the peace of the Auguftan age; and their refpective fchools maintained their inveterate conflict from the age of Auguftus to that of Adrian. (See Capito and Cassiani.) The controverfies of the different fects were in a great meafure determined by the perpetual edict. The lawyers of the age of the Antonines, like the cotemporary philofophers, difclaimed the authority of a mafter, and adopted from every fyftem the moft probable doctrines. An indulgent edict of the younger Theodofius excufed the judge from the labour of comparing and weighing the arguments of different competitors. Five civilians, Caius, Papinian, Paul, Ulpian, and Modeftinus, were eftablifhed as the oracles of jurifprudence; a majority was decifive: but if their opinions were equally divided, a cafting vote was afcribed to the fuperior wifdom of Papinian.

When Juftinian afcended the throne, A.D. 527, the reformation of the Roman jurifprudence was an arduous but indifpenfable tafk. In the fpace of ten centuries, the infinite variety of laws and legal opinions had filled many thoufand volumes, which no fortune could purchafe and no capacity could digeft. Books could not eafily be found; the fubjects of the Greek provinces were ignorant of the language that difpofed of their lives and properties; and the barbarous dialect of the Latins was imperfectly ftudied in the academies of Berytus and Conftantinople. In thefe circumstances, Justinian, finding the authority of the Roman law almost abolished in the West, by the declension of the empire, resolved to make a general collection of the whole Roman jurisprudence, and committed the care thereof to his chancellor Trebonian or Tribonian.

Tribonian was eminently qualified for the office. To the literature of Greece he added the use of the Latin tongue; the Roman civilians were deposited not only in his library but in his mind; and he most assiduously cultivated those arts which opened the road of wealth and preferment. From the bar of the prætorian prefects, he raised himself to the honours of quæstor, of consul, and of master of the offices; the council of Justinian listened to his eloquence and wisdom, and envy was mitigated by the gentleness and affability of his manners. This minister, aided by nine learned associates, began, in the first year of the reign of Justinian, and under his direction, to revise the ordinances of his predecessors, as they were contained, since the time of Adrian, in the Gregorian, Hermogenian, and Theodosian codes; to purge the errors and contradictions, to retrench whatever was obsolete or superfluous, and to select the wise and salutary laws best adapted to the practice of the tribunals and to the use of his subjects. The work was accomplished in 14 months, from A.D. 528, Feb. 13, to A.D. 529, April 7; and the twelve books, or tables, which the new decemvirs produced, might be designed to imitate the labours of their Roman predecessors. The new "Code" of Justinian was honoured with his name, and confirmed by his royal signature; authentic transcripts were multiplied by the pens of notaries and scribes; they were transmitted to the magistrates of the European, the Asiatic, and afterwards the African provinces; and the law of the empire was proclaimed in solemn festivals at the doors of churches. It still remained to extract the spirit of jurisprudence from the decisions and conjectures, the questions and disputes of the Roman civilians. Seventeen lawyers, with Tribonian at their head, were appointed by the emperor to exercise an absolute jurisdiction over the works of their predecessors; and the "Digest," or "Pandects," were rapidly composed in three years, from A.D. 530, Dec. 15, to A.D. 533, Dec. 16. From the library of Tribonian, they chose 40, the most eminent civilians of former times; 2000 treatises were comprised in an abridgment of 50 books; and it has been carefully recorded, that 3,000,000 of lines, or sentences, were reduced, in this abstract, to the moderate number of 150,000. The edition of this great work was delayed a month after that of the "Institutes;" and it seemed reasonable that the elements should precede the digest of the Roman law. The "Institutes," completed A.D. 533, Nov. 21, which comprise an ample system reduced to a short and elementary treatise, are comprehended in four books. (See INSTITUTES.)

The "Code," the "Pandects," and the "Institutes," were declared to be the legitimate system of civil jurisprudence; they alone were admitted in the tribunals, and they alone were taught in the academies of Rome, Constantinople, and Berytus. Justinian addressed to the senate and provinces his "eternal oracles;" and his pride, under the mask of piety, ascribed the consummation of this great design to the support and inspiration of the deity.

In order to maintain the text of the "Pandects," the "Institutes," and the "Code," the use of ciphers and abbreviations was rigorously proscribed; and as Justinian recollected, that the perpetual edict had been buried under the weight of commentators, he denounced the punishment of forgery against the rash civilians who should presume to interpret or pervert the will of their sovereign. Six years, however, had not elapsed from the publication of the "Code," before the versatile emperor condemned the imperfect attempt, by a new and more accurate edition of the same work (A. D. 534, Nov. 16.); which he enriched with 200 of his own laws, and 50 decisions of the darkest and most intricate points of jurisprudence. Every year, or according to Procopius, each day, of his long reign, was marked by some legal innovation. Many of his acts were rescinded by himself; many were rejected by his successors; many have been obliterated by time; but the number of 16 "edicts," and 168 "novels," (A. D. 534—565.) has been admitted into the authentic body of the civil jurisprudence. (See AUTHENTICS and NOVEL.)

All these together, viz. the "Code," the "Digest," the "Institutes," and the "Novels," form the *Corpus juris civilis*, or body of the civil law, as reduced by order of Justinian.

For the space of about 300 years, this system of law obtained without any innovation. But the new constitutions, made by the emperors from time to time, at length occasioning some alterations; the emperor Basil, and Leo his son, composed a new body of the Roman law, chiefly from the Justinian, in the Greek language; dividing it into seven volumes, and 60 books; under the title of "Basilica." From which time, Justinian's body had but little credit in the East; the Basilica taking place of it.

In the West, the civil law had a different fortune; for, though some traces of its authority remained in Italy, yet it was little known in Europe, till a copy of Justinian's "Digests" was accidentally found at Amalfi, in Italy, about the year 1130; and this circumstance, together with the policy of the Romish ecclesiastics, contributed to introduce it into several nations, and occasioned that inundation of voluminous comments, with which this system of law, more than any other, is now loaded.

It is true, however, it was never taught publicly till the 12th century; when the study of it was introduced into several universities abroad, particularly that of Bologna; where exercises were performed, lectures read, and degrees conferred in this faculty, as in other branches of science; and from hence it was carried by Irnerius's disciples into other countries, and in a little time was taught in all the universities.

Many nations, on the continent, just then beginning to recover from the convulsions consequent upon the overthrow of the Roman empire, and settling by degrees into peaceable forms of government, adopted the civil law (being the best written system then extant) as the basis of their civil constitution; blending and interweaving it among their own feudal customs, in some places with a more extensive, in others a more confined authority.

It was first brought over into England by Theobald, a Norman abbot, who was elected to the see of Canterbury in 1138; and he appointed a professor, viz. Roger, surnamed Vacarius, prior of Beck in Normandy, who opened a school in the university of Oxford, to teach it to the people of this country. Nevertheless, it gained ground very slowly; king Stephen, A. D. 1149, issued a proclamation, prohibiting the study of it: upon which Vacarius returned into Normandy, and was chosen abbot of Beck. And though the clergy were attached to it, the laity rather wished to preserve the old constitution.

A kind of persecution was raised against the professors and students of the civil law, by the common lawyers and others; but John of Salisbury says, "that, by the blessing of God, the more the study of it was persecuted, the more it flourished."

The bishops and clergy, many of whom were foreigners, applied

applied themfelves wholly to the ftudy of the civil and canon laws, which now came to be infeparably interwoven with each other; whereas the nobility and laity adhered with equal pertinacity to the common law. Thefe two parties manifefted a reciprocal jealoufy of what they were unacquainted with, and neither of them perhaps allowed (fays judge Blackftone) the oppofite fyftem that real merit which is abundantly to be found in each. This appears, on the one hand, from the fpleen with which the monaftic writers fpeak of our municipal laws upon all occafions; and, on the other, from the firm temper which the nobility fhewed at the famous parliament of Merton. Stat. Merton. 20 Hen. III. c. 9. The fame jealoufy appears above a century afterwards, (11 Ric. II.) when the nobility declared, with a kind of prophetic fpirit, "that the realm of England hath never been unto this hour, neither by the confent of our lord the king and the lords of parliament fhall it ever be, ruled or governed by the civil law." The clergy, however, finding it impoffible to root out the municipal law, began to withdraw themfelves by degrees from the temporal courts; and to that end, very early in the reign of king Henry III., epifcopal inftitutions were publifhed, forbidding all ecclefiaftics to appear as advocates *in foro feculari:* and wherever they retired, and wherever their authority extended, they difplayed the fame zeal to introduce the rules of the civil, in exclufion of the municipal law. This appears in a particular manner from the fpiritual courts of all denominations, from the chancellor's courts in both our univerfities, and from the high court of chancery; in all which the proceedings are to this day in a courfe much conformed to the civil law; for which no tolerable reafon can be affigned, unlefs that thefe courts were all under the immediate direction of the popifh ecclefiaftics, among whom it was a point of religion to exclude the municipal law; pope Innocent IV. having forbidden the very reading of it by the clergy, becaufe its decifions were not founded on the imperial conftitutions, but merely on the cuftoms of the laity. And if it be confidered, that our univerfities began about that period to recover their prefent form of fcholaftic difcipline; that they were then, and continued to be till the time of the reformation, entirely under the influence of the popifh clergy; (fir John Mafon the firft proteftant, being alfo the firft lay chancellor of Oxford), this will lead us to perceive the reafon why the ftudy of the Roman laws was in thofe days of bigotry purfued with fuch alacrity in thefe feats of learning; and why the common law was entirely defpifed, and efteemed little better than heretical. The ftruggle between the laws of England and of Rome was continued through the reign of king Henry II.; the former fupported by the ftrength of the temporal nobility, when the popifh clergy endeavoured to fupplant them in favour of the latter. This difpute was kept on foot till the reign of Edward I.; when the laws of England, under the new difcipline introduced by that fkilful commander, obtained a complete and permanent victory.

Before the reformation degrees were as frequent in the canon law as in the civil law. Many were graduates *in utroque jure* or *utriufque juris.* J. U. D. or *juris utriufque doctor*, is ftill common in foreign univerfities. But Henry VIII., in the 27th year of his reign, when he had renounced the authority of the pope, iffued a mandate to the univerfity of Cambridge, to prohibit lectures, and the granting of degrees in canon law in that univerfity. It is probable that, at the fame time, Oxford received a fimilar prohibition, and that degrees in canon law have ever fince been difcontinued in England. See DEGREE.

However, the zeal and influence of the clergy prevailed; and the civil law acquired great reputation from the reign of king Stephen to the reign of king Edward III. both inclufive. Henry II., who fucceeded Stephen, being a much greater politician, was far from difcouraging the ftudy of the civil law; which, in conjunction with that of the canon law, prevailed very much in the univerfities, but ftill more in the cathedral fchools and monafteries.

Many tranfcripts of Juftinian's Inftitutes are to be found in the writings of our ancient authors, particularly of Bracton and Fleta; and judge Blackftone obferves, that the common law would have been loft and over-run by the civil, had it not been for the incident of fixing the court of common pleas in one certain fpot, and the forming the profeffion of the municipal law into an aggregate body.

It is allowed, that the civil law contains all the principles of natural equity; and that nothing can be better calculated to form good fenfe, and found judgment. Hence, though in feveral countries it has no other authority but that of reafon, and juftice, it is every-where referred to for authority.

It is not received at this day in any nation without fome alterations: and fometimes the feudal law is mixed with it, or general and particular cuftoms; and often, ordinances and ftatutes cut off a great part of it.

In Turkey the "Bafilics" are only ufed. In Italy the canon law and cuftoms have excluded a good part of it. In Venice cuftom hath almoft an abfolute government. In the Milanefe, the feudal law and particular cuftoms bear fway. In Naples and Sicily, the conftitutions and laws of the Lombards are faid to prevail. In Germany and Holland, the civil law is efteemed to be the municipal law: but yet many parts of it are there grown obfolete; and others are altered, either by the canon law, or a different ufage.

In Friezeland, it is obferved with more ftrictnefs: but in the northern parts of Germany, the jus Saxonicum, Lubecenfe, or Culmenfe, is preferred before it. In Denmark and Sweden it hath fcarce any authority at all. In France only a part of it is received; and that part is in fome places as a cuftomary law: and in thofe provinces neareft to Italy, it is received as a municipal written law. In criminal caufes, the civil law is more regarded in France; but the manner of trial is regulated by ordinances and edicts.

The civil law, in Spain and Portugal, is connected with the jus regium and cuftom. In Scotland, the ftatutes of the federunt, part of the regiæ majeftatis, and their cuftoms, controul the civil law.

In England, it is ufed in the ecclefiaftical courts; in the high court of admiralty; in the court of chivalry; and in the courts of the two univerfities: yet in all thefe it is reftrained and directed by the common law. See CANON *Law*.

CIVIL *Liberty*. See LIBERTY.

CIVIL *Lift*, the money allotted for the fupport of the king's houfehold, and for defraying certain neceffary charges of government. See KING and REVENUE.

CIVIL *Month*. See MONTH.

CIVIL *Obligation*. See OBLIGATION.

CIVIL *State*, confifts of the nobility and commonalty, exclufive of the clergy, and of the military and maritime orders.

CIVIL *Subjection*, in *Law*, is a fpecies of compulfive obligation, whereby an inferior is conftrained by a fuperior to an action contrary to what his own reafon and inclination would fuggeft; as when a legiflator eftablifhes iniquity by a law, and commands a fubject to do what is inconfiftent with religion or found morality. This excufe cannot be admitted in *foro confcientiæ*, but obedience to the laws in being is a fufficient sufficient extenuation of civil guilt before the municipal tribunal. Blackst. Com. vol. iv. p. 28.

Civil *War.* See War.

Civil *Year*, is the legal year, or civil account of time, which every government appoints to be used within its own dominions. It is thus called in contradistinction to the natural year; which is measured exactly by the revolution of the heavenly bodies. See Year.

CIVILIANS' *College.* See College.

CIVILISATION, a law or judgment, which renders a criminal process civil. Civilisation is performed by turning the information into an inquest, or *vice versa.*

Civilisation, in *Political Economy*, denotes the conversion or transformation of a country or people from a savage or barbarous state into a state formed by a due regard to the principles and obligations, the habits and manners of social life, by the means of mental and moral instruction, salutary laws, and regular government.

CIVITA, or Civeda, in *Geography*, a town of Italy, in the Bressan, seated on the Oglio, 25 miles W. of Brescia.

Civita *Aquana*, a town of Naples, in the province of Abruzzo Ultra; 15 miles E. of Aquila.

Civita *d'Antina*, a town of Naples, in the province of Abruzzo Ultra; 12 miles S. of Celano.

Civita *Borello*, a town of Naples, in the province of Abruzzo Citra; 19 miles N.N.E. of Molese.

Civita *di Cascia*, a town of Italy, in the state of the Church, and province of Umbria; 5 miles S.W. from Norcia.

Civita *Castellana.* See Castellana.

Civita *di Chieti.* See Chieti.

Civita *Lavinia*, a town of Italy in the Campagna di Roma; 4 miles from Veletri.

Civita *Luparella*, a town of Naples, in the province of Abruzzo Citra; 2 miles N. of Civita Borello.

Civita *Mandonia*, a town of Naples, in the province of Calabria Citra; 15 miles N.N.E. of Bisignano.

Civita *à Mare*, a town of Naples, in the province of Capitanata; 13 miles E.S.E. of Termola.

Civita *Nuova*, a town of Italy, in the marquisate of Ancona, on the road from Loretto to Fermo; 7 miles from the former and 9 from the latter. It is seated near the coast of the Adriatic or gulf of Venice, on a small river or creek. N. lat. 43° 16″, E. long. 13° 46′.—Also a town of Istria, seated on the Adriatic sea, N.W. from Ancona, and 20 leagues E. of Venice, within a small creek or bay, on a prominent part of the coast, E. from Savori. N. lat. 45° 36′. E. long. 14° 2′.

Civita *di Penna*, a town of Naples, in the province of Abruzzo Ultra, the see of a bishop, suffragan of Chieti; 10 miles S.E. of Teramo.

Civita *Real*, a town of Naples, in the province of Abruzzo Ultra, 13 miles N.W. of Aquila.

Civita *di St. Angelo*, a town of Naples, in the province of Abruzzo Ultra, seated on a mountain; 3 miles from Poto di Salino.

Civita *Tomassa*, a town of Naples, in the province of Abruzzo Ultra; 6 miles S.W. of Aquila.

Civita *Vecchia*, or Malta, a town seated on a hill in the centre of the island of Malta, strongly fortified. It is the see of a bishop, and contains, besides a large and handsome cathedral, several other churches and convents. From the town may be seen the whole island, and sometimes the coasts of Africa and Sicily.

Civita *Vecchia*, a fortified sea-port town of Italy, in the state of the church and patrimony of St. Peter, situated in a bay of the Tuscan sea. The port was enlarged and rendered commodious by Trajan; it is the best in Italy, and was declared free by Benedict XIV. It is the usual station for the pope's galleys. The air is unhealthy and the water not good; 27 miles N.W. from Rome. N. lat. 42° 5′ 24″. E. long. 11° 46′ 15″. The alum-work, which is situated about an Italian mile N.W. from Tolfa, and six from Civita Vecchia, is reckoned by some Italian historians to have been the first; however it is certainly the oldest of any that is carried on at present. The founder of it was John di Castro, a son of the celebrated lawyer, Paul di Castro, (See Castro), who had an opportunity at Constantinople, where he traded in Italian cloths, and sold dye-stuffs, of making himself acquainted with the method of boiling alum. Returning to his country upon the capture of the city, he found at Tolfa a plant (the *ilex aquifolium* or holly), which indicated alum in the soil, and which he had observed in the aluminous districts of Asia; and upon examining the soil discovered alum. Pope Pius II. availed himself of the discovery, which was made, according to his account, about the year 1460 or 1465, and this salt was afterwards manufactured in great quantities, and sold to the Venetians, the Florentines, and the Genoese. See Alum.

CIVITALI, Matteo, in *Biography*, a sculptor and architect of some eminence, who was born at Lucca, where, amongst many other works, he constructed in 1444 the little temple, which contains the miraculous crucifix, in the church of St. Martino, a statue of St. Sebastian, and another of the Madonna, which was placed at an angle of the church, on the outside; which works Vasari considers as no wise inferior to those of his master, Giacomo della Quercia. But the greatest work of Civitali in sculpture, is in the chapel of St. John the Baptist at Geneva, where he left six admirable and highly finished statues of white marble, representing Adam, Eve, Abraham, Abias, Zacharias, and Elizabeth. Soprani.

CIVITARA, in *Geography*, a town of Naples, in the province of Capitanata; 2 miles N.E. of Dragonera.

CIVITAS Equestrium, Novodunus, in *Ancient Geography*, a place of Gallian Lyonnensis, which had been an episcopal see till the year 412; now Nions.

Civitas *Nova*, a town of Scythia.

CIVITATES Fœderatæ, were cities, which in consequence of the alliance they had contracted with the Roman people, were obliged when required, although they were governed by their own proper magistrates, to furnish a contingent of auxiliary troops.

CIVITELLA, in *Geography*, a town of Naples, in the province of Otranto; 5 miles N.E. of Tarento.—Also, a fortress of Naples, in the province of Abruzzo Ultra; 7 miles N. of Teramo.

CIVRAC, a town of France, in the department of the Gironde; 7 miles E. of Libourne.

CIVRAY, or Sivray, a town of France, and principal place of a district, in the department of the Vienne, seated on the Charente; $8\frac{1}{2}$ leagues S.W. of Poitiers. The place contains 1484, and the canton 9728 inhabitants; the territory includes $207\frac{1}{2}$ kiliometres, and 14 communes.

CIVRY, a town of France, in the department of the Eure and Loire, and chief place of a canton, in the district of Chateaudun; 7 miles E.N.E. of Chateaudun.

CIUS, in *Ancient Geography*, a river of Lower Mœsia, which had its source in the mountains of Thrace, and discharged itself into the Danube. Eustathius says, that a town of the same name was situated near this river.

Cius, a town of Asia Minor in Bithynia, situated on the sea-coast, at a small distance from Nicæa. It had been episcopal.

CIZARA,

CIZARA, a town of Asia, in the Lesser Armenia, placed by Ptolemy near the Euphrates.

CIZE', in *Geography*, a valley of France, of which St. Jean-Pié-de-port is the capital.

CIZYA, in *Ancient Geography*, a town of Thrace, into which Eustathius was sent as an exile.

CKEBOE, in *Geography*, a town of Norway; 6 miles S.S.E. of Drontheim.

CLACKLAND, a small island of Scotland, near the east coast of the island of Arran.

CLACK *wool, to,* is to cut off the sheep's mark, which makes it weigh lighter; as to force wool, signifies to clip off the upper and hairy part thereof; and to bard it, is to cut the head and neck from the rest of the fleece. Stat. 8 H. VI. cap. 22.

CLACKMANNAN, in *Geography*, the principal town of the county of Clackmannanshire, stands on an eminence 190 feet above the level of the Forth, which descends gradually on each side of the town, but on the western, where the ancient tower of Clackmannan is situated, the ground is broken, and discovers vast rocks of the most romantic forms, which give great interest to the admirable view from the venerable structure just mentioned, originally built by king Robert Bruce, and for a long time the residence of the Bruces. The town possesses few attractions; and though the principal street is broad and convenient, yet the mean appearance of many of the houses gives an air of wretchedness to the place, which seems confirmed by the ruinous state of the tolbooth and court-house, where the election for a member of parliament is held, and at intervals the sheriff's court. The inhabitants are indebted to the river Devon for their harbour, which enters the Forth at Clackmannan, and to sir Lawrence Dundas for its improvement in 1772: the mean depth of water is at present 20 feet at the mouth of the harbour, and 10 at the shipping-place. The town pays feu duty to the proprietor of the estate of the same name, on which it stands. The population amounts to 640.

Clackmannan parish is about six miles in length, and nearly five in breadth. Eight hundred acres of this parish are covered with natural woods, which are highly useful and ornamental; the remainder of the land is arable, and very productive, with the exception of a small proportion that is clay, and consequently wet. The gentlemen farmers of the county formed a club, twenty years ago, for the express purpose of introducing agricultural improvements, from which great advantages have been derived; nor are the natives less indebted to the Devon Iron Company, who have furnished employment to numbers at their extensive works, erected on the estate of lord Cathcart, near which is the new and flourishing village of Newtonshaw. There are, besides, two large distilleries at Kilbagie and Kennet-Pans: at the latter place is a commodious harbour. Coal, limestone, and freestone, are very plentiful throughout the parish, which is intersected by the rivers Ford and Devon. Population 2528, in 1791.

CLACKMANNANSHIRE, a county of Scotland. This district, which is about nine miles in length, and not exceeding eight in its greatest breadth, is bounded on the south and south-west by Stirlingshire and the frith of Forth, and on the west, north, and east, by Perthshire. The coast is highly favourable to the fisherman and mariner, as it furnishes many excellent harbours for shipping, and creeks for the reception of boats. The surface rises from the shore, and forms the Ochil mountains, of which Bencleugh, in the parish of Tilly-coultry, is the highest; the plain near the Forth is extremely fertile, producing great crops of corn, and abounding with rich pastures. Although the farmers of this county have made considerable improvements in agriculture, and are enabled to export a great deal of grain, they turn their attention rather to raising flocks and herds than wheat, for which they have strong inducements in the plentiful feed for sheep, furnished by nature on the sides of the Ochil mountains. These eminences contain valuable ores of silver, lead, copper, cobalt, and antimony, besides beautiful specimens of iron ore, agates, pebbles, and a few topazes. In addition to these advantages, the district abounds with coal throughout, freestone, and granite, the conveyance of which has lately been greatly facilitated by the introduction of turnpike roads. There are four parishes, the county town, and a large village named Alloa in Clackmannanshire, which, in conjunction with the county of Kinross, sends one member to parliament. "The valued rent is 26,482*l.* Scots, and the real land rent is about 14,200*l.* sterling." The population, according to the enumeration returned to sir John Sinclair, was 8749. The principal mansions situated within the county are Tullibody, the residence of the family of Abercromby; Clackmannan, that of Mr. Bruce of Kennet; Shawpark and Alloa, the former the seat of lord Cathcart, and the latter of the Erskines of Alloa.

CLACKNACARRY, a village in Invernessshire, in Scotland, about $1\frac{1}{2}$ mile N. of the town of Inverness; it is situate on the S.W. side of loch Beauly, and at the east end of the intended *Inverness and Fort-William*, or Caledonian Canal, the works of which are rapidly proceeding. The spring-tides here rise about 11 to 15 feet, neap tides 7 feet. In 1804, the excavation of the bason and sea-lock at this place were begun; an immense embankment was begun, which, in May 1806, had extended 240 yards into the lock, or two-thirds of its intended length, for inclosing the site of the sea-lock, which is therein to be built for the admission of ships and vessels as large as 32-gun frigates. A rail-way has been formed for bringing earth from the hill on the west side of the road from Inverness to Beauly, and under which it passes, for completing the embankment in the sea above mentioned: another rail-way has been laid, from the Rubble-Stone Quarry in Clacknacarry to this embankment, and also to the second lock on the canal, the masonry of which is now (1807) in a great measure completed. Clacknacarry may be expected hereafter to become a considerable place of trade, when this stupendous and important canal of communication between the east and west seas is completed.

CLADAUS, or CLADEUS, in *Ancient Geography*, a river of Peloponnesus, in that part of the Elide called Triphylia. It discharges itself into the Alpheus; and Pausanias says, that the inhabitants of the Elide paid religious worship to this river.

CLADEUTERIA, in *Antiquity*, a festival celebrated at the time of pruning the vines. It was likewise called *lisbœa*.

CLADIUS, *in Natural History*, a name given by the ancients to the stag or deer, when four years old; in this year, or at the end of it, it was called *cerastes*. The Greeks had names for all the years' growth of this animal up to its perfection: in the first year they called it *nebrus;* in the second *pattalea;* in the third *dicrotus;* and in the fourth *cladius*, or *cerastes* towards the end of that year. This name the creature retained all its life afterwards, it being supposed at its full maturity at that time.

CLADODES, in *Botany*, Bosc. Nouv. Dict. Lour. Flor. Cochin. Class and order, *monœcia polyandria*.

Gen. Ch. *Cal.* four-leaved; leaves oval, concave. *Cor.* none. *Stam.* in the *male*, filaments eight, membranous. *Pist.*

in the *female*, germ superior, trigonous; stigmas three, sessile, oblong. *Peric.* capsule nearly round, three-lobed, three-celled, three-valved. *Seeds* one in each cell.

Sp. C.—A shrub. *Leaves* alternate, lanceolate, smooth, wrinkled. *Flowers* small, in terminal racemes. A native of Cochinchina.

CLADONIA, a genus formed, by Hoffman, out of the lichens of Linnæus. It is figured by him in Pl. 25. of his Plantæ lichenosæ, and belongs to the Scyphiphora of Ventenat. See LICHEN and SCYPHIPHORA.

CLAESSEN, AERT, or ALAERT, in *Biography*, a painter of some eminence, born at Leyden in the year 1498. At a very early period he evinced a strong inclination for painting. In 1516, he became the scholar of Cornelius Engelbrechtsen, and by his continued application shortly acquired proficency in his art. He chiefly employed his talents in painting subjects from the Old and New Testament, or other well known histories; and rejected the allurements of poetical fictions, or fabulous images. Though his compositions were good, his manner of painting was by no means pleasing. At first, his style resembled that of his master, Engelbrechtsen; but this he changed upon seeing the works of John Schoorel: he imitated M. Hemskerck in the richness of architectural decoration.

Claessen was as remarkable for his modesty as for his professional merit; and he could never be persuaded to quit the tranquil obscurity of his situation for the honours which his talents as an artist would have intitled him to. His facility in composing was astonishing; and he made a vast number of drawings for the painters on glass, for which he never received a greater price than seven-pence each. The family Buytenwegh, at Leyden, possessed three pictures of this artist, which were full of expression. The first was Christ on the Cross, between the Two Thieves, with the Maries, and other figures below. The second represents our Saviour bearing the Cross, followed by his disciples and a multitude of people; and the third, Abraham conducting his son Isaac, loaded with wood, to the place of sacrifice. H. Galtzius at Haerlem, had another picture of this artist, which he highly esteemed. The subject was the passage of the Red Sea: the variety of the figures, and the singularity of the dresses and turbans were surprising.

The death of Aert Claessen was occasioned by his falling into a canal, where he was unfortunately drowned, in the year 1564. Descamps.

CLAGENFURT, in *Geography*, a town of Germany, and capital of the duchy of Carinthia, seated on the Glan, built in a square form, and surrounded with a good wall. It has six churches and three convents; a manufacture of cloth, and a society for the promotion of agriculture and useful arts; 50 miles N. of Trieste. N. lat. 46° 45′, E. long. 14° 11′.

CLAGGAN BAY, a bay in the county of Galway, Ireland, south of Claggan point. It is of easy access, has clean, good holding ground, and pretty well sheltered, with depth of water sufficient for the largest ships. M'Kenzie.

CLAGGAN *Point*, a cape of Ireland on the west coast of the county of Galway, long. 10° 4′ west from Greenwich, lat. 53° 34′ N.

CLAIC, Fr. a hurdle, or sort of rectangular wicker-work. Hurdles serve at sieges in lieu of blinds or mantelets, when there is a want of them, to cover a lodgment, a sap, or a passage of the ditch. They cover them with earth in order to guard them against fire-works. They make use of *pitched claics*, or hurdles, with good effect for making causeways in boggy or marshy places, when the water is carried off from them by drains.

CLAIM, in *Law*, a challenge of interest in any thing that is in possession of another; at least out of a man's own. See NON-CLAIM.

There are divers sorts of claims; as claim by charter, by descent, by acquisition, &c.

Claim is otherwise defined to be a challenge of the ownership or property which one hath not in possession, but which is detained from him by wrong. It is either verbal, when a person by words claims or challenges the thing that is not in his possession, or it is by an action brought, &c.; and it relates sometimes to lands, and sometimes to goods and chattels. Where any thing is wrongfully detained, this claim should be made; and the person who makes it may thus avoid descents of lands, disseisins, &c. and preserve his title, which would otherwise be in danger of being lost. Co. Litt. 250. A man who hath present right or title to enter, must make a claim; and in case of reversions, &c. a person may make a claim, when he hath right, but cannot enter on the lands; and when he dares not make an entry on the land, for fear of personal injury, he may approach as near as he can to the land, and claim the same; and this shall be sufficient to vest in him the seisin. 1 Inst. 250. If nothing hinders a man, having right to land, from entering or making his claim; he must do it before he shall be sued to be in possession of it, or can grant it over to another; but where the party who hath right is already in possession, and where an entry or claim cannot be made, it is otherwise. 1 Rep. 157. A claim may be made by the party himself, and sometimes by his servants or deputy; and a guardian in socage, &c. may make a claim, or enter in the name of the infant that hath right, without any commandment. Co. Litt. 245. Claim or entry should be made as soon as may be; and by the common law it is to be within a year and a day after the disseisin, &c.; and if the party who hath unjustly gained the estate, do afterwards occupy the land, in some cases an assise, trespass, or forcible entry may be had against him. Litt. Sect. 426, 430. If a fine is levied of lands, strangers to it are to enter and make a claim within five years, or be barred; infants after their age, feme-coverts after the death of their husbands, &c. have the like claim, by stat. 1. R. III. c. 7.

CLAIM, *Continual*, a claim made from time to time, within every year and day, to land, or other thing, which, on some accounts, cannot be attained without danger.

Thus, if I am disseised of land, into which, though I have a right, I do not enter for fear of being beaten; I am to hold on my right of entry at my best opportunity, by approaching as near as I can, once every year, as long as I live: and thus I leave the right of entry to my heir. This claim, if it be repeated once in the space of every year and day (whence it derives the name of continual claim), has the same effect with, and in all respects amounts to, a legal entry. Litt. §. 419. 423. By stat. 32 Hen. VIII. c. 43. five years must elapse without entry or continual claim, in order that a descent on the disseisor's death should take away the entry of the disseisee, or his heir; but after the five years, the disseisee must make continual claim as before the statute. And by stat. 4 Ann. c. 16. §. 14. no claim (or entry) shall be of effect to avoid a fine, unless an action shall be commenced thereon within a year, and prosecuted with effect.

CLAIM *of liberty*, a suit or petition to the king in the court of Exchequer, to have liberties and franchises confirmed there by the king's attorney-general.

CLAIM, *False*. See FALSE.

CLAIM, *Quit*. See QUIT.

CLAIN,

CLAIN, or CLANE, in *Geography*, a ſmall fair town on the river Liffey, in the county of Kildare, Ireland, which gives name to the barony. At an abbey here, the ruins of which are ſtill ſeen, a ſynod was held in 1162. It is 16 miles W. from Dublin.

CLAIN, a river of France, which paſſes by Poictiers, and runs into the Vienne; 3 miles S. of Chatellerault.

CLAIR, JEAN MARIE LE, in *Biography*, a French violiniſt of great merit and celebrity for compoſition, as well as performance. Though contemporary with Rameau, his melody and ſtyle were ſuperior to thoſe of that eminent theoriſt and opera compoſer. The productions of Le Clair manifeſt original genius, as well as knowledge of harmony, and the finger-board of his inſtrument. His ſolos were printed in England by Walch, and uſed to be frequently and admirably played by Pinto.

Le Clair was born at Lyons, 1697, and died at Paris in 1764. His early inclinations led him to the art of dancing, and he firſt appeared on the ſtage at Rouen as a dancer. By a ſingular chance, the famous Dupré was at that time the leader of the orcheſtra at the Rouen theatre, as firſt violin; but both, diſcontented with their talents, did juſtice to each other, and changed places: Dupré became the firſt dancer that ever exiſted, and Le Clair ſoon opened a new path to harmony.

Batiſte and Guignon at that time enjoyed great reputation; but Le Clair eſtabliſhed his fame upon a more ſolid foundation, by the manner in which he performed double ſtops: a new ſtyle, at firſt introduced by Batiſte, but which Le Clair brought to the higheſt degree of perfection.

Le Clair, ſtill aſpiring at greater perfection in his art, went to Holland, and placed himſelf under the celebrated Locatelli, the greateſt performer on the violin of his time; and returning to Paris, excited admiration in all who heard him.

His ſolos, duets, trios, and concertos, were long in univerſal favour, and ſtill form the beſt ſchool for the violin in France, as the works of Corelli do in Italy. His opera of *Sylla* and *Glaucus* had no extraordinary ſucceſs; there are in it, however, many excellent parts, which have been inſerted in other operas, and are always heard with pleaſure.

The ſimplicity of Le Clair's character inclined him to diſlike the great world, and its turbulence, and determined him to retire to a ſmall houſe of his own in the ſuburbs of Paris: but in going home, after ſupping in town, October 22d, 1764, he was aſſaſſinated, without its ever being diſcovered by whom, or for what.

CLAIR, in *Geography*, a country of America, in the territory N.W. of the Ohio; laid out in April, 1790.

CLAIR, ST. a fort of America in the ſtate of Ohio, ſituated 25 miles N. of fort Hamilton, on a ſmall creek which falls into the Great Miami, and 21 miles S. of fort Jefferſon.

CLAIR, ST. the name of a *lake* lying about midway between lake Huron and lake Erie, about 90 miles in circumference, and comprehending, according to the meaſurement of Mr. Hutchins, 89,500 acres. It receives the waters of the three great lakes, Superior, Michigan, and Huron, and diſcharges them through the river or ſtrait, called Detroit, into lake Erie. This lake is of a circular form, and navigable for large veſſels, except a bar of ſand towards the middle, which prevents loaded veſſels from paſſing. The cargoes of ſuch as are freighted muſt be taken out, carried acroſs the bar in boats, and then re-ſhipped. The fort of Detroit is ſeated on the weſtern bank of the river of the ſame name, about 9 miles below lake St. Clair.

CLAIR, ST. a town of France in the department of the Channel, and chief place of a canton, in the diſtrict of St. Lô; the place contains 644, and the canton 9647 inhabitants; the territory includes $127\frac{1}{2}$ kiliometres and 16 communes.

CLAIRA, a town of France, in the department of the Eaſtern Pyrenees; 5 miles N.E. of Perpignan.

CLAIRAC, a town of France, in the department of the Lot and Garonne, advantageouſly ſituated in a valley on the Drot, and containing about 3000 inhabitants; who cultivate tobacco and corn, and make a great quantity of wine and brandy; one league S.E. of Tonneins, and $4\frac{1}{2}$ N.W. of Agen.

CLAIRAUT, ALEXIS-CLAUDE, in *Biography*, a celebrated mathematician, was born at Paris in 1713, and, under the inſtruction of his father, who was a teacher of mathematics in that city, he made a ſurpriſing proficiency at a very early age in this department of ſcience. When he was 4 years old, he had learned to read and write; at the age of 9 and 10 years he appears to have been well acquainted with algebra, geometry, and conic ſections; and between 12 and 13 he read a memoir to the Academy of Sciences, concerning four geometrical curves of his own invention. At this early period he ſeems to have laid the foundation of his work on curves, having a double curvature, which he finiſhed in 1729, before he had completed his 16th year. At the age of 18, or in 1731, he was nominated adjunct mechanician to the Academy; in 1733 aſſociate, and in 1738 penſioner. Few, if any, of the members of this learned ſociety contributed a greater number and variety of ingenious papers on the ſubjects of aſtronomy, mathematics, optics, &c. to its memoirs, from the year 1727 to 1762, than M. Clairaut. His memoir "De l'Orbite de la Lune dans le Syſteme de Newton," was communicated to the Academy in 1743; and he proſecuted the ſubject in ſeveral ſubſequent memoirs and ſeparate publications. In 1750 the Academy of Peterſburgh propoſed a prize for the year 1752, on the ſubject of the lunar motions, with a view of aſcertaining "whether all the inequalities that had been obſerved in the motion of the moon are conformable to the theory of Newton, and what is the true theory of theſe inequalities, by means of which the place of the moon might be exactly determined at any given moment?" Clairaut obtained this prize, and his paper on the ſubject was printed at Peterſburgh in that year in 4to. He alſo gained another prize for his new lunar tables, publiſhed in 1754, under the title of "Tables de la Lune, calculées ſuivant la Théorie de la Gravitation univerſelle," Paris, 8vo. In 1765 he publiſhed a new edition of the piece which had gained the prize at Peterſburgh in 1752, and alſo new "Tables of the Moon," ſomewhat different in form from thoſe which he had preſented to the public in 1754. In the year 1756 M. D'Alembert publiſhed a new edition of his "Tables," which had appeared in 1754, in his "Recherches ſur differens points importans du Syſtéme du Monde," and which Le Monnier had publiſhed in his "Inſtitutions Aſtronomiques." About this period commenced the diſpute between Clairaut and D'Alembert, concerning their reſpective theories, which engaged the public attention for ſome years; the papers of Clairaut, relating to this controverſy, were communicated to the public in the "Journal des Savans" for 1758, 1759, 1761 and 1762. Beſides the various communications abovementioned, and others inſerted in the Memoirs of the Academy, M. Clairaut publiſhed the following works ſeparately, *viz.* "On Curves of a double Curvature," in 1730, 4to.; "Elements of Geometry," 1741, 8vo.; "Theory of the Figure of the Earth," 1743, 8vo.; "Elements of Algebra," 1746, 8vo.; and "Tables of the Moon," 1754, 8vo. Clairaut died, at the age of 52 years, on the 17th of May 1765.

1765. Montucla, Hist. des Mathem. by De la Lande, vol. iv.

CLAIRE, in *Geography*, a town of France, in the department of the Lower Seine, 10 miles N. of Rouen.

CLAIR-OBSCURE, or CHIARO-SCURO, one of the great component parts of painting or drawing, is the art of distributing the lights and darks in a picture, in such a manner as to give at once proper relief to the figures, the best effect to the whole composition, and the greatest delight to the eye.

Chiaro-scuro, the original word is Italian, and compounded of *chiaro, light*, and *oscuro, dark*.

Although the word chiaro-scuro is generally considered as synonymous with light and shade, yet it is proper to observe, that it is of a more extended sense; as it denotes not only the lights and shades of a picture, but also its lights and darks, of what kind soever. In this latter sense chiaro-scuro is so nearly allied to colouring, that, for some centuries, it was not thought possible to disunite them.

The engravers, from the earliest period of their art till the time of Rubens, never attempted more than to give to each object in their engravings its proper lights and shades, leaving to painting alone the privilege of producing effect of chiaro scuro, by the opposition of objects of dark local colour to light ones. Thus, the effect of chiaro-scuro, so forcible in the picture, was weak and incomplete in the print; the lights upon a piece of black drapery, or any other dark-coloured object, being left the same as those upon a white, or light-coloured object. But engravers at present, by adopting a different principle, are enabled to make the effect of their prints, so far as relates to chiaro-scuro, as rich and powerful as it is in the pictures they copy: this is done by giving, besides the lights and shades, the relative lightness or darkness of the local or proper colour of each object in the picture, thereby producing what is called by artists the tone of the picture.

A thorough conception and knowledge of the chiaro-scuro is of the greatest importance to the painter. It is chiefly by the proper application of that branch of the art that he is enabled to make the various objects in his picture appear to project or recede, according to their relative situations or distances; and thus far the principles of it are necessary to the artist, ere he can hope to render his imitation just or intelligible. But, it being required in the works of fine art, not only that truth should be told, or that beauty should be represented, but likewise that the one and the other should be made appear to every possible advantage; it has, therefore, ever been the study of great painters, not only to give the due appearance of roundness, or projection to the objects in their pictures, by proper lights and shadows; but likewise to unite or contrast the masses of light and dark, in such a manner as to give at once the most forcible impression to the imagination, and the most pleasing effect to the eye.

Chiaro-scuro may, therefore, be said to be of two kinds; that which is necessary, and that which is expedient or ornamental.

The first kind has been, in a greater or less degree, understood and practised from the revival of painting in the thirteenth century; and, in short, it was utterly impossible that any artist should have attempted to imitate on a plain surface the appearances of round bodies, without discovering the necessity of lights and shades. However, even this, which may be called natural chiaro-scuro, was but very imperfectly understood till the time of Masaccio, near the middle of the 15th century; the painters, prior to this period, having had very little idea of what are called projecting shadows; such as are thrown upon one object, by another intervening between it and the rays of light. Indeed, in the pictures of most of the old painters who preceded Lionardo da Vinci, the ground on which the figures stand, is made so light on that side where this projecting shadow should be thrown, that they frequently seem to have only air to support them.

Lionardo da Vinci, towards the end of the 15th, and the beginning of the 16th century, was the first who, in his admirable writings, as well as in his pictures, treated the subject of chiaro-scuro scientifically; but although the few remaining works of his pencil have prodigious force, rotundity, and softness; yet the system which he recommends and generally adopted, of relieving the dark side of his figures by a light back-ground, and the light parts by a dark one, prevented that expansion and breadth of effect which the great Coreggio soon after discovered could only be attained by a contrary mode of conduct, that of relieving one shadow by another still darker, and of uniting several light objects into one great mass.

The conduct of Coreggio, with respect to his lights and shadows, is worthy the most attentive consideration; and there never, perhaps, was a painter who, independent of the advantage, which he well knew how to take, of the occasional opposition of dark to light-coloured objects, produced so simple, so grand an effect of chiaro-scuro. His figures, as well as the other objects in his pictures, are at all times so disposed, as naturally to receive the light exactly in those parts where it is most wanted, and best suits the effect of the whole; and yet this is done so skilfully, and at the same time with such an appearance of ease, that neither propriety nor grace of action seems in anywise to be sacrificed in the astonishing combination.

The principal painters of the Venetian school, Giorgionè, Titian, Bassan, Tintoret, and Paul Veronese, were great masters of effect; but with them this effect is more frequently the result of accordance or opposition of the local colours of the different objects composing their pictures, than of any very studied or remarkably skilful disposition of the masses of lights and shadows.

Michelangiolo da Caravaggio, who flourished at the end of the sixteenth century, and Guercino, who came soon after, produced the most powerful effects of chiaro-scuro, by means widely different from those adopted by any of their predecessors: but though they rendered their pictures most striking, by reason of the very strong oppositions of light and shadow, which they made almost constantly to pervade them, beauty of form and expression was too frequently sacrificed to force; and we are taught this truth, that chiaro-scuro, like many other parts of painting, cannot be carried beyond certain limits, but at the expence, more or less, of the other essentials of the art.

Gerard Hunthorst, called by the Italians Gherardo della Notté, and Adam Elshemer, produced astonishing effects of chiaro-scuro in their candle and moon-light pieces, which are deservedly in the highest estimation with the lovers of painting; whilst Rubens, with his all-commanding genius, grasped the various magic treasures of the pencil, and by uniting the wide expansive effect of Coreggio, the richly contrasted tints of the Venetians and the force of Caravaggio, has only left us to regret, that his magnificent inventions were not drawn with the purity of Raffaele, or the correctness and grandeur of Buonaroti.

If Rubens astonishes by his unbounded display of light, the parsimonious use made of it by Rembrant, is not less captivating or surprising. Rembrant considered the lights in his pictures as so many gems, acquiring increased lustre from

from their rarity; and indeed the ſtriking effect he has produced by the extraordinary means he adopted, happily ſhews, how vain the attempt to limit or reſtrain by rules the workings of genius in the human mind.

An attentive ſtudy of the works of theſe great maſters, either in their pictures or prints, together with a conſtant reference to nature, is the ſureſt method of attaining a knowledge of the chiaro-ſcuro; but although, in this caſe, precept can in no wiſe ſuperſede example, a few remarks may be of uſe in directing the ſtudent.

Effects of chiaro-ſcuro are produced by combinations of lights, middle tints, and ſhadows; to which may be added, as was before obſerved, the oppoſitions of dark coloured objects to light ones.

Light, as applicable to painting, may be conſidered of four kinds: firſt, that proceeding without interruption, immediately from the ſun to the object; this cauſes very forcible and cutting ſhadows, and ſtrong reflected lights, from one object to another; but though the chiaro-ſcuro thus produced is moſt brilliant and powerful, the means will ſeldom be reſorted to by thoſe artiſts who are unwilling to ſacrifice beauty of form, or delicacy and truth of expreſſion, to glitter and ſplendour of effect, unleſs indeed in landſcape, to which the glow of ſun-ſhine alone gives life and animation.

The ſecond kind of light is that produced when the rays of the ſun are interrupted by clouds or miſts: this is what Lionardo da Vinci calls the univerſal light, and which he particularly recommends, as it gives an effect at once broad, rich, ſimple, and tranquil, and in no degree deſtroying the beauty either of forms or expreſſion. In this caſe, the lights and ſhades are ſoftly and imperceptibly blended into each other, and the reflected lights are proportionally leſs diſcernible.

The third kind of light is that of the moon, of a cold hue, and infinitely leſs powerful than that of the ſun. The ſtill effects of moon-light have never been more truly deſcribed, than by the exquiſite and feeling pencil of Vanderneer, many of whoſe works in this way are beyond all price.

The fourth kind of light is ſuch as proceeds from torches, candles, or any other artificial flame. This kind of light tinges the object it illumines with its own yellow hue; its influence is but ſmall, except upon objects near it, and the ſhadows are proportionally dark and extended.

Painters have, by combining the various properties of theſe different ſorts of light, produced a fifth kind, which may be termed ideal, or pictureſque light; thus Rubens, amongſt others, has not unfrequently united in one picture the brilliant illumination cauſed by the direct rays of the ſun, and thoſe forcible reflections which in nature are only the conſequence of ſuch powerful light, with that ſoftneſs and repoſe which the more quiet, or what Da Vinci terms univerſal light, is alone calculated to occaſion. Caravaggio and Spagnoletto joined the deep ſhadows of night to meridian brightneſs; and many of their extravagant followers who painted at Venice about 1640, acquired by their diſmal and almoſt midnight effects, the appellation of the "*Setta de tenebroſi*," the gloomy ſect of painters.

However, when this ideal chiaro-ſcuro is uſed with diſcretion, and employed in ſuch a manner as to co-operate with, or increaſe the expreſſion of the picture, by its conformity to the character of the ſubject repreſented; more beautiful and ſtriking effects are the reſult, than could have been occaſioned by the moſt exact imitation of any real appearance in nature. For it is ever to be remembered, that not the mere imitation, but, as it were, the rivalſhip of nature, ſhould be the exalted aim of the artiſt who is ambitious of ſhining in the higher departments of painting, ſculpture, or indeed any of the fine arts.

The middle tint is occaſioned by the rays of light ſtriking in a ſide direction, or obliquely on the object; it is neither light nor dark, but that beautiful medium by which the ſkilful artiſt is enabled to blend, by imperceptible gradations, the extremes of both. The management of the middle tints is of the greateſt importance, but can only be learned by frequent examinations of the works of the greateſt painters, and an aſſiduous ſtudy of nature.

With reſpect to ſhadows, it has been before obſerved, that in nature they ever appear powerful and abrupt, in proportion as the light is forcible; and that in theſe caſes the reflected lights, caſt by reverberation, from the enlightened part of one object upon the ſhaded ſide of another object oppoſite to it, are ſtrong. Theſe reflected lights, when well managed, produce moſt beautiful effects upon fleſh and other ſemi-tranſparent bodies, and are frequently of great uſe in harmonizing and uniting thoſe maſſes of light which would otherwiſe have been broken into ſmall parts, or diſagreeable forms; beſides which, a greater appearance of projection can ſometimes be given by a reflected light, than could have been accompliſhed by the introduction of the ſtrongeſt ſhadow.

The doctrine of reflections, and indeed every thing that relates to chiaro-ſcuro, is clearly exemplified in the works of Rubens, Jordaens, and Rembrant; but it is proper to obſerve, that the former, both with reſpect to his effects of chiaro-ſcuro and colouring, ſometimes "o'erſteps the modeſty of nature."

The great merit of Rubens is moſt conſpicuous in his large works, where the diſtance intervening between the eye of the ſpectator and the picture effectually blends and harmonizes all the tints; in his eaſel pictures, the artifice by which his effect is produced is generally too apparent, his tranſitions are too abrupt, and his reflections more powerful than nature can juſtify.

Shadows may perhaps be properly divided into two kinds: firſt, the ſimple ſhadow; ſuch as is naturally occaſioned upon that ſide of an object which is not turned towards the luminary; and, ſecondly, the projecting ſhadow, which takes place upon that ſide of an object which is turned towards the luminary, in conſequence of the intervention of ſome other object between it and the luminary. The projecting ſhadow is always darker in its origin, than the ſhaded ſide of the intervening body which occaſioned it, and for this reaſon: that ſide of an object upon which the projecting ſhadow is thrown, being turned towards the dark ſide of the object which occaſioned it, can receive no reflected light; whereas the ſhaded ſide of the intervening body which occaſioned the projecting ſhadow can receive reflected light, being turned towards the illuminated parts of other objects in the picture.

The knowledge of lights and ſhades is nearly connected with the ſcience of perſpective, and, in particular, when buildings or other regularly formed objects are to be repreſented; great benefit may be derived from the rules of Dr. Brooke Taylor. See Perspective.

It may here be neceſſary to ſay a few words reſpecting what are called by painters accidental or catching lights, and accidental ſhadows. The accidental light is in fact generally no other than a ſmall portion of the common light, ſtriking as it were partially upon ſome ſmall object, or part of a large object, ſurrounded by large maſſes of ſhadow. Fine effects of this kind are to be obſerved in the landſcapes of Rembrant, where the ſcene, generally in ſhadow, or middle tint, is partially illumined by the rays of the ſun, ſtriking through the apertures of a cloud. Parmagiano, in a picture of the marriage of St. Catharine, has produced a very beautiful and striking effect, by the introduction of a light which may be justly styled accidental. The principal group, which is in a room, is illumined from the left; behind the Madonna is a door opening into another room, where Old Joseph receives the light by means of a window opening to the right; thus two contrary lights are introduced in the same picture, and yet without departing from the laws of nature. This elegant work of genius was commented on by Lomazzo, in his "Treatise on Painting," and is now in the possession of William Morland, esq.

Another species of accidental light, is occasioned by the introduction of a second light in a picture, different in kind from the principal light. Thus, in the kitchen scenes of Bassan, Teniers, or Ostade, when a fire is introduced, in some part of the picture, the composition being otherwise illumined by the light of day; this fire becomes an accidental light; and the case is similar, when, in one corner of a moonlight, the fishermen are represented, by their warm fire, mending their nets against the morning's dawn.

In the Fresco of Raffaele, in the Vatican, of St. Peter delivered out of prison, there are three distinct kinds of light; the first and principal light is occasioned by irradiation from the angel, the second proceeds from a torch, and the third from the moon. Such accidental lights, when skilfully and judiciously introduced, never fail to produce a beautiful and striking effect; but they should never be admitted, except in those subjects which seem naturally to require, or to allow of them.

With regard to what are called accidental shadows, it may be sufficient to observe, that if any difference exists between them, and projecting shadows, it is this only; the accidental shadow is generally caused by the intervention of a body, at some distance from the object overshadowed, and consequently, the accidental shadow is less powerful, and less edgy, than the projecting shadow. In landscape, great scope is allowed in the introduction of accidental shadow, it being easily accounted for, by the supposition of clouds, mountains, or other objects; but, in historical painting, an accidental shadow should never be resorted to, unless the cause of that shadow can be made apparent in the picture; it is true that Sir Joshua Reynolds, in one of his lectures, seems inclined to justify the conduct of Paul Veronese, when in one instance he departed from this rule; but, perhaps, a notion inadvertently stated, even by so great an artist, should carry with it little weight, when opposed to the opinions and authorities of the most celebrated painters of every age; the circumstance is here mentioned, because this supposed licence has been so eagerly caught at, and so frequently, we might say unnecessarily, resorted to, by painters of the present day.

With respect to the knowledge of chiaro-scuro, possessed by the ancients, we are but imperfectly informed; however, if we can form any judgment from the paintings discovered at Herculaneum, and in the baths of Titus at Rome (which, although, perhaps, not executed by the most eminent artists, may nevertheless be reasonably supposed to approach them in point of merit, as much with respect to chiaro-scuro, as to the other parts of the art), this part of painting, as well as perspective, was but little understood by them. Mr. Webbe, however, in his Treatise on Painting, strenuously supports the antients on this question, but perhaps not upon sufficient grounds; to him the reader is referred. See PAINTING *amongst the Ancients*.

Amongst the best established maxims, relating to chiaro-scuro, are the following:

That there should be one principal light in every picture; that other lights may, and ought to be admitted, but that they should at all times, be either less in quantity or lower in tone, than the great principal light; that this principal light should either be placed on the most important object in the picture, or be so managed, as to conduct the eye of the spectator to that object; that, independent of the forms of the objects and groups themselves, each mass of light, and dark, should in itself be of an agreeable shape; and that these masses should be so linked, as it were together, that no body, either of light or dark, may appear like a spot unconnected with the rest.

One thing more should be observed. Although, as has been before said, the system of Lionardo da Vinci, of constantly opposing a shade to a light, produces a poverty of effect; yet it gives a zest and appearance of truth to a picture, to introduce, in some small part of it, a figure, or other object, relieved at once, by dark on a light ground.

For further information, respecting clair-obscure, the reader is referred to Sir Joshua Reynolds's Lectures, and to his Notes on Mr. Mason's Translation of Du Fresnoy's elegant poem on painting; where the subject, with the one exception we have taken the liberty to make, is treated with a perspicuity, the result of deep investigation and long professional experience.

Although a knowledge of the chiaro-scuro is generally considered as necessary to the painter alone, yet the fine effects produced by it are well worthy the consideration of the sculptor and the architect. The sculptor who, when modelling his design, avails himself not of the direction or peculiarities of the light afforded by the situation where his group, his statue, or basso-relievo is to be placed, loses one of the greatest advantages afforded by his art. Michael Angelo's fine figure of Lorenzo da Medici in the sagresty of St. Lorenzo at Florence, and some of Bernini's monuments in St. Peter's at Rome, would forfeit half their claim to our admiration if removed to a light different from that for which they were composed.

Observations of the same tendency might be made respecting architecture; the fine chiaro-scuro occasioned by the intercolumniation, and the broad projecting pediments of the temples of Pestum, and the church of Covent Garden, leave the grandest impressions on the mind of every beholder. See SCULPTURE and ARCHITECTURE.

CHIARO-SCURO, is also used to denote a species of engraving, said to have been discovered by Ugo di Carpi, an Italian painter at the commencement of the 16th century; in which he was followed by Andrea Andriani of Mantua, and others; but the Germans, and apparently with some reason, dispute with the Italians the honor of the invention. These prints are produced by three distinct impressions from the same number of blocks of wood; the first gives the outline, the second, the middle tints, and the third, the shadows; so that the print, when complete, resembles a drawing in bistre upon a tinted paper, and touched with white.

CHIARO-SCURO is likewise used to signify those pictures which are painted with different shades of the same colour only. Of this class are the fine friezes, by Polidor, and others, on the façades of the palaces at Rome, and other cities of Italy; and the ingenious imitations of cameos and basso-relievos, with which so many painters in distemper have ornamented the interior of magnificent dwellings.

For the illustration of this article see the following plates, *viz.*

1. The simple principles of Chiaro-Scuro illustrated.
2. The conduct of Correggio in the distribution of his masses

maſſes of light and ſhade, exemplified in one of his compoſitions in the Duomo at Parma.

3. An example of Rubens.

4. A ditto of Rembrandt.

CLAIRVAUX, in *Geography*, a town of France, in the department of Jura, and chief place of a canton in the diſtrict of Lons-le-Saulnier, 3 leagues S.E. of it. The place contains 1210, and the canton 7226 inhabitants; the territory includes 160 kiliometres and 33 communes.—Alſo, a town of France, in the department of the Aube, and diſtrict of Bar-ſur-Aube, which took its name from an abbey built there in the year 1115; 2 leagues S. of Bar-ſur-Aube.

CLAIRVILLE, St. a ſmall ſettlement of America, in the ſtate of Ohio, and county of Belmont, 12 miles from the river Ohio, on the poſt road from Wheeling to Kentucky.

CLAISE, a river of France, which runs into the Creuſe near La Haye.

CLAIX, a town of France, in the department of the Iſere, and diſtrict of Grenoble; 4 miles ſouth of Grenoble.

CLAKIS, in *Ornithology*, a name given by the people of Lancaſhire, and ſome other places, to the BARNACLE, a ſmall ſpecies of wild gooſe; the *Anas erythropa*, or *Anas cinerea, fronte alba*, of Gmelin. It is found in Hudſon's Bay, and the N. part of Europe, and in winter in England.

CLAM, in *Geography*, a town of Germany in the archduchy of Auſtria, 1 mile W. of Gran.

CLAM *town*. See EGG *harbour*.

CLAMATOR, in *Antiquity*, was uſed to ſignify a domeſtic officer, whoſe buſineſs was to call the gueſts to dinner.

CLAMEA *admittenda in itinere per attornatum*, in *Law*, is a writ whereby the king commands the juſtice in eyre to admit a perſon's claim by an attorney, who, being employed in the king's ſervice, cannot come in perſon. Reg. Orig. 19.

CLAMECY, in *Geography*, a town of France, in the department of the Niévre, and principal place of a diſtrict, at the conflux of the Beuvron and the Yonne. The nominal biſhop of Bethlehem reſided in the fauxbourgs of this town; the ſee having been fixed here from the time when the Chriſtians were expelled the Holy Land; his revenue was ſmall, and his dioceſe limited to the place of his reſidence; 11 leagues N.N.E. of Nevers, and 7 ſouth of Auxerre.

CLAMOR, or CLAMEUR *de Haro*, a popular term in the French laws, importing a complaint, or cry, whereby any one implores the aſſiſtance of juſtice againſt the oppreſſion of another.

CLAMOR, *βοη*, in *Medicine*, an intenſeneſs of the voice, or a loud outcry. This is ſometimes the cauſe of a rupture of the veſſels, and ſometimes of a diſorder, like an inflammation about the membranes of the fauces and muſcles; which may be compared to that ulcerous and inflammatory laſſitude, which affects the hands, legs, and loins, after exceſſive hard labour; the ſpirituous and humid particles being exhauſted, and the fibres and membranes dried and contracted. A clamor is ſometimes alſo a ſort of remedy, and preſcribed as ſuch in order to rouſe perſons out of a lipothymy, or ſyncope.

CLAMOR *bellicus*. See CHARGE and SHOUT.

CLAMPS, in *Gunnery*. See CAP-*ſquares* and CANNON.

CLAMPS, in *Ship Building*, are ſtrakes of plank, in large ſhips, on the gun-deck, eight or nine inches thick, fayed to the ſides, to ſupport the ends of the beams.

CLAMP-*hanging*, may be fixed to any place in the ſide of a ſhip for faſtening ropes to, in order to ſuſpend the ſtages for the workmen, &c.

CLAMPS, in a *Ship*, are alſo pieces of timber applied to a maſt, or yard, to ſtrengthen it, and prevent the wood from burſting.

CLAMP is alſo a crooked iron plate, faſtened to the after end of the main cap of ſnows, to ſecure the try-ſail maſt.

CLAMP, alſo denotes a little piece of wood, in form of a wheel; uſed inſtead of a pully in a mortice.

CLAMP, is likewiſe the term for a pile of bricks built up for burning.

CLAMP-*nails*, are ſuch nails as are uſed to faſten on clamps in building and repairing of ſhips.

CLAMPETIA, in *Ancient Geography*, a town of Italy, in Magna Græcia, in the country of the Brutians. It is placed by M. D'Anville S.W. of Conſentia, and is the modern Amamea.

CLAMPING, in *Joinery*, &c. When a piece of board is fitted with the grain, to the end of another piece of board croſs the grain; the firſt board is ſaid to be clamped. Thus the ends of large old tables were commonly clamped, to preſerve them from warping.

CLAMPONNIER, or CLAPONNIER, in the *Manege*, a long-jointed horſe; that is, one whoſe paſterns are long, ſlender, and over-pliant. The word is obſolete, and is properly applicable only to the ox kind; for *la claponniere* in French, is in them what the paſtern is in a horſe.

CLAN, a term uſed in Scotland to denote a number of families of the ſame name, under a feudal head or chief, who protected them, and, in return for that protection, commanded their ſervices as his followers, and led them to war, and on military excurſions.

The diviſion of the country into clans, had no ſmall effect in rendering the nobles conſiderable. The nations which overrun Europe, were originally divided into many ſmall tribes; and when they came to parcel out the lands which they had conquered, it was natural for every chieftain to beſtow a portion, in the firſt place, upon thoſe of his own tribe or family. Theſe all held their lands of him; and as the ſafety of each individual depended on the general union, theſe ſmall ſocieties clung together, and were diſtinguiſhed by ſome common appellation, either patronymical or local, long before the introduction of ſurnames, or armorial enſigns. But when theſe became common, the deſcendants and relations of every chieftain aſſumed the ſame name and arms with him; other vaſſals were proud to imitate their example, and by degrees they were communicated to all thoſe who held of the ſame ſuperior. Thus clanſhips were formed; and in a generation or two, that conſanguinity, which was at firſt in a great meaſure imaginary, was believed to be real. An artificial union was converted into a natural one; men willingly followed a leader, whom they regarded both as the ſuperior of their lands, and the chief of their blood, and ſerved him not only with the fidelity of vaſſals, but with the affection of friends. In the other feudal kingdoms, we may obſerve ſuch unions as we have deſcribed, imperfectly formed; but in Scotland, whether they were the productions of chance, or the effect of policy, or introduced by an Iriſh colony, and ſtrengthened by carefully preſerving their genealogies, both genuine and fabulous, clanſhips were univerſal. Such a confederacy might be overcome, it could not be broken; and no change of manners or of government has been able, in ſome parts of the kingdom, to diſſolve aſſociations which are founded upon prejudices ſo natural to the human mind. How formidable were nobles at the head of followers, who, counting that cauſe juſt and honourable which their chief approved, were ever ready to take the field at his command, and to facrifice their lives in defence of his perfon, or of his fame? Againft fuch men a king contended with great difadvantage; and that cold fervice, which money purchafes, or authority extorts, was not an equal match for their ardour and zeal. Robertfon's Hift. Scotland, vol. i. p. 27, 28.

CLANBRASSIL, in *Geography*, the name of an old territory in Ireland, part of the prefent county of Armagh, which has been retained in the Irifh peerage. It is formed of the Irifh word *clann*, (often called *glen* or *glan*), and the family name of the tribe that inhabited it.

CLANCARTHY, (fometimes called *Clancare* and *Glencare*,) is a name formed like the preceding, from M'Carthy more ni Carra, a very powerful nobleman in the counties of Cork and Kerry, Ireland, whofe defcendant was made an earl with this title by queen Elizabeth. It is at prefent the title of the family of Trench.

CLANCULARII, in *Ecclefiaftical Hiftory*, a fect of Anabaptifts who denied the neceffity of making an open profeffion of the faith; and taught that a private one would be fufficient. Thefe were called alfo Hortulani and Gardeners, from the places they chofe to affemble in, inftead of churches.

CLANDESTINA, in *Botany*, Tourn. See LATHRÆA *Clandeftina*.

CLANDESTINE, any thing done fecretly, and without the knowledge of fome of the parties interefted in it; or without the proper folemnities.

The word comes from the prepofition *clam*, of κλειω, *claudo*, *I fhut*; or κλεμμα, *furtum*, *theft*.

Thus a marriage is faid to be clandeftine, when performed without the publication of banns, the confent of parents, or the knowledge of the ordinary. The council of Trent, and the French ordonnances, annul all clandeftine marriages. See MARRIAGE.

CLANDON COLLIERIES, in *Geography*, are coal-pits in Somerfetfhire, to which a rail-way is conducted from the Radftock line of the Somerfetfhire coal canal. See CANAL.

CLANEBOYS, the name of two diftricts in Ireland, one in the county of Antrim, and the other in that of Down, which belonged to the O'Neils, and are often mentioned in Irifh hiftory. They are alfo called Clan-Hugh-boy, from Hugh boy O'Neil, the leader of the Sept when they conquered thefe territories on the death of William de Burgho, earl of Ulfter, in 1333. Leland—O'Brien.

CLANEUS, in *Ancient Geography*, an epifcopal town of Afia, in Galatia Salutaris; called alfo Clangis.

CLANGULA, in *Ornithology*, the *Anas* of Gmelin's Linnæus: varied with black and white, with a tumid violaceous head, and a white fpot at the opening of the mouth; the fmall reddifh-headed duck of Willughby and Ray; the golden eye of Pennant and Latham; and the garrot of Buffon. See ANAS.

CLANIS, in *Ancient Geography*, *La Chiana*, a river of Italy, in Etruria. This river, called by the Greeks Glanis, was formed by the union of a great number of ftreams and torrents which defcended from the mountains; and when they became ftagnant in their courfe, they produced fmall lakes near Clufium. The river ran towards the Tiber.

CLANIS, or CLANIUS, a river of Italy in Campania. It rofe in the mountain of Abella, and difcharged itfelf into the fea near Patria.—Alfo, a river of Spain.

CLANMAURICE, in *Geography*, a name given to one of the baronies in Kerry, that originally belonged to Maurice fon of Raymond le gros, a companion of Strongbow's, from whom are defcended the Fitzmaurices, earls of Kerry, and the prefent marquis of Lanfdown.

CLANRICKARD, (originally Clanrichard) a territory in Connaught, belonging to one branch of the family of Bourke, or Bourgho, the defcendant of which is at prefent earl of Clanrickard.

CLANRICKARD, ULIAC, earl, and afterwards marquis of, in *Biography*, was the moft refpected, moft powerful, and moft effectual friend of Charles I. and the government in the weft at the beginning of the rebellion of 1641. He was deputy to the marquis of Ormond, whom the king had appointed lord lieutenant, and after uncommon exertions in the royal caufe, he was at laft obliged to leave Ireland. Lord Clanrickard wrote memoirs of the tranfactions in which he bore fo confpicuous a part. Lord Clarendon refers to thefe as giving fuch a full relation of all material circumftances as to render it unneceffary for himfelf to enter into detail. Bifhop Nicholfon, however, in his hiftorical library, confiders the publication under the name of the memoirs, &c. of the marquis of Clanrickard as "a lean collection of letters, warrants, orders, and other loofe and incoherent ftate papers;" and blames the anonymous editor as wifhing "to lay moft of the bloodfhed of thefe difmal times at the door of the Englifh proteftants." As the authenticity of the papers is not difputed, they will of courfe be examined by thofe who wifh to know the melancholy events of that time. The marquis died in 1659 before the king's reftoration. Leland. Nicholfon.

CLANUM, in *Ancient Geography*, a town of Gaul, in the environs of Arelate, between Cabellio and Ernuginum. Anton. Itin.—Alfo, a town of Gallia Lyonnenfis, on the road from Caracotinum to Auguftobona, between Agredinum and Auguftobona.

CLANWILLIAM, in *Geography*, the name of two baronies in Ireland; one in the county of Limerick, and the other in the county of Tipperary. The laft gives the title of earl to the noble family of Meade.

CLAP, in *Surgery*, a vulgar name for Gonorrhœa, a puriform difcharge from the urethra in men, and from the vagina in females. See BLENNORRHAGIA and GONORRHŒA. Dr. Samuel Johnfon derives the word *clap*, from the old French term *clapoir*; but we rather incline to believe it is of Saxon or German origin; *die klepperinn*, in German, fignifies a lewd woman or proftitute.

CLAP-*board*, a board cut, in order to make cafks or veffels.

CLAP-*net*, in *Birding*, a fort of net contrived for the taking of larks with the looking-glafs, by the method called daring, or doring. The nets are fpread over an even piece of ground, and the larks are invited into the place by other larks faftened down, and by a looking-glafs compofed of five pieces, and fixed in a frame, fo that it is turned round very fwiftly, backwards and forwards, by a cord pulled by a perfon at a confiderable diftance behind a hedge. See DORING.

CLAPHAM, in *Geography*, a village in Suffex, a rectory in the rape of Arundel, fituate near the edge of the clay and fand covering the chalk of the South-Downs. The fituation of the fteeple of its church was determined in the government trigonometrical furvey in 1792, by an obfervation from Chanctonbury Ring ftation diftant 27,201 feet; and another from Rook's Hill ftation diftant 68,929 feet, and bearing 75° 30′ 37″ N.W. from the parallel to the meridian of Dunnon; whence are deduced, its latitude 50° 50′ 38″ N. and longitude from Greenwich 27′ 45″ W. or 1^m 50^s.9 in time.

CLAPHAM-*Common obfervatory*, belonging to Mr. Cavendifh; the exact fituation of the tall pole or objects affixed over this gentleman's tranfit-room, was determined in the government trigonometrical furvey in 1787, by an obfervation from

from Hundred-Acres ftation diftant 43,351 feet, and bearing 13° 45′ 28″ S.W. from the parallel to the meridian of Greenwich; and another from Severndroog Tower diftant 47, 295 feet; whence are deduced its latitude 51° 27′ 13″ N. and longitude from Greenwich 8′ 40″ W. or 34ˢ.7 in time; alfo, that this obfervatory bears 26° 29′ 52″ W. from the S. meridian of the crofs on St. Paul's cathedral, diftant 24,563 feet.

CLAR, or CLAER, in *Metallurgy*, bone afhes perfectly calcined, and finely powdered, kept purpofely for the covering of the infides of COPPELS.

CLAR, ST. in *Geography*, a town of France, in the department of the Gers, and chief place of a canton in the diftrict of Lectoure; the place contains 1290 and the canton 8509 inhabitants; the territory includes 160 kiliometres and 16 communes.

CLARA, a fmall poft town on the river Brofna, in the King's County, Ireland; 53 miles weft from Dublin.

CLARA, LA, a town of the ifland of Cuba; 18 miles N.W. from Spirito Santo.

CLARA, or MEL, an ifland in the Indian Sea, near the coaft of Siam; 25 miles long and 4 wide. N. lat. 11° 4′. E. long. 97° 50′.

CLARAC, a town of France, in the department of the Lower Pyrennées, and chief place of a canton in the diftrict of Pau; the place contains 233 and the canton 9194 inhabitants: the territory comprehends 125 kiliometres and 15 communes.

CLARAMONT *powder*, the name of a medicinal powder, very famous in Venice, and fome other places, for its virtues in ftopping hæmorrhages of all kinds, and in the cure of malignant fevers. It has its name from the perfon who firft found out its virtues, and who has written a book exprefsly about it. It is a white earth found near Baira, not far from Palermo, and is thence called alfo by fome writers, *terra de Baira*.

CLARATUMBA, in *Geography*, a town of Poland, with a celebrated abbey, in the palatinate of Cracovia; 4 miles E. of Cracow.

CLARE, a county of Ireland in the province of Munfter, fituated on the weftern coaft. It was anciently called Thomond, which implies *North Munfter*, and was a kingdom or principality under the O'Briens, defcendants of Brien Boromhe, the king of Ireland, who was flain, fighting againft the Danes, in the battle of Clontarf, A.D. 1014. One of the family was acknowledged as king of Thomond by Henry III.; and Murrough O'Brien was made earl of Thomond by Henry VIII. on refigning his old title of prince, and receiving a new grant of his lands from that monarch. Such agreements were then common, the petty Irifh princes hoping thus to preferve their poffeffions, and the Englifh fovereigns wifhing to conciliate them; but the plan did not anfwer. The title of Thomond has continued, with fome fhort intervals, in the O'Brien family. Thomas de Clare, fon of the earl of Gloucefter, having come to Ireland in 1276, and married a daughter of the earl of Defmond, fettled in this county. Some accounts ftate, that a large portion of it was beftowed on him by Brien Inath, king of Thomond, on condition of receiving affiftance to regain his authority, which had been ufurped by another branch of the family. Other accounts fay, that this diftrict was given to De Clare by Edward I.; and it is not unlikely that he procured from the latter a confirmation of the grant of the Irifh prince. This Thomas de Clare, and his fon or brother Richard, built fome caftles and an abbey, and from them the county received its prefent name. Thomond, as its name implies, had always been confidered as a part of Munfter; but when Connaught was divided into counties in 1562, Clare was added to it. At that time each province had a peculiar governor, called lord-prefident, and as the earls of Thomond had poffeffions in other parts of Munfter, and were moftly connected with it, they naturally wifhed Clare to be part of that province, which, on petition, was effected in 1602. Some have fuppofed that it ought to be reckoned in Connaught, becaufe it is on the fame fide of the Shannon; but the eafieft accefs to it was through Limerick, the environs of which city extend into it, and its bifhopric is under the primate of Munfter.

Clare is bounded on the north by the county of Galway, on the eaft and fouth by the Shannon, which divides it from the counties of Tipperary, Limerick, and Kerry, and on the weft and north-weft by the Atlantic Ocean and the bay of Galway. It extends from north to fouth 33 miles (42 Englifh), and from eaft to weft 52 (66 Englifh), containing 476,200 acres (765,042 Englifh), or about 744 fquare miles (1195 Englifh). It is divided into nine baronies, and 79 parifhes, moft of which are in the united fees of Killaloe and Kilfenora. Thefe 79 by unions, form only 30 benefices, and only 19 of them had churches, when Dr. Beaufort publifhed his memoir. The number of houfes in the official return of 1791 was 17,396, according to which the population may be eftimated at 104,000. Three members reprefent it in the Houfe of Commons, two of whom fit for the county, and one for the borough of Ennis.

The county of Clare confifts of extenfive tracts of ground of various quality; much of fattening and meadow ground; much of light limeftone pafture, fit for rearing fheep and young cattle; much arable land; extenfive bogs, and fome mountain. The lands called *Corcaffes*, confifting of about 20,000 acres, along the Fergus and Shannon, are faid by Mr. Young to be peculiarly fit for fattening bullocks, 4000 of which were then annually fattened on them; and the ftore cattle of Clare are at prefent more numerous than in the adjoining counties. The foil of the Corcaffes is defcribed by that intelligent traveller as either a rich black loam, or a deep rich blue clay; whilft the higher lands are limeftone or limeftone-gravel. The bogs near the Shannon are valuable on account of the fupply of turf they furnifh for the Limerick market; and thofe in the interior, though they do not fet fo high, fupply fuel to the neighbouring inhabitants. The worft grounds are the eaftern mountains, the peninfula north of the Shannon, and the barony of Burren. This laft is exceedingly rocky, but its rocks are limeftone, and fuch is the luxuriance of the pafturage interfperfed among them, that thefe feemingly barren hills fupport a great number of cattle and very large flocks of fheep. The other tracts of mountain are generally gritftone. Mr. Young ftates the average rent of the Corcafs lands at 20*s*., and the average rent of the whole county at 5*s*. per acre, in 1776. An intelligent proprietor of part of the Corcafs lands has informed the writer, that they now fet at from 3 guineas to 5 guineas per acre; and he fuppofes the average rent of the whole county not lefs than 30*s*. Rape is fown in confiderable quantities in mountain or boggy grounds, both of which are burned for it. Some of the rape feed is preffed into oil at mills near Killaloe, and the rape cakes fent to England for manure; but the greater part is exported to England, where it is preffed for the ufe of the woollen manufacturers in Yorkfhire. One houfe in Limerick fhipped the laft feafon (1805), near 5000 barrels of rape-feed, value above 10,000 pounds; but it is cultivated in the counties of Limerick and Tipperary as well as in Clare. Beans were grown in large quantities, when Mr. Young was in Clare, but the cultivation has been laid afide, as they are no longer ufed

ufed for bread by the peafantry. Flax is fown in fmall quantities for home confumption, but fpinning is not general, and fcarcely a remnant of the manufacture of the excellent Clare dowlafs now exifts. The only manufactures, indeed, for which there is a market, are coarfe flannels and worfted ftockings, which are chiefly fold at Ennistymon, on the weftern coaft.

Mr. Young has fpoken in high terms of the cider orchards of this county. Since he wrote, in a time of fcarcity they were very generally deftroyed; but the price of cider being much increafed, and the mode of making it much improved, they are now attended to, and in good keeping. The cacagee apple is peculiarly efteemed, but the trees being bad bearers, it is fcarce.

The whole weftern coaft of Clare does not afford one harbour in which fhips may lie in fafety, and its little ports on the Shannon can never rival Limerick. The only rivers that deferve notice are the Shannon and Fergus. The former of thefe, when it firft reaches the fhores of Clare, is expanded into Lough Deirgheart; but its breadth is contracted as it approaches Killaloe. Between Clare and Kerry the breadth of this noble river varies from one mile to five. The Fergus, the principal river rifing in Clare, is of no importtance, floops only being capable of navigating it. Its eftuary, however, at its junction with the Shannon, is very wide and full of iflands. This river and feveral others in Clare, dip under ground in fome part of their courfe.

There are in this county many *turlachs*, *i. e.* fpots which at one time are lakes, and at another found fheep-walks. Of thefe, that at Kilcorney, in Burren, is moft remarkable, the waters iffuing, frequently more than once a year, from a fpacious cave, and deluging the adjacent flats. There are fome lakes, but none very confiderable.

The county town is Ennis on the Fergus, and it is the only town of note in the county. The Ogham infcription on Callan Mount, (fee CALLAN), and feveral ruins, particularly thofe of Quin Abbey, (fee ARDSALLIS), and the ifland of Inis Scattery, render this county interefting to the antiquarian, whilft the plants and minerals with which its mountains and ftony parts abound, make it equally deferving the attention of the botanift and mineralogift.

The following plants found in Clare, are reckoned, by profeffor Wade, amongft the *plantæ rariores* of Ireland; *viz.* Iris fœtidiffima, Afperula cynanchiea, Lyfimachia vulgaris, Arbutus uva urfi, Butomus umbellatus, Sedum telephium, Potentilla fruticofa, Rubus faxatilis, Dryas octopetala, Mentha pulegium, Turrites hirfuta, Cardamine bellidifolia, Cheiranthus finuatus, Gnaphalium dioicum, and Satyrium hircinum. An intelligent botanift, who is employed by the provoft and fellows of Trinity College, Dublin, vifited Clare in the autumn of 1805; but the refult of his refearches has not yet been made public.

The mineralogy of Clare is very little known. Mr. Donald Stewart, the itinerant mineralogift of the Dublin Society, has, however, mentioned fome particulars. Lead ore is faid to occur in various places; in fome of which it was formerly raifed and fmelted. Manganefe is abundant; and there are different ores of iron, particularly micacious iron ore, or *eafingman*, and red iron-ftone. Boate mentions iron-works, belonging to Englifh merchants, in Clare, previous to the rebellion of 1641. Thefe probably contributed to its being fo bare of timber. At Doolin in Burren there has been found a vein of purple fluor fpar, fimilar to that brought in ornaments from Derbyfhire. Some of the fpecimens have cubic cryftals; but the extent of the vein is not known, and no attempt has been made to apply it to any ufeful purpofe. Beaufort, Young, &c. &c.

CLARE, a poft-town of the county of Clare, Ireland, on the river Fergus, which is navigable to it for fmall veffels, and about two miles S. from Ennis, which was alfo formerly called Clare. Between the two towns are the ruins of Clare abbey. It is 114 miles S.W. from Dublin.

CLARE, a river of the county of Galway, Ireland, flowing into Lough Corrib. On this river is a fmall fair-town of the fame name, from which the barony of Clare is called.

CLARE, the name of a high rocky ifland belonging to the county of Mayo, Ireland; fituated at the entrance of Clew bay. It is about four miles long, but of very unequal breadth; and it affords good anchorage for fhips in moderate weather. W. long. 9° 49′ from Greenwich. N. lat. 53° 49′.

CLARE, an ifland lying fouth of the county of Cork, Ireland, on which is the moft fouthern point of Ireland, generally known by the name of Cape Clear. This ifland, in Smith's time, contained about 400 families, which its produce was fcarcely able to fupport. The men are all fifhermen, and they are good pilots. It is about three miles long, and nearly one wide. W. long. 9° 23′ from Greenwich. N. lat. 51° 21′. Smith.

CLARE, at prefent an unpaved and inconfiderable market town in the county of Suffolk, England, was once a place of importance, and contains the ruins of a ftrong caftle. Gilbert de Clare, founded a Benedictine monaftery here in 1090, which was removed in 1124, by his fon Richard, to Stoke, near Clare, after which, Edmund Mortimer, earl of March, converted it into a college for fecular priefts, who were governed by a dean, and fix prebendaries. Archbifhop Parker was dean of this foundation in 1545, the date of its diffolution. There was, befides, a priory of monks of the order of St. Auguftine, founded probably by Richard de Clare in 1248, who introduced that order into England: the monaftic buildings were recently inhabited by a farmer, and the chapel is now a barn. Exclufive of the founder, Joan of Acres, Lionel, duke of Clarence, with his wife, and Edward Monthermer, earl of Gloucefter and Hereford, were buried in the priory chapel. The large and handfome parifh church is fuppofed to have been built by an abbot of Bury. The civil and fpiritual courts are held at Clare, and it gave the title of marquis to the dukes of Newcaftle of the Holles family, as it afterwards did to thofe of the Pelham. Without, and eaftward of the town, is a large barrow. There are two annual fairs, the market day is Tuefday, and it is 56 miles N.E. from London.

CLARE, a townfhip on St. Mary's bay, in Annapolis county, Nova-Scotia. It has about 50 families, and confifts of woodland and falt-marfh.

CLARE. See *St.* CLAIR.

CLARE, *Nuns of St.* in *Ecclefiaftical Hiftory*, were founded at Affife in Italy, about the year 1212. Thefe nuns obferved the rule of St. Francis, and wore habits of the fame colour with thofe of the Francifcan friars; and hence were called *Minoreffes;* and their houfe, without Aldgate, the *Minories*, where they were fettled when firft brought over into England, about the year 1293. They had only three houfes befides this.

CLAREMONT, in *Geography*, a townfhip of America, in Chefhire county and ftate of New Hampfhire, on the E. fide of Connecticut river, oppofite to Afcutney mountain in Vermont, and on the N. fide of Sugar river; 24 miles S. of Dartmouth college, and 121 S.W. by W. of Portfmouth. It was incorporated in 1764, and contains 1889 inhabitants.

CLAREMONT, a county of America, in the ftate of S. Carolina and diftrict of Camden, containing 2479 white inhabitants, and 2110 flaves. The county-town is Statefburg.

CLARENCE,

CLARENCE. See CHIARENZA.

CLARENCEUX *King of Arms*, in *Heraldry*, the second officer in the college of arms. It is uncertain when this office, which is held by patent under the great seal during good behaviour, was first created. It is stated by some authors to have been instituted by Edward III., by others, by Henry V.; who, they say, preferring the herald of his brother Thomas, duke of Clarence, constable of the army, created him a king of arms by the title of Clarenceux, (in Latin Clarentius) and placed the south part of England under his province. After Henry VI. it sunk into the office of a herald, but was again restored to the rank of a king of arms by Edward IV.

The official seal of Clarenceux is argent, a cross gules, on a chief of the second a lion passant guardant, crowned with an imperial crown or, and is borne on the dexter side impaled with his paternal coat. The badge, which is worn pendant from a gold chain, is enamelled with the above arms, surmounted by the crown of a king of arms on a green ground on one side, and on the reverse, the royal arms on a white ground. He wears a collar composed of S. S. of silver gilt. See COLLAR.

The coronet of a king of arms is composed of a plain circle of gold, thereon 16 strawberry leaves, eight of which are higher than the rest, and round the rim the motto "Miserere mei Deus secundum magnam misericordiam tuam."

His tabard is of velvet, thereon embroidered the king's arms, embossed in gold and silver.

CLARENDON, in *Geography*. See *Cape* FEAR *River*.

CLARENDON, a county of America, lying in the Sumpter district, in the state of S. Carolina, about 30 miles long and 30 broad, containing 2333 inhabitants.

CLARENDON, a township of America, near the centre of Rutland county, Vermont, watered by Otter creek, and its tributary streams; 14 or 15 miles E. from Fairhaven, and 44 N.E. from Bennington. It contains 1764 inhabitants. On the S.E. side of a mountain, in the westerly part of Clarendon, is a curious cave, 2½ feet in diameter at its mouth, and nearly the same through its whole length of 31½ feet; but at this distance from the mouth it opens into a spacious room, 20 feet long, 12½ wide, and 18 or 20 feet high. The floor, sides, and roof appear to consist of a solid rock, which is rough and uneven. The water percolating through the top has formed stalactites of various forms, some conical, and others having the appearance of massive columns. This room communicates by a narrow passage with others equally curious. Morse.

CLARENDON, a parish of Jamaica, in the county of Middlesex, the low lands of which are favourable for plantation of tobacco. In 1789 the number of sugar-plantations in this parish was 56, and that of negroes 10,150.

CLARENDON *Fort*, a fort on the W. coast of the island of Barbadoes in St. James's parish; 1¾ mile S. from Speight's town.

CLARENDON, *Constitutions of*, in *Antiquity*, a charter or code of laws established by the parliament at Clarendon in Wiltshire, A. D. 1164; sixteen articles of which related particularly to ecclesiastical matters, and were designed by king Henry II. to check the power of the pope and his clergy, and to limit the total exemption which they claimed from the secular jurisdiction. The substance of them is as follows: 1. All pleas between clergymen and laymen shall be tried in the king's courts. 2. Churches in the king's gift shall not be filled without his consent. 3. All clergymen, when accused of any crime, shall be tried in the king's courts; and when convicted, shall not be protected from punishment by the church. 4. Clergymen shall not go out of the kingdom without the king's leave. 5, 6, Regulate the manner of proceedings in the ecclesiastical courts. 7. None of the king's ministers or vassals shall be excommunicated without his knowledge. 8. Appeals from the archbishop to be made to the king. 9. Pleas between a clerk and a layman, whether an estate was in free-alms or a lay-fee, to be tried in the king's court by a jury. 10. One of the king's tenants might be interdicted, but not excommunicated, without the consent of the civil judge of the place. 11. All prelates, who hold baronies of the king, shall perform the same services with other barons. 12. The revenues of vacant sees and abbeys belong to the king. The election of prelates shall be with the king's consent; and they shall swear fealty, and do homage to the king, before their consecration. 13, 14, 15, Direct the manner of proceeding, in case any of the king's barons shall disseise any of the clergy of the lay-fees which they held under them. 16. The sons of villains shall not be ordained without the leave of their masters.

These constitutions were vehemently opposed by Becket, who, in a great measure, prevented their salutary effects. The king, however, by passing so many ecclesiastical ordinances in a national and civil assembly, fully established the superiority of the legislature above all papal decrees or spiritual canons, and gained a signal victory over the ecclesiastics. Apprehending that the bishops, though overawed by the present combination of the crown and the barons, would take the first favourable opportunity of denying the authority, which had enacted these constitutions; he resolved, that they should all set their seal to them, and make a promise to observe them. None dared to oppose his will, except Becket, who obstinately withheld his assent. At length, after much persuasion, and when he found himself deserted by all the world, even by his own brethren, he was obliged to comply; and he promised "legally, with good faith, and without fraud or reserve," to observe the constitutions; and he took an oath to that purpose. The king, thinking that he had now finally prevailed in this great enterprise, sent the constitutions to pope Alexander III. who then resided in France; and he required that pontiff's ratification of them. But Alexander, who, notwithstanding the most important obligations to the king, plainly saw, that these laws were calculated to establish the independence of England on the papacy, and of the royal power on the clergy, condemned them in the strongest terms; abrogated, annulled, and rejected them. There were only six articles, of the least importance, which, for the sake of peace, he consented to ratify. Becket repented of his assent, and redoubled his austerities by way of punishment for his criminality; and he refused to exercise any part of his archiepiscopal function, till he should receive absolution from the pope which was readily granted him. See the article BECKET.

CLARET, JOAN, in *Biography*, a Flemish painter, who lived about the year 1600, at Turin, where he painted many altar-pictures in a very bold and masterly style, little inferior to those of his cotemporary and friend Gio. Antonio Mulinari. Lanzi, Storia Pittorica.

CLARET, or *Clairet*, *pale red*, a name which the French give to such of their red wines as are not of a deep or high colour. See WINE.

The word is a diminutive of *clair*, *bright*, *transparent*. There are various accounts in the Phil. Trans. of attempts to improve the operation of tapping, by injecting the abdomen after the lymph is drawn off with claret and other astringents. Ibid. vol. xlix. part ii. N° 65. an. 1756.

CLARET, *Claretum*, in the *Ancient Pharmacy*, was a kind of of wine sweetened with sugar, and impregnated with aromatics; sometimes also called *Hippocras*, or *vinum Hippocraticum*; because supposed to have been first prescribed by Hippocrates. It has its name *claret* from its being clarified by percolation through a flannel bag, called *manica Hippocratis*.

Claret, in *Geography*, a town of France, in the department of the Hérault, and chief place of a canton, in the district of Montpellier; 5 leagues N. of Montpellier. The place contains 774, and the canton 1834 inhabitants: the territory includes 172½ kiliometres, and 10 communes.—Also, a town of France, in the department of the Lower Alps, and district of Sisteron; 11 miles N. of it.

Claret, in *Music*. See Clarion.

CLARIÆ, in *Ancient Geography*, a people of Thrace, placed by Pliny near the Danube.

CLARIAS, or Clarias *Nilotica*, in *Ichthyology*, the name of a fish of the *silurus* kind, common in the Nile, and brought to market at Memphis, and in many other parts of Egypt, but of an insipid taste, and eaten only by the poorer sort of people. The tail is broad and forked, and has externally two horny appendages of a round figure, and a hand's breadth in length, in which it differs from all other fishes. It is the *silurus clarias* of Gmelin. See Silurus.

Clarias is also the name given by Gronovius to the *Silurus anguillaris* of Gmelin. See Black-*fish*.

CLARICHORD. See Clavichord.

CLARIFICATION, is the separation, by chemical means, of any liquid from substances suspended in it, and rendering it turbid. If a difference can be made between clarification and filtration, it is, that the latter is effected by mere mechanical means, but the former either by heat or by certain additions.

The liquors, subjected to clarification, are generally solutions of animal on vegetable matter, in which the particles that produce the turbidness are so nearly of the same specific gravity with the liquor itself, that mere rest will not effect a separation. In these too the liquid is generally rendered thicker than usual by holding much mucilage in solution, which further entangles the turbid matter, and prevents it from sinking. Hence it is that vinous fermentation has so powerful an effect as a clarifier (wine being much more limpid than the grape, or other saccharine juice of which it is made), since this process always destroys a portion of saccharine mucilage, and generates alcohol, which is thin and limpid.

Coagulating fluids greatly assist clarification, when mixed with any turbid liquor; the process of coagulation entangling with it every thing which is simply suspended, and carrying it either to the top, in the form of a thick scum, or to the bottom, as a tough sediment, according to circumstances. Thus, to clarify muddy cider, the liquor is beaten up with a small quantity of fresh bullock's blood, and suffered to stand at rest for some hours; after which the liquor above is as clear as water, and almost as colourless, and at the bottom of the vessel is a thick, tough cake, consisting of the coagulated blood, which has carried down with it all the matter which rendered the cider turbid. Many albuminous and gelatinous substances act in the same manner. Of these the best known is white of egg, which, when used for this purpose, should be beat up cold with the liquor to be clarified, and afterwards, on applying a heat of about of 180°, the egg coagulates, and carries up with it all the opake particles of the fluid, in the form of a thick scum.

The first process of sugar-baking is carried on in this way either by white of egg or blood. The proportions required of these are always very small, compared to the quantity of the liquor to be clarified.

Mere heat will clarify liquors, when the substance that rendered them turbid is coagulable by heat; thus the juice of cabbage, and many other green vegetables, when heated, throw up a curdy green coagulum, and the remaining liquor is limpid and colourless.

Heat also assists in another way, in diminishing the specific gravity of liquors, which allows the coagulating matters to collect in a denser form, and thus to be more easily separable.

A most remarkable and unaccountable power is possessed by newly burnt charcoal, in clarifying all mucilaginous liquids, as already mentioned under the article Carbon.

Clarification is often found detrimental when used to prepare vegetable decoctions or infusions for medicinal purposes; and hence it is a much less frequent process in the Materia Medica than formerly.

Thus, if syrup of poppies be clarified till it becomes quite limpid, it loses almost all its narcotic power, and is, as a medicine, little better than simple syrup. (See also the article Filtration.)

Sugar is clarified with the whites of eggs, and sugar beat together with lime and with ox's blood, and with other materials. See Sugar.

For malt liquors, particularly beer, there are various methods of clearing; the best is by casting into it fixed nitre: some add the quintessence of malt and wine; whites of eggs made into balls with a little flour and isinglass: oil, and quintessence of barley, have the same effect. It is exceedingly cleared and strengthened by adding to it, during the time of its fermentation, some ardent spirit. See Ale, Beer, and Malt *liquor*.

CLARIFIERS, a name given to the copper pans or cauldrons fixed in a boiling-house, and used for the purpose of clarifying sugar. See Sugar.

CLARIGATIO, in *Roman Antiquity*, a ceremony that always preceded a formal declaration of war. It was performed in this manner; first four heralds, crowned with vervain, were sent to demand satisfaction for the injuries done to the Roman state. These heralds, taking the gods to witness that their demands were just, one of them, with a clear voice, demanded restitution within a limited time, commonly 33 days; which being expired without any restitution made, then the *pater patratus*, or prince of the heralds, proceeded to the enemies' frontiers, and declared war.

Clarigatio is also used for apprehending a man, and holding him to bail. The Greeks called this action androlepsia.

CLARIGATION, in the *Law of Nations*, denotes a loud, clear call, or summons made to an enemy, to demand satisfaction for some injury received; in defect whereof, recourse will be had to reprisals.

Clarigation amounts to much the same with what the Greeks call ανδροληψια. Though Naude uses the word in a somewhat different manner. "Reprisals," says he, "signify the same as *pignorationes Budæo, aut clarigationes Hermolao*: for, as to the Greek word *androlepsia*, it is equivalent to the Latin *pignorandi potestas*."

CLARINET, the name of a musical instrument, which has not been known in this country till within about 50 years ago, and which is said to have been invented about the close of the 17th century by John Christopher Denner, a wind musical instrument maker of Leipsic. This instrument has been found liable, by long use, to get out of tune by the widening of the bore, which is a fault that cannot afterwards be remedied. Messrs. Goulding and Co. of Pall-Mall, have lately obtained a patent for an improvement in the construction of this instrument. In order to prevent the inconvenience

venience above-mentioned, the patentees have conftructed an inftrument which is lined throughout with a tinned brafs tube, intended both to prevent the wood from decaying and to improve the tone of the inftrument. Another inconvenience arifing from the leathering of the keys, which was apt to be out of order in marching regiments, is remedied by lining the holes with a foft metal pipe ground perfectly flat upon the furface, to which a ftopper is fcrewed, that renders the pipe air-tight.

CLARINO, in the *Italian Mufic*, fignifies a trumpet; thus, *a duoi clarini*, added to any compofition, denotes that it was made for two trumpets. See Cornet and Trumpet.

CLARION, probably the *claret* of Lufcinius, a kind of trumpet, whofe tube is narrower, and its tone acuter and fhriller, than the common trumpet.

Menage derives the word from the Italian *clarino*, of the Latin *clarus*, by reafon of the clearnefs of its found. Nicod fays, the clarion, as now ufed among the Moors, and the Portuguefe, who borrowed it from the Moors, ferved anciently for a treble to feveral trumpets, which founded tenor and bafs. He adds, that it was only ufed among the cavalry and the marines.

Clarion, in *Heraldry*. Guillim fays clarions are a kind of old-fafhioned trumpets, others imagine they reprefent the rudder of a fhip, and others a reft for a lance.

CRARISIA, in *Botany*, Bofc. Nouv. Dict. Flor. Peruv. Pl. 28. Clafs and order, *diœcia diandria*.

Gen. Ch. *Male*. Catkins filiform, imbricated. *Cal.* a one-flowered fcale, containing two ftamens. *Female. Cal.* a very fmall fcale. *Pift.* Germ oval; ftyles two, awl-fhaped; ftigmas two. *Peric.* Drupe oval. *Seed* one. Two fpecies, both trees, are mentioned in the Flora Peruviana.

CLARISSIMI, among the Romans, a title of honour belonging to the third rank of nobility under the emperors. See Spectabiles.

CLARITAS Julia, in *Ancient Geography*, alfo called *Attubi* according to Pliny, a town of Spain, in Boetica.

CLARIUM, a fortrefs of Greece, in the Peloponnefus, fituate, according to Polybius, in the middle of the territory of Megalopolis.

CLARK-*goofe*, in *Ornithology*, a fpecies of wild goofe found in Zetland. Phil. Tranf. N° 473. fect. 8.

CLARKE, Samuel, in *Biography*, a minifter and writer of confiderable refpectability, was born in 1599, at Woolfton in Warwickfhire. He received his grammar education at Coventry, whence he removed to Emanuel college, Cambridge. When he had taken the degree of bachelor of arts, he left the univerfity, and after having acted for a fhort period as private tutor in a gentleman's family, he removed to Chefhire, and afterwards to Warwickfhire, in which counties he long officiated as a minifter with the greateft refpect and acceptance. On the publication of the *et cætera* oath he was one of the deputies chofen by the minifters of the diocefe of Worcefter to prefent a petition on their behalf to the king, Charles I., who was then at York. He was nominated to prefent a petition on the fame fubject to the parliament; and in 1660 he prefented an addrefs of thanks from the London minifters to Charles II., on his declaration refpecting ecclefiaftical affairs. He had this year been chofen minifter of St. Bennet's Fink in London, and in 1661 we find him named among the commiffioners of the Savoy for reforming the "Book of Common Prayer." At St. Bennet's Fink he continued in the diligent exercife of his profeffion, until the publication of the fatal act of uniformity, which turned him and about two thoufand others out of their places. After this meafure had been carried into effect, he did not altogether feparate from the eftablifhed church; but frequently attended its fervices both as a hearer and a communicant. He died on the 25th December 1682. He was a man of confiderable learning and extenfive reading; of plain, fimple, and unaffected manners; of exemplary piety and moral purity of life. He was an indefatigable ftudent, and a voluminous writer, as appears by the number and the extent of his publications. We fhall content ourfelves with naming the principal of them, which were his "Martyrology," "Lives of fundry Eminent Perfons," "Marrow of Ecclefiaftical Hiftory," and "Marrow of Divinity," all printed in folio.

Mr. Clarke had a fon of his own name, who was ejected from Grendon in Buckinghamfhire; he was the author of a work intitled "Annotations on the Bible," which has been highly fpoken of by Dr. Owen and Mr. Baxter. Clark's Narrative of his own Life. Calamy. Neal.

Clarke, Samuel, an oriental fcholar of the firft eminence, was born at Brackley, in the county of Northampton; and in 1638, when he was in the fifteenth year of his age, entered as a ftudent at Merton college, Oxford. Three years afterwards the city being garrifoned for the ufe of the king, he was obliged to leave the univerfity; but in 1648, after it had furrendered to the parliament, he returned, fubmitted to the vifitors they had appointed, and took the degree of mafter of arts. The year following he was defigned firft archi-typographus of the univerfity; to which was added the grant of the fuperior beadlefhip of civil law. He kept a boarding fchool at Iflington about the year 1650, and lent his affiftance towards the publication of the "Polyglot Bible." In 1658, however, he returned to the univerfity, was elected archi-typographus, and fuperior beadle of civil law, fituations which he continued to retain to the end of his life. His works confift of "Variæ Lectiones, et Obfervationes in Chaldaicam Paraphrafin," which appeared in the fixth volume of the "Polyglot Bible." "Scientia Metrica, et Rhythmica; feu Tractatus de Profodia Arabica ex Authoribus probatiffimis eruta." "Septimum Bibliorum Polyglotorum volumen, cum Verfionibus antiquiffimis, non Chaldaica tantum, fed Syriacis, Æthiopicis, Copticis, Arabicis, Perficis contextum." He made a tranflation from the original manufcript in the Cambridge public library, of "Paraphraftes Chaldæus in Libr. Paralipomenωn," a work which the learned Caftell fays he confulted in compofing his elaborate "Lexicon Heptaglotton." He reviewed alfo, with great care, the Hebrew text, the Chaldee Paraphrafe, and the Perfian Gofpels in the Polyglot Bible, and tranflated the laft into Latin. There is, befides, afcribed to him a Latin tranflation from the Hebrew, of a work entitled "Mafſeceth Beraioth, Titulus Salmudicus, in quo agitur de Benedictionibus, Precibus, et Gratiarum Actionibus, adjectâ Verfione Latinâ. In ufum Studioforum Literarum Talmudicarum in Æde Chrifti." He died near Oxford on the 27th of December 1669. Wood's Athenæ Oxon.

Clarke, Samuel, a learned divine of the eftablifhed church, was born at Norwich, in the month of October 1675; his father, Mr. Edward Clarke, was a gentleman of high refpectability in that city, one of its aldermen, and for fome years one of its reprefentatives in parliament. He received the firft part of his education at the free fchool of his native town, where he made a rapid progrefs in the acquifition of the learned languages. In the year 1691 he entered a ftudent at Caius college, Cambridge, and foon diftinguifhed himfelf by his ardent defire of knowledge, and by his unremitting diligence and fuccefs in the profecution of his ftudies. The fyftem of Des Cartes was at this time in high esteem, and taught with much zeal and confidence at the universities; but Mr. Clarke, even at this early age, had too much acuteness and penetration to mistake its fallacious inductions for demonstration, or its hypothetical fancies for sound philosophy. He had seen and carefully perused the Principia of Newton, then just published; and to his scrutinizing mind the more rational system; the more clear, solid, and conclusive reasonings of that great philosopher carried irresistible conviction. In the first ardour of his zeal for the principles he had newly embraced, and without regarding the deference which he knew to be due to the learning and talents of his respectable tutor, Mr. John Ellis, and to the other professors of the university, he performed a public exercise, with a view to his first degree, upon a question taken from the Principia, in the discussion of which he astonished his auditory by the clearness of his perceptions, and the solidity and force of his argumentation. Having thus become, upon enlightened conviction, a convert to the Newtonian system, he directed his thoughts to the best means of ensuring for it a more general reception. The work then in common use as a text-book was Rohault's System of Philosophy, upon Cartesian principles, which was written in very corrupt and barbarous Latin. Mr. Clarke, at the age of twenty-one, undertook the arduous, but commendable, task of making a more pure and classical translation of it; and he embraced this opportunity to disseminate his own system by subjoining to the original text a variety of such judicious and excellent notes as were calculated to lead the student, insensibly, to perceive the fallacy of the author's hypothesis. This plan produced its intended effect; Clarke's edition of Rohault, which passed through four editions, continued for some years the standing text-book of the university, until it undermined its own authority, and gave way to the publications of Rutherforth and Rowning, who were both avowedly the disciples of Newton. It being Mr. Clarke's design to take orders, he now directed his attention to the subjects more immediately connected with the sacred function. He began by studying the scriptures of the Old and New Testament in their original languages, and by carefully perusing the writings of the earlier Christian fathers, which contain much valuable matter relative to the principles and the evidences of Christianity. Shortly after he had been ordained he was introduced by Whiston to Dr. Moore, the bishop of Norwich, who was a warm friend to literature, and a great patron of learned men. Bishop Moore was so much pleased with Mr. Clarke, that on the collation of Whiston to the living of Lowestoffe, in the year 1698, he appointed him to be his domestic chaplain. In this situation he remained twelve years, enjoying every mark of the esteem and friendship of his learned patron, and associating with him on all occasions, rather with the intimacy of a brother than the distant reserve of a dependant. At his death, Dr. Moore evinced the confidence he had in him by entrusting to his care the entire management of his domestic affairs; it were almost superfluous to add that Mr. Clarke acquitted himself of his trust with honour and fidelity.

In the year 1699 he may be said to have commenced his literary career, as a divine, by the publication of "Three Practical Essays on Baptism, Confirmation and Repentance;" and also "Reflections" on a work entitled "Amyntor," known to be the production of Mr. Toland, and which related to the writings of the Primitive Fathers, and the Canon of the New Testament. These works of Mr. Clarke, although not to be ranked with his subsequent publications in point of literary merit, display the author's piety to great advantage, and show him to have been deeply versed in the writings of the earlier christians. As he was at this period intensely engaged in a critical study of the scriptures, he availed himself of the advantages he enjoyed, in the uncontrouled disposal of his time, and the free access allowed him to the valuable library of his patron, to impart the benefit of his labours to the public. In pursuance of this design he published, in the year 1701, a Paraphrase on the Gospel of St. Matthew, which was soon followed by Paraphrases on the Three Gospels of Mark, Luke, and John. These are plain, judicious, and learned expositions on the original text; and, being, in a great degree, free from the verbosity and circumlocution so common in works of a similar nature, may be read with great pleasure, and with great advantage, by all who seek their real improvement in christian knowledge and practice. It was originally the intention of the author to have carried on his undertaking through the whole of the books of the New Testament, and he had made some progress in the Acts of the Apostles, when other avocations, more urgent it should seem, diverted him from his purpose. Dr. Moore's great esteem and partiality for Mr. Clarke made him solicitous to advance him in his profession, by every means within his power and influence. He presented him with the rectory of Drayton, near Norwich, and obtained for him a parish in that city, which together produced a considerable addition to his income. At this time Mr. Clarke preached without notes, a practice in which, it is said, he was peculiarly happy, and which he continued until he removed to St. James's, where his more polite auditory induced him to read his discourses, and to compose them with every possible attention to method and style.

In the year 1704 Mr. Clarke's increasing reputation procured for him the appointment to preach Mr. Boyle's Lecture, and he chose for his subject the Being and Attributes of God. The general satisfaction which he gave, on this occasion, caused him to be reappointed the year following to the same office, when he delivered a course of sermons on the Evidences of Natural and Revealed Religion. These two courses were afterwards printed together, having been previously compressed and arranged into continued discourses, and passed through several editions with successive additions and improvements. The mode of reasoning pursued by Mr. Clarke, in proving the Being and Attributes of God, from arguments *à priori*, excited considerable attention on the appearance of his work, and led to much curious and interesting discussion. It was alleged against him that such reasoning was objectionable, as being too metaphysical and subtil for the generality of mankind to comprehend, and as, in many cases, inconclusive and unsatisfactory to the most cultivated and enlightened minds. It is to be observed, however, in justification of Mr. Clarke, that he has declared he did not himself consider the arguments *à priori* to be equally forcible and demonstrative with those which might be drawn from the works of creation, on the evidence of which he considered that the belief in the existence of God must ultimately rest. Nevertheless he thought, that as unbelievers had made great use of the arguments *à priori* on the other side of the question, in support of their atheistical tenets, it were highly desirable and proper that they should be met on their own ground, that the world might see, in the most striking point of view, the fallacy of their deduction, and that the being of God was proved, almost to demonstration, by the very mode of argumentation employed by them to infer his non-existence. So far as this Mr. Clarke's explanation is satisfactory; and must be admitted

mitted to hold him very free from meriting the wafpifh and illiberal reflection caft upon his labours by Pope, in the following lines of his Dunciad:

> "Let others creep by timid fteps and flow,
> On plain experience lay foundations low;
> By common fenfe to common knowledge bred,
> And laft to nature's caufe through nature led.
> We nobly take the high *priori* road,
> And reafon downward till we doubt of God."
> B. 4. line 455, &c.

Mr. Clarke has executed his undertaking with great ability; and has deferved well of the friends of religion for having fet this particular proof of the exiftence of God in the cleareft light of which it will, perhaps, admit in the prefent limited fphere of our knowledge and capacities. He has difplayed, throughout the whole performance, a clearnefs and accuracy of apprehenfion, a depth and folidity of judgment, and a force and acutenefs of reafoning, which give him a juft title to be ranked in the firft clafs of metaphyficians. Mr. Clarke's fecond treatife, on the Evidences of Natural and Revealed Religion, was not more fortunate than the other in efcaping animadverfion and controverfy. The foundation, on which he built his fyftem, was the eternal differences, relations, and fitneffes of things; and as thofe terms frequently recur in his book, they became, in a confiderable degree, fafhionable in the ethical vocabulary of the day. Notwithftanding this, his hypothefis was rejected by many; and it loft much of the authority it had gained on the promulgation of the more fentimental notions of Lord Shaftfbury, afterwards more fyftematically treated by Profeffor Hutchefon, in his "Inquiry into the Original of our Ideas of Beauty and Virtue," in which the principle of diftinct moral inftincts is propofed and fupported. Mr. Clarke's work is, however, as a whole, ineftimably valuable, as containing the moft fatisfactory proofs of the divine origin, authority, and obligation of the chriftian religion. It has had many able defenders, and among others Dr. Price, who was himfelf a hoft.

In the year 1706 Mr. Clarke's patron fucceeded in his wifh to remove him to London, where he thought he would find a wider field of ufefulnefs for the exercife of his great talents; his intereft procured for him the rectory of St. Bennett's, Paul's Wharf, where he continued for fome time to officiate with the higheft reputation. In the courfe of this year he publifhed a letter addreffed to Mr. Dodwell; it was in anfwer to a treatife which that gentleman had recently publifhed to prove, among other things, that the foul was not naturally immortal, but became fo at baptifm. Although Dr. Hoadly, in his memoirs of Clarke, obferves that this letter gave general fatisfaction, it does not appear to have enforced univerfal conviction even at that time; for the philofophical part of the argument, on the materiality of the human foul, was taken up and ably defended by Mr. Collins, and the difpute has been fubfequently revived by feveral writers of ability and reputation. Mr. Clarke publifhed alfo this year an elegant Latin tranflation of fir Ifaac Newton's "Treatife on Optics," which he had undertaken at the folicitation of the author, and was, by this means, inftrumental in diffeminating the light which this great philofopher had thrown upon that fubject, among the learned and inquifitive in other parts of Europe. Newton complimented him for this favour with the fum of one hundred pounds for each of his five children.

The bifhop of Norwich having brought his friend to London, now introduced him at court, and procured for him from queen Anne, the appointment to be one of her majefty's chaplains in ordinary; and the rectory of St. James becoming fhortly after vacant, fhe, at the bifhop's requeft, prefented it to Mr. Clarke. On this elevation to a fituation, where he would be attended by and be obliged to affociate with the higheft characters in the ftate, it was deemed defirable that he fhould take the degree of doctor in divinity. With this view he repaired to Cambridge, where he performed a public exercife which was long remembered, and which, at the time, filled thofe who heard it with aftonifhment and delight, by the erudition it difplayed, and the eloquence and claffical purity of language with which it was compofed and delivered. Mr. Clarke's thefis was an elaborate difquifition on the following queftion; "Nullum Fidei Chriftianæ Dogma, in S. Scripturis traditum, eft rectæ rationi diffentaneum." "No Article of the Chriftian Faith, delivered in the Sacred Scriptures, is contrary to right Reafon;" which he maintained in a moft mafterly manner, againft his acute and learned opponent, Dr. James, the regius profeffor.

In the year 1712, Dr. Clarke appeared in a new character, and difplayed his tafte in philological erudition, by the publication of a moft fplendid edition of Cæfar's Commentaries in folio, enriched with many judicious notes and corrections, and embellifhed with fome beautiful engravings. Mr. Addifon fpeaks, in deferved commendation of this book in the 367th number of the Spectator, as a work that did honour to the Englifh prefs. Since that time it has continued to rife in value, and is now fold at very advanced prices. An octavo edition of it was afterwards publifhed. This year Dr. Clarke involved himfelf in a protracted, and, on many accounts, painful controverfy by the publication of his "Scripture Doctrine of the Trinity." An application was made to him previous to its appearance by fome of the minifters of queen Anne, to defire he would abandon his intentions, or at leaft delay the publication; but he, much to his honour, difregarded their requeft, and boldly fubmitted his opinions to the examination of the public. The method purfued by him in treating fo tender a fubject, was certainly the moft candid and unobjectionable that could well be devifed. The firft part contains a "Collection and Explication of all the Texts in the New Teftament relating to the Doctrine of the Trinity;" in the fecond, "The foregoing Doctrine is fet forth at large, and explained in particular and diftinct Propofitions;" and in the third part, "The principal Paffages in the Liturgy of the Church of England relating to the Doctrine of the Trinity are confidered." Nothing could be more fair than to try a doctrine afferted by its abettors to be exclufively a doctrine of revelation, by the language and expreffions in which that revelation is conveyed, and by a full and critical examination, collectively and feparately, of all the paffages wherein it is fuppofed to be taught. It is impoffible that any method can be more likely to elicit the truth, and to point out to the ferious inquirer what he ought to believe. But notwithftanding Dr. Clarke's candid manner of bringing the fubject forward into difcuffion, it occafioned a controverfy, in which paffion and bigotry had far too large a fhare of influence. Dr. Hoadly remarks, however, that the difpute lay at laft principally between the author and a writer (who was known to be Dr. Waterland), whom he ftyles very fkilful in the management of a debate, and very learned and well verfed in the writings of the ancient fathers. But Dr. Clarke was not to be let off with the fimple warfare of printed controverfy, in which, indeed, he appeared to combat his adverfaries with manifeft fuperiority in point of weapons and fkill. A complaint was formally made to the bifhops by the lower houfe of convocation, in 1714, of the heterodox opinions and dangerous

tendency

tendency of the work in queſtion; and, at the requeſt of the upper houſe, they afterwards delivered in extracts from it in proof of their charges. To theſe extracts Dr. Clarke wrote a reply; but from ſome cauſe or other, not now to be aſcertained, it was not laid before the houſe. The biſhops evinced on this occaſion a very becoming ſpirit of conciliation and peace; and endeavoured to calm the violence which was ſo conſpicuous in the proceedings of their brethren of the lower houſe. Dr. Clarke, we are told, was *prevailed upon* to lay before the upper houſe a paper, which was regarded as his ſubmiſſion, and which certainly tended to convey the impreſſion, that he believed in the doctrine of the trinity in the ſenſe wherein it is commonly underſtood. His declarations are not, indeed, explicit; nor were they admitted by the lower houſe as a ſatisfactory exculpation from their charges; but they were, nevertheleſs, ſuch as it ill became ſo great a man, ſo learned an advocate, and ſo liberal and enlightened a philoſopher, to condeſcend to make. His friend Whiſton, who had a bolder ſpirit, did not ſcruple to cenſure his conduct; and, in juſtice to Dr. Clarke, it muſt be obſerved, that he afterwards condemned it himſelf, and ſaw, but too late, the error he had committed. He drew up a paper in explanation of the former, which was given in to the upper houſe of convocation; but the ſeaſon was paſſed, and his enemies had caught the opportunity to triumph over his failing. On the conſideration of his firſt paper the biſhops, though much to the diſſatisfaction of thoſe who had preferred it, diſmiſſed the complaint. It was ſuppoſed and aſſerted by ſome, particularly by chevalier Ramſay, that Dr. Clarke after this changed his opinions reſpecting the Trinity, and relinquiſhed the ſentiments maintained by him in his "Scripture Doctrine;" but this charge has been diſproved by the ſtrongeſt evidence, and by the moſt reputable and competent authorities,—by Dr. Clarke's own writings and emendations in the liturgy made but a ſhort time previous to his death,—by the teſtimonies of his friend and biographer doctor Hoadly,—and of his own ſon Mr. Samuel Clarke.

In the years 1715, 1716, Dr. Clarke engaged in an amicable controverſy with the learned Leibnitz, on the abſtruſe, metaphyſical doctrines of philoſophical liberty and neceſſity, in which each of theſe able diſputants diſplayed all the ſkill in argumentation and debate, of which they were reſpectively maſters. The papers written on this occaſion were printed in the year 1717, and inſcribed to the princeſs of Wales, afterwards queen Caroline, through whoſe hands they had all paſſed, and whom Dr. Hoadly calls the witneſs and judge of every ſtep of the controverſy. Dr. Clarke, in the year 1718, gave riſe to a curious controverſy reſpecting apoſtolical and primitive doxologies, by introducing ſome alterations into thoſe of the ſinging pſalms which had been that year reprinted for the uſe of his church. The alteration complained of conſiſted in aſcribing glory to God *through* Chriſt, inſtead of paying *equal* honours to each of the three perſons of the Trinity. On this occaſion the biſhop of London thought the ſubject of ſufficient importance to publiſh a paſtoral letter to the clergy of his dioceſe, to warn them againſt innovations, and to forbid them to uſe the new doxologies. This letter was anſwered by Whiſton, and occaſioned the publication of ſeveral pamphlets on both ſides of the queſtion. Whiſton, however, obſerves, that the biſhop of London, in the way of *modern authority*, was quite too hard for Dr. Clarke in the way of primitive Chriſtianity. About this period Dr. Clarke was preſented to the maſterſhip of Whigſton Hoſpital, a poſt which he did not ſcruple to accept, as it did not require him to renew his ſubſcription, and which was rendered doubly agreeable to him by the handſome manner in which it was conferred by Mr. Lechmere, chancellor to the Duchy of Lancaſter. In 1724 he publiſhed ſeventeen ſermons in an octavo volume, eleven of which had never before been printed. On the death of ſir Iſaac Newton, the maſterſhip of the Mint, which by that event became vacant, was offered to him; but being a ſecular preferment, Dr. Clarke, with a very becoming reſpect to the dignity of his character, and agreeably to the opinion of his beſt friends, declined to accept it. In the year 1728, he publiſhed in the Philoſophical Tranſactions (No. 401), a letter addreſſed to Mr. Benj. Hoadly, on the velocity and force of bodies in motion; which is an able vindication of the doctrine of ſir Iſaac Newton on that ſubject.

Dr. Clarke's philological labours, as editor of Cæſar's Commentaries, have already been noticed. In the year 1729, he gave new proofs of his refined taſte and critical ſkill in the learned languages, by the publication of the 12 firſt books of Homer's Iliad, which he accompanied with an elegant Latin verſion, and illuſtrated with a number of very learned and moſt excellent notes and annotations. Homer, we are told, was his favourite author; and he has acted towards him in a manner worthy of his partiality, by ſtripping him of the ambiguities in which ignorance had involved his meaning, and preſenting him to the learned world in his native ſimplicity and beauty. The twelve laſt books were publiſhed in 1732 by Dr. Clarke's ſon; from whom we learn that Dr. Clarke had himſelf finiſhed his annotations on the three firſt of them, and part of the fourth. This work ſtill maintains its well-deſerved reputation, and continues to be received into our principal ſchools.

In the midſt of theſe various labours of public utility, Dr. Clarke was interrupted and cut off in the full maturity and ſtrength of his intellectual powers, by a pleuritic indiſpoſition, by which he was attacked on the 11th of May, 1729, after he had gone to Serjeants' Inn to preach before the judges. It baffled all medical aid, and, after ſubjecting him to very acute ſufferings, proved fatal to him on the 17th of the ſame month. Since his death his brother has publiſhed an "Expoſition of the Church Catechiſm," which compriſed the ſubſtance of a courſe of lectures which Dr. Clarke had delivered on this ſubject while miniſter of St. James's pariſh. He had carefully reviſed them before his death, and left them ready for publication. But his poſthumous publication of greateſt importance is the collection of his ſermons in ten volumes, which were given to the public by the ſame reſpectable relation. As a writer of ſermons, Dr. Clarke had many excellencies. Whatever ſubject he treats, his matter is ſolid and important, his arrangement lucid and comprehenſive, his illuſtrations apt and impreſſive, and his language plain, perſpicuous, nervous and perſuaſive. In his explications of Scripture he is peculiarly happy; for if it be objected to them in any inſtance, that they are more elaborate and circumſtantial than neceſſary, their length will be found to be amply compenſated by their intrinſic excellence and value. Dr. Clarke's character as a writer on all the ſubjects to which he directed his attention, ſtands deſervedly high. His works, although they diſplay no brilliancy of imagination or dazzling coruſcations of genius, are a ſtanding monument of a great and comprehenſive mind, which could bring within its graſp all uſeful and ornamental learning, and treat whatever ſubjects came under its obſervation with equal ability, accuracy, and preciſion. In theology, in metaphyſics, in natural philoſophy, and in claſſical erudition, he has eſtabliſhed a credit which will be as laſting as ſcience itſelf. His penetration was on all occaſions lively and ſtrong, his memory retentive and faithful, and his judgment equally perfect to direct him in the application of its vaſt ſtores.

To

To these high intellectual endowments, Dr. Clarke joined a mild, modest, and unassuming temper, the most amiable and affectionate disposition, sincere and elevated piety, and the most unimpeachable uprightness, and purity of conduct and behaviour.

Hoadly's Account of the Life, &c. of Dr. S. Clarke, prefixed to his works. Whiston's Historical Memoirs of the Life of Dr. Samuel Clarke, 8vo. Biog. Brit.

Clarke, William, an eminent antiquary, was born at Haghmon abbey, in the county of Salop, in 1696. The first part of his education he received at the grammar-school in Shrewsbury; whence he removed to Cambridge, and became a fellow of St. John's, in that university, in January 1716-17. His rising reputation soon procured for him the situation of domestic chaplain to Dr. Ottley, bishop of St. David's; and on that prelate's death, in 1723, he was appointed domestic chaplain to the duke of Newcastle. In this situation he did not continue long; for archbishop Wake, from motives of personal respect, as well as a regard to the solicitation of Dr. Wotton, whose daughter Mr. Clarke had married, presented him to the rectory of Buxted, in Sussex. It is remarkable that Mr. Clarke did not take his bachelor's degree before the year 1731, nor that of master of arts before 1735. In 1738 he was made prebendary and residentiary of the cathedral church of Chichester. Mr. Clarke's first appearance as a writer was in a preface to Dr. Wotton's "Leges Walliæ, or the Ecclesiastical and Civil Laws of Howel Dda, and other Princes of Wales." It has been supposed, that a valuable "Discourse on the Commerce of the Romans," re-printed by the learned Bowyer, with whom he was in the habit of corresponding, in his "Miscellaneous Tracts," came from his pen. But the work on which Mr. Clarke's character as an antiquary is chiefly founded, is that on "The Connection of the Roman, Saxon, and English Coins; deducing the Antiquities, Customs, and Manners of each People to modern Times; particularly the Origin of Feudal Tenures and Parliaments; illustrated throughout with critical and historical Remarks on various Authors, both sacred and profane:" it was published in 1767, in one volume in quarto, and dedicated to the duke of Newcastle. This publication was occasioned principally by the discovery which Mr. Martin Folkes had lately made of the old Saxon pound: it received some improvements from the suggestions of Arthur Onslow, esq., the speaker, and was greatly indebted to Mr. Bowyer for some notes, a dissertation on the Roman sesterce, and a valuable index. The work has been much esteemed by learned men, as elucidating many obscure, but interesting subjects, connected with the history of this country. Mr. Clarke assisted Mr. Bowyer in translating "Trapp's Lectures on Poetry;" and wrote several notes to the English version of "La Bleterie's Life of Julian." Several other writings were left by him in manuscript, particularly some sermons, and some curious papers relating to the history, &c. of the county of Sussex. Although antiquities appear to have engrossed the principal part of his attention, he is said to have possessed a taste for poetry; and some lines of his, published by his friend Mr. Hayley, prove him to have had considerable talent for epigrammatic composition. In 1768 he resigned the rectory of Buxted to his son Mr. Edward Clarke, and in 1770 he was presented to the vicarage of Amport, and appointed chancellor of the diocese of Chichester: but he did not long live to enjoy this promotion, being taken away by death in October 1771. In private life Mr. Clarke was distinguished by the mildness and amiableness of his character, and in his public conduct, by his unremitting attention to his professional duties. His son, Mr. Edward Clarke, above-mentioned, passed some time in Spain, in the capacity of chaplain to the earl of Bristol, the English ambassador; and, on his return, published some "Letters concerning the Spanish Nation," containing much useful information respecting that country. Biog. Brit.

Clarke, Jeremiah, an English organist and ecclesiastical composer, had his education in the Chapel Royal, under Dr. Blow, who seems to have had a paternal affection for him. In 1693 he resigned, in his favour, the place of master of the children and almoner of St. Paul's, of which cathedral Clarke was soon after likewise appointed organist. In 1700 Dr. Blow and his pupil were appointed gentlemen extraordinary in the King's chapel; of which, in 1704, on the death of Mr. Francis Piggot, they were jointly admitted to the place of organist.

The compositions of Clarke are not numerous, as an untimely and melancholy end was put to his existence before his genius had been allowed time to expand.

Early in life he was so unfortunate as to conceive a violent and hopeless passion for a very beautiful lady of a rank far superior to his own; and his sufferings, under these circumstances, became at length so intolerable, that he resolved to terminate them by suicide. The late Mr. Samuel Wiley, one of the lay-vicars of St. Paul's, who was very intimate with him, related the following extraordinary story. "Being at the house of a friend in the country, he found himself so miserable, that he suddenly determined to return to London; his friend observing in his behaviour great marks of dejection, furnished him with a horse, and a servant to attend him. In his way to town, a fit of melancholy and despair having seized him, he alighted, and giving his horse to the servant, went into a field, in the corner of which there was a pond surrounded with trees, which pointed out to his choice two ways of getting rid of life; but not being more inclined to the one than the other, he left it to the determination of chance; and taking a piece of money out of his pocket, and tossing it in the air, determined to abide by its decision; but the money falling on its edge in the clay, seemed to prohibit both these means of destruction. His mind was too much disordered to receive comfort, or take advantage of this delay; he therefore mounted his horse and rode to London, determined to find some other means of getting rid of life. And in July 1707, not many weeks after his return, he shot himself in his own house in St. Paul's church-yard; the late Mr. John Reading, organist of St. Dunstan's church, a scholar of Dr. Blow, and master of Mr. Stanley, intimately acquainted with Clarke, happening to go by the door at the instant the pistol went off, upon entering the house, found his friend and fellow-student in the agonies of death."

The anthems of this pathetic composer, which Dr. Boyce has printed, are not only more natural and pleasing than those of his master Dr. Blow, but wholly free from licentious harmony and breach of rule. He is mild, placid, and seemingly incapable of violence of any kind. In his first anthem (vol. ii.) which required cheerfulness and jubilation, he does not appear in his true character, which is tender and plaintive. The subject of the next is therefore better suited to the natural bias of his genius. There is indeed nothing in this anthem which indicates a master of grand and sublime conceptions; but there are a clearness and accuracy in the score, and melancholy cast of melody and harmony suitable to the words, which are likewise well accented, that cannot fail to soothe and please every appetite for music which is not depraved.

His full anthem, "Praise the Lord, O Jerusalem," is extremely natural and agreeable, and as modern and graceful as the gravity of the choral service will with propriety allow.

And

And in his verse anthem, the movements in triple time are as pathetic, and even elegant, as any music of the same period, ecclesiastical or secular, that was produced, either at home or on the continent. There is a very agreeable verse anthem of his composition in a collection published by Walsh, "The Lord is my strength and my song," with more spirit in it than we thought he could muster. But the verse, "O Lord, send us now prosperity," on a ground-base in Purcell's manner, is extremely pleasing and ingenious. Tenderness is, however, so much his characteristic, that he may well be called the musical Otway of his time.

Clarke, John, an engraver, who resided at Edinburgh, where he engraved the portraits of William Prince of Orange, and the princess Mary, in the form of a medallion; it is dated 1690. Amongst other portaits by him, are those of Sir Matthew Hale and Andrew Marvell; besides which, he engraved two sets of prints, called the Humours of Harlequin and Columbine.

Strutt and Heinecken mention another John Clarke, who lived in England at the same period; and two other engravers, called William and Thomas Clarke. The latter flourished in 1635.

Clarke, in *Geography*, a county of Kentucky, between the head-waters of Kentucky and Licking rivers. Its chief town is Winchester.

Clarke, a town of America, in the state of Virginia, 9 miles N.W. of Richmond.

CLARKSBURG, the chief town of Harrison county, in Virginia; seated on the E. side of Monongahela river, 40 miles S.W. of Morgan-town, and containing about 40 houses, a court-house, and gaol.

CLARKSTOWN, a town of America, in the state of New-York, and county of Orange, lying on the W. side of the Tappan sea, at the distance of 2 miles, and 29 miles from the city of New-York; by the state census of 1796, 224 of its inhabitants are electors.

CLARKSVILLE, the chief town of the district, which, till of late, was called Tennessee county, in the state of Tennessee, in America, pleasantly seated on the E. bank of Cumberland river, and at the mouth of Red river, opposite to that of Muddy creek; containing about 30 houses, a court-house, and a gaol, and distant 45 miles N.W. from Nashville, and 940 W. by S. from Philadelphia. N. lat. 36° 25'. W. long. 88° 57'.

Clarksville, a small settlement of America, in the N.W. territory, which contained in 1791 about 60 persons. It is situated on the northern bank of the Ohio, opposite to Louisville, a mile below the Rapids, and 100 miles S.E. of Port Vincent. It is often flooded when the river is high, and inhabited by people who cannot at present find a better situation.

CLARO-OBSCURO. See Clair-*obscure*.

CLAROS, in *Ancient Geography*, a wood and temple of Apollo in Ionia, in the country of the Colophonians, according to Strabo, who adds, that they were situated before the town of Colophon, and that they were consecrated to Apollo, who had formerly an oracle there.—Also, a town of Asia, in Ionia.—Also, a mountain of Asia Minor, in Ionia, near the town of Colophon. Apollo is supposed by some to have derived from this place his appellation of "Clarian."—Also, an island of the Ægean sea, since called "Calamo," and the "Calymna" of Pliny.

CLARTHY, in *Geography*, a river of Wales in the county of Cardigan, which joins the Clarwen at the N.W. extremity of the county of Brecknock.

CLARWEN, a river of Wales, which runs into the Wye near Rhaiadr-Gwy.

CLARY, in *Botany* and *Gardening*. See Salvia.

Clary, in *Geography*, a town of France, in the department of the north, and chief place of a canton in the district of Cambray; the place contains 1494, and the canton 17,205 inhabitants; the territory includes $132\frac{1}{2}$ kiliometres, and 17 communes.

Clary-*water*, is composed of brandy, sugar, clary-flowers, and cinnamon, with a little ambergris dissolved in it. It helps digestion, and is cardiac. This water is rendered either purgative or emetic, by adding resin of jalap and scammony, or *crocus metallorum*. Some make clary-water of brandy, juice of cherries, strawberries and gooseberries, sugar, cloves, white pepper, and coriander seeds; infused, sugared, and strained.

CLASMIUM, in *Natural History*, the name of a genus of fossils, of the class of the gypsums; the characters of which are, that they are of a soft texture, and of a dull and opake look, being composed, like all the other gypsums, of irregularly arranged flat particles.

The word is derived from κλασμος, *a fragment*, or *small particle*, from the flaky small particles of which these bodies are composed. Of this genus there is only one known species; this is of a tolerably regular and even structure, though very coarse and harsh to the touch. It is common in Italy, and is greatly esteemed there; we have of it also in some parts of Derbyshire; but with us it is not particularly regarded, but burnt among the rest. It neither gives fire with steel, nor ferments with *aqua fortis;* but calcines readily in the fire, and affords a very valuable plaster of Paris.

CLASP-*nails*. See Nails.

CLASPERS, in *Botany*. See Cirrus.

CLASS, *Classis*, a distribution of persons or things, ranged according to their merit, value, or nature. See Rank, &c.

The word comes from *classis*, derived by some from the Greek καλεω, *congrego*, *convoco;* a *class* being nothing but a multitude assembled apart.

Class is particularly used for a distinction among scholars, who are distributed into several classes or forms, according to their capacities and attainments.

Quintilian uses the word *classis* in this sense, in the first book of his "Institutiones."

Class, in *Botany*, a term first employed by Gesner, afterwards taken up by Tournefort, and finally established by Linnæus, to denote the primary division of plants into large groups, each of which is to be subdivided, by a regular downward progression, into orders, or sections, as they are called by Tournefort, genera and species, with occasional intermediate subdivisions, all subordinate to the division which stands immediately above them. So that the classes may be compared to the first layer of a truncated pyramid, which increases gradually as it receives the orders, genera, and occasional intermediate subdivisions, till at length it terminates in an immense base, consisting entirely of species. A class is thus defined by Tournefort in the Isagoge in Rem Herbariam, prefixed to his "Institutiones Rei Herbariæ," p. 51: Classis autem nomine intelligitur congeries generum, quibus nota quædam communis adeo propria est, ut ab omnibus aliis generibus plantarum prorsus differant. "A class is a collection of genera, all possessing some peculiar common character, by which they may be readily distinguished from all other genera." The definition given by Linnæus in his "Philosophia Botanica," p. 100, is more particular. Classis est generum plurium convenientia in partibus, fructificationis secundum principia naturæ et artis. "A class is founded on the agreement of several genera with each other, in the parts of fructification, according to the principles of nature

nature and art." Tournefort, following the fteps of Gefner, had before determined, though he did not include it in his definition, that the divifion into claffes ought to depend, either folely on the flower, or folely on the fruit; at the fame time affigning the reafon why, in his own practice, he gave the preference to the former. Ifag. p. 65, 66. In the formation of claffes, it is of effential importance that they fhould not be very numerous, and that their boundaries fhould be ftrongly and diftinctly marked. See CLASSIFICATION.

CLASSENDORF, in *Geography*, a town of Bohemia, in the circle of Leitmeritz; 5 miles N. of Kamnitz.

CLASSIC, CLASSICAL, a term chiefly applied to authors read in the claffes at fchools, and who are in great authority there. In this fenfe, Aquinas, and the mafter of the fentences, were claffic authors in the fchool-divinity; Ariftotle, in philofophy; Cicero and Virgil, in the humanities. Aulus Gellius ranks among claffic authors, Cicero, Cæfar, Salluft, Virgil, Horace, &c.

The term claffic feems properly applicable only to authors who lived in the time of the Roman republic, and the Auguftan age, when the Latin was in its perfection.

It appears to have taken its rife hence, that an eftimate of every perfon's eftate being appointed by Servius Tullius, he divided the Roman people into fix bands, which he called *claffes*. The eftate of thofe of the firft *claffis* was not to be under two hundred pounds: and thefe, by way of eminence, were called *claffics, claffici*.

Hence, alfo, authors of the firft rank came to be called *claffics:* all the reft were faid to be *infra claffem*.

The firft *claffis*, again, was fubdivided into centuries; making fourfcore centuries of footmen, and eighteen of horfemen. Each *claffis* confifted, one half of the younger fort, who were to make war abroad; and the other of old men, who ftaid at home for the defence of the city.

CLASSICA COLONIA, in *Ancient Geography*, one of the names of a town in Gallia Narbonnenfis, called by Cæfar *Forum Julii*.

CLASSICAL *Learning* may be underftood to fignify fuch an acquaintance with the beft Latin and Greek writers, as fhall enable the reader to perceive and admire the peculiar beauty of their compofitions, and to adopt their diction and fentiment. The principal claffic Greek authors are, Homer, Hefiod, Plato, Demofthenes, Æfchines, Xenophon, Plutarch, Ifocrates, Epictetus, Lucian, Sophocles, Euripides, Longinus, Theocritus, Anacreon, Pindar, Ariftophanes, &c. The chief Latin writers are, Cicero, Livy, Cæfar, Salluft, Virgil, Horace, Terence, Plautus, Juvenal, Ovid, Pliny, Valerius Paterculus, Tacitus, &c.

CLASSICUM, in *Ancient Military Language*, the found of a trumpet, or a trumpet itfelf. When the Romans wifhed to give the fignal for combat, one man by order, and in prefence of the general, founded with the trumpet. Several others, on an elevated fituation, if there was one near them, anfwered the fignal with the found of their trumpets; and at this fecond fignal, the trumpets of all the cohorts founded at once.

CLASSIFICATION, in a general fenfe, denotes the arrangement or affortment of various objects into thofe feveral claffes, denoted by appellatives, which, in the fchools, are called *genera* and *fpecies*. It is, fays the ingenious Dr. Smith, (Differtation on the Origin of Languages, annexed to his Theory of Moral Sentiments), an application of the name of an individual to a great number of objects, whofe refemblance naturally recals the idea of that individual, and of the name which expreffes it, that feems originally to have given occafion to the formation of thofe claffes and affortments, which, in the fchools, are called *genera* and *fpecies*; and for the origin of which Rouffeau finds himfelf fo much at a lofs to account. What conftitutes a *fpecies* is merely a number of objects, bearing a certain degree of refemblance to one another; and, on that account, denominated by a fingle appellation, which may be applied to exprefs any one of them.

This claffification of different objects, as profeffor Dugald Stewart accurately and fatisfactorily ftates it, (Elements of the Philofophy of the Human Mind, p. 155, &c.) fuppofes a power of attending to fome of their qualities or attributes without attending to the reft; for no two objects are to be found without fome fpecific difference; and no affortment or arrangement can be formed among things not perfectly alike, but by lofing fight of their diftinguifhing peculiarities, and limiting the attention to thofe attributes which belong to them in common. This power of confidering certain qualities or attributes of an object apart from the reft; or the power, as the ingenious profeffor chufes to define it, which the underftanding has of feparating the combinations which are prefented to it, is diftinguifhed by logicians by the name of "abftraction," which fee. Abftraction, which fome philofophers have fuppofed to form the characteriftical attribute of a rational nature, is the ground-work of claffification; and without this faculty of the mind we fhould have been perfectly incapable of general fpeculation, and all our knowledge muft have been limited to individuals; while fome of the moft ufeful branches of fcience, particularly the different branches of mathematics, in which the very fubjects of our reafoning are abftractions of the underftanding, could never have poffibly had an exiftence.

CLASSIFICATION *of Animals for Comparative Anatomy*. The firft fyftematic arrangements of animals were founded upon their external figure and moft obvious habits of life; confequently they were always imperfect, and often erroneous; thus, the divifion of animals into terreftrial, aërial, and aquatic, although apparently natural, included, under the fame title, individuals no way allied to each other, except in the form of their bodies, and the element they inhabited: it is in this manner that the vulgar determine the rank of animals at prefent; thus, the whale tribe, and even feals, are called fifhes, and many mollufca and other marine animals are very generally termed fifh.

In proportion to the cultivation and advancement of the ftudy of zoology, it became neceffary to inftitute claffes and orders founded upon lefs obvious characters than the general appearance or economy of the animals; for which purpofe, the number and arrangement of the toes, teeth, claws, beaks, fcales, and other obfcure or minute parts were employed; and by thefe means the primary divifions and fubdivifions of the animal kingdom were made more numerous; the tranfition from them to the genera lefs abrupt; and the difcrimination of fpecies more eafy and accurate.

It was on this plan that Linnæus proceeded in the formation of his great fyftem, which has been fo much and fo generally admired; the characters he chofe, however, were confeffedly artificial; and as his objects chiefly feemed to be the afcertainment and defcription of the fpecies, he often difregarded natural order, and frequently violated it in the moft palpable manner: his diftinctions are more efpecially at variance with the anatomical ftructure of animals; even where he propofed to form his fyftem upon this foundation, he frequently fell into error.

In order to juftify our departure from a fyftem which the naturalifts of this country have not yet rejected, it will be be necessary to point out some of its more objectionable parts. Linnæus makes two grand divisions of animals, the *red* and the *white-blooded;* and under the latter denomination, he includes many animals in whom no blood or circulating fluid exists, and some others whose blood is really red. The class of *vermes*, which most people would expect to signify worms, contains all the inferior orders of animals, except insects; thus assembling together genera having as little alliance to each other, with respect to form, habits, and organization, as there exists between a quadruped and a fish. For example, what resemblance is there between a cuttle fish, an earth-worm, and a hydatid? or how can the common attributes of worms, *viz.* an unilocular heart and cold white blood be applied to them? The cuttle-fish has three hearts, placed at some distance from each other; its blood is transparent; the male and female organs of generation exist in separate individuals; the animal is furnished with numerous external organs, and possesses the senses of vision and hearing, and resides in the sea. The earth-worm has no heart; its blood is red; has both male and female organs in the same individual; can scarcely be said to possess any projecting external parts; is destitute of the senses of sight and hearing, and is an inhabitant of the earth.

Lastly, the hydatid has neither blood nor circulating vessels; is without sex; is unprovided with any organs of sense or of motion, and lives in the interior of other animals.

The constitution of the Linnæan orders is not more natural than that of the classes. One of the most remarkable examples of artificial arrangement presents itself in the first order of mammalia; in which we find man and the bat associated together; two animals, between whom there is no circumstance of agreement, except the situation of their mammæ, which Linnæus makes an essential character of the order.

The animal, to which man bears the greatest resemblance with respect to external form, is the monkey; but from which he is so distinguished by his mode of progression, that he should be placed, even on that account, in a separate order, if not in a distinct class.

The position of the head, by which it is equipoised upon the vertebral column, the forward direction of the eyes, the want of a cervical ligament to assist the muscles of the neck in sustaining the weight of the head, the capacity of the chest, which would interfere with the employment of the superior extremities, as feet, the shape of the pelvis, and of the cavity for receiving the head of the thigh bone, the length of the inferior extremities, the strength of the posterior muscles of the leg, and the projection of the heel, which increases their power, the position of the sole of the foot, the conjunction of the great toe with the others, and the original thickness of the integuments of the bottom of the feet, are all peculiarities of the human body; and concur to prove that man was designed by nature to walk erect, whilst the structure of the most perfectly formed monkey prevents the animal's sustaining the upright position for any length of time without an effort, or without clinging to some external support.

The mental character, the instincts, and the habits of the human kind, are, however, so very peculiar, and so very important in their consequences, that in all systems of natural arrangement, man ought to constitute a class distinct from all other animals. Man alone is endowed with the faculty of reasoning and a moral sentiment; for in those instances where animals have appeared to act from judgment, it was the result of imitation, instinct, or a previous education. Human language is almost always artificial, and formed by convention, and may be used as the signs of abstract ideas; whilst that of animals consists of instinctive cries or sounds, which commonly express only immediate wants or sensations. No animal is capable of constructing tools or machinery for the purpose of diminishing labour; whilst mankind perform almost all their actions with the aid of instruments or machines. The mechanical powers of the human race have a most extensive influence upon its natural history: it is by these that man is able to maintain his dominion over the rest of the creation, for no animal is naturally so defenceless. Born without weapons, and even any covering, he would be incapable of resisting the attacks of rapacious animals, or of sustaining the extreme effects of climate; it is also by mechanical means that we are enabled to profit by our own or others' experience, and to transmit the inventions and discoveries of one generation to another, which forms one of the most distinguishing characteristics of mankind, and to which they chiefly owe their superiority over the brute creation. The social habits and sexual instincts of the human species are very different from those of animals; almost all the works of man are produced by co-operation, and subordination amongst the agents; but animals commonly act independently, and without controul; for even where their instincts lead them to conduct their labours in concert, every individual performs its own task, without receiving any instructions or commands from others. To live in a state of organized society is, therefore, only natural, and peculiar to the human kind.

In animals the desires of the sexes occur at determined seasons, at which times they are ungovernable, and to their gratification commonly succeeds a sentiment of aversion; whilst the intercourse of the sexes in the human species is not the effect of a periodic instinct, and is always regulated by taste, or some other mental sentiment or consideration, not immediately concerned in the performance of the procreative act.

Many other circumstances might be enumerated, as distinguishing attributes of the human kind, but the above have been adduced as being more peculiarly classific characters, or more properly belonging to natural history; and are sufficient in themselves to shew the impropriety of arranging man with other animals.

In some other Linnæan orders of mammalia, several of the genera have no natural alliance to each other. Thus, in the order *bruta*, we meet with the elephant, the walrus, the sloth, and the anteaters, animals extremely different in their form, organization, and all their habitudes. The order *feræ* includes, with the real beasts of prey, the seal, whose mode of life is so peculiar, and the hedge-hog, mole, and shrew, which are really fugitive animals; and in the order *belluæ* we find the hippopotamus, hog, and tapir, whose uncouth figure, slow, heavy gait, and general economy, plainly declare their relation to the elephant and rhinoceros, with whom they should have been united, rather than with such a fleet and finely proportioned quadruped as the horse.

Although the orders which Linnæus instituted in birds are more natural than those of mammalia, they are not unexceptionable. The genus *lanius* perhaps more properly belongs to the *passerine* tribe, than to the birds of prey. The order *picæ* is unquestionably too extensive, and contains many genera, which, in their general form and modes of life, ought to be placed amongst the passeres. All the orders of birds seem to require a further division; and the peculiarities in the structure and mode of progression in the struthious birds would point out the propriety of forming them into a distinct order. The appellations also of all the orders may be thought to admit of improvement; but

 where

where names do not lead to errors, with refpect to fact, it is of little confeqence whether they be quite appropriate or not.

The orders of the claffes, amphibia and fifhes, as they appear in the later editions of the Syftema Naturæ, are lefs objectionable than any other part of the Linnæan claffification, and, confequently, have undergone lefs alterations by modern naturalifts.

It is in the arrangement of the inferior orders of animals that Linnæus appears to have been moft cenfurable. The order of *apterous infects* is compofed of genera differing fo much from each other in anatomical ftructure, that they have given rife to the formation of fome new claffes by late naturalifts. The orders *mollufca* and *teftacea*, of the clafs *vermes*, are by far the worft conceived parts of the Linnæan fyftem: under the denomination of *mollufca*, we find fome animals that have all the external characters, as well as anatomical ftructure, of *worms*, properly fo called; others, which have fo many peculiarities of form and of organization, that they almoft deferve to conftitute a diftinct clafs; and others again, which are fo fimple in their formation, that they might be confidered as the link between the animal and the vegetable kingdoms. The feparation of the teftaceous from the naked mollufca is a glaring impropriety, unlefs the objects of natural hiftory were merely to defcribe the coverings or habitations of animals, without regard to the real form, ftructure, and habits of the individuals they contain.

The number of the genera and fpecies of animals in every clafs is infinitely increafed fince the days of Linnæus, which is partly the confequence of modern difcoveries, and partly owing to a more accurate examination and comparifon of the fpecies which were already known.

At the fame time that we have thus ventured to cenfure, without referve, the errors of Linnæus, we cannot forbear acknowledging with admiration the talents, zeal, and induftry which he exerted in the fervice of natural hiftory; he has not been furpaffed by any, as a patient and laborious collector of facts, and few have fhewn more ability in the arrangement of their materials. Had he but paid as much attention to natural order, and the anatomy of animals, as he did to artificial characters, his fyftem would have remained a lafting monument of his indefatigable induftry, and comprehenfive genius; and it would have been only left to fucceeding naturalifts to fill up his orders with fuch genera and fpecies as later difcoveries might afford.

It is from accurate and enlarged views of the organization of animals that almoft all the modern improvements with refpect to the claffification of animals have arifen; we cannot wonder, therefore, that we receive them almoft entirely from the naturalifts of France and Germany, who ftudy comparative anatomy with a degree of zeal and attention unknown in this country.

Of thofe who have contributed to the introduction of a natural method in zoology, we may enumerate Daubenton, Vic d'azir, Blumenbach, Fabricius, Geoffroy, Cuvier, Brongniard, La Cepede, La Marck, Latreille, Dumeril, &c.

In compofing the following claffification of animals we have made a free ufe of the works of the above writers, not however, by fervilely copying them, but by adopting their arrangement wherever we confidered it juft and natural. In fome inftances, when we thought it neceffary, we have ventured to differ decidedly even from fuch celebrated authorities, and in other cafes we have added fuch new divifions of animals, as appeared to be required, more efpecially for the convenience of anatomical defcription. The claffification of mammalia is nearly the fame as that propofed by Geoffroy and Cuvier; we have, however, given different names to feveral of the families, and have feparated the genus Lamantin from the feal and whale tribes, as differing from both in form and in anatomical ftructure. The clafs of birds is formed upon the plan of that contained in Cuvier's Tableau Elementaire de l'Hiftoire naturelle, except that we have made a diftinct order of the running birds, and have tranfpofed fome of the other genera. In the arrangement of reptiles we have followed that of Brongniard and Daudin, with the inftitution of the additional family of amphibia, including the firens which we have judged it proper to feparate from the frog kind, until it be determined whether they are animals in a tadpole ftate of exiftence or not. In the clafs of fifhes we have adopted the fyftem of La Cepede, as lately modified by Dumeril, in which are introduced the genera of Bloch, La Cepede, Commerfon, &c. In the conftitution of the mollufca, the lateft improvements of Cuvier have been admitted, who was the author of the clafs, and to thefe we have added fome other fubdivifions, which appeared to be both natural and confonant. The arrangement of winged infects is the fame which Dumeril has formed from the Linnæan and Fabrician fyftems, but we have replaced the two genera cancer and monoculus of Linnæus amongft the apterous infects, although all the French naturalifts had agreed that they fhould conftitute a diftinct clafs to which they gave the name of cruftacea. The eftablifhment of the clafs cruftacea does not appear to reft upon good principles. It was inftituted upon the grounds of the animal compofing it having divided blood veffels, and the prefumption of there being no vafcular fyftem in the other families of infects. There would feem, however, to be a regular gradation from the heart and large arteries of cruftacea to the dorfal veffel of flying infects. In fome that hold an intermediate place, fuch, for example, as fpiders, ramifications of the dorfal veffel can be detected; and analogy would lead us to conclude that the dorfal veffel of flying infects performs at leaft fome of the functions of the heart and principal arteries of cruftacea, and that the large veins of the latter may be fo much extended as at laft to occupy the entire cavity of the body of the infect, and thus elude our obfervation. But granting the opinion of the French naturalifts to be correct, (which is not probable) that infects have no apparatus for preparing the nutritious fluid previous to its converfion into the organic ftructure of the animal, ftill there are fo many circumftances of refemblance between cruftaceous and other infects, that they cannot with propriety be placed in feparate claffes; they have both the external fkeleton, both poffefs a fimilar ftructure of the mufcles and the fame arrangement of the nerves, they are alike furnifhed with antennæ and compound eyes, which exift in no other clafs of animals. The lateral pofition of the jaws, and the want of glandular vifcera, which are fupplied by numerous tubes connected with the alimentary canal, are alfo peculiarities of ftructure only found in cruftaceous and other infects. After fully confidering all the characters of the cruftacea of Cuvier we have judged it beft to form thefe animals into two orders of apterous infects, one of which is the true cruftacea and correfpond to the genus cancer (Linn.) and the other is the genus monoculus (Linn.) or the teftaceous infects of Muller. We have alfo inftituted fome other natural families of apterous infects, one of which nearly anfwers to the *arachnides*, a clafs lately formed by fome of the French naturalifts upon ftill lefs pretence than that of cruftacea.

The divifion of worms into thofe refiding in the earth or water, and thofe inhabiting the interior of other animals, is fo very obvious that it has been made by moft naturalifts; but La Marck and Dumeril have gone farther, and have ranked inteſtinal worms amongſt zoophytes, which the ſimplicity of their organization might perhaps authoriſe; but on account of their uſual form and affinity which ſome of the ſpecies bear to the external worms, we have been induced to ſtill retain them in the claſs of vermes.

The claſs of zoophytes is formed upon the plan generally adopted by the French naturaliſts: we have, however, made ſome more ſubdiviſions, eſpecially of the zoactinia, or radiated animals.

It is not expected that the annexed claſſification will meet univerſal approbation from Engliſh readers; ſome entertain ſo high a reverence for every thing belonging to Linnæus, that they will not hear of the leaſt deviation from his ſyſtem; not remembering that the nature of truth and error is the ſame, whether it be ſanctioned by authority or not. Others may object to the introduction of ſo many ſubdiviſions of the claſſes, and the employment of new terms, from an apprehenſion that they will increaſe the difficulties (already too numerous) attending the ſtudy of natural hiſtory. To theſe it may be obſerved that the acquiſition of every ſpecies of knowledge is facilitated by judicious ſubdiviſions and appropriate terms, and that all the obſcurity and confuſion of natural hiſtory have ariſen from the want of a proper nomenclature. It has been long known that the ſpecies are eaſily diſcovered after we are acquainted with the characters of the genus to which they belong, and that the moſt difficult part, both of zoology and botany, is to attain a knowledge of the genera; the obvious reaſons for which are, that the paſſage from the genera to the ſpecies is ſhort and eaſy, while the former are too much eſtabliſhed upon independent characters, and are not the branches of the orders, or the ſubdiviſion next above them. The inſtitution of ſub-orders is eminently calculated to remove theſe difficulties; and if they be conſtructed ſo as to form natural families, they greatly facilitate and extend our acquaintance with the habits, manners, and economy of animals, which are the true objects of natural hiſtory.

To fully perceive the utility of ſub-diviſions and general terms in zoology, we ſhould ſuppoſe the ſubject in its two extremes; one when all the names are individual, or at moſt ſpecific; the other where there are regular and natural gradations from the claſs to the ſpecies; in the firſt caſe the ſtrongeſt memory would hardly embrace the number of individuals contained in one genus, while, in the other, the whole animal kingdom might be ſurveyed with eaſe; but it is needleſs to dwell upon the convenience and neceſſity of arrangement in a ſcience which eſſentially conſiſts in the generalization and compariſon of facts.

The improvements in the claſſification of the ſubjects of natural hiſtory, like the new chemical nomenclature, have been treated in this country with contempt and deriſion, and like it, alſo, they will be ſlowly, yet univerſally acknowledged. One reaſon alone, if there exiſted no other, would juſtify our adoption of the modern ſyſtem of claſſification, upon the preſent occaſion: it is becauſe it is the moſt conſonant with the anatomical ſtructure of animals, which we have to deſcribe, and in reference to which, alone, the following tables are conſtructed.

VIEW of the CLASSES of ANIMALS.

					Classes.
ANIMALS.	A brain containing cavities; an internal oſſeous ſkeleton	warm blood, and heart with two ventricles	viviparous, and ſuckle their young	I.	MAMMALIA.
			oviparous, and without mammæ	II.	AVES.
		cold blood, and heart with one ventricle	having lungs, and wanting fins .	III.	REPTILIA.
			with gills and fins	IV.	PISCES.
	Without a brain or internal ſkeleton	An articulated external ſkeleton		V.	INSECTA.
		No articulated members	Simple nerves	VI.	MOLLUSCA.
			Knotted nerves	VII.	VERMES.
			Without nerves	VIII.	ZOOPHYTA.

CLASS I. MAMMALIA.

		Orders.
The Feet	divided into digiti or toes, which are furniſhed with claws or nails	1. Digitata.
	having the parts correſponding to the toes enveloped in horny caſes or hoofs	2. Ungulata.
	degenerated into the form of fins, and employed for ſwimming	3. Pinnata.

CLASSIFICATION.

DIGITATA.—First Order of MAMMALIA.

Teeth	Members	Thumb or pollex	Families	Genera		Sub-genera	
of three sorts; members	distinct; the thumb or pollex	separate on both hands and feet	QUADRUMANA	Simia	Ape	Pithecus	Orang.
						Callitrix	Sapajou.
						Cercopithecus	Guenon.
						Cynocephalus	Macaque.
						Papio	Baboon.
						Cebus	Alouate.
				Lemur	Maki	Lemur	Maki or Maucauco
						Indri	Indri.
						Lori	Lori.
						Galago	Galago.
						Tarsius	Tarsier.
		separate on the feet only	PEDIMANA	Uomlatus	Womlat.		
				Didelphis	Opossum	Didelphis	Sarigue.
						Dasyurus	Dasyure.
						Phalangista	Phalanger.
						Coescoes.	
				Perameles	Peramele.		
		not separate; walk on the toes	DIGITIGRADA	Mustela.	Weazel	Mustela	Weazle and Martin
						Lutra	Otter.
						Mephitis	Mouffete.
				Viverra	Civet.		
				Felis.	Cat.		
				Canis	Dog	Canis	Dog.
						Hyæna	Hyæna.
		not separate; walk on the sole of the feet	PLANTIGRADA	Erinaceus	Hedge Hog	Erinaceus	Hedge Hog.
						Setiger	Tenrec.
				Sorex	Shrew	Sorex	Shrewmouse.
						Mygale	Desman or Musk Shrew.
						Chrysochloris	Chrysochlore.
						Scalops	Scalope.
				Talpa	Mole.		
				Ursus	Bear.	Ursus	Bear.
						Taxus	Badger.
						Nasua	Coati.
						Procyon	Racoon.
						Potos	Kinkajou.
						Ichneumon	Mangouste.
	united by a membrane in form of a wing		CHEIROPTERA	Vespertilio	Bat	Pteropus	Rousset.
						Vespertilio	Common Bat.
						Rinolophus	Rinolphus.
						Phyllostoma	Phyllostome.
						Noctilio	Noctilio.
				Galeopithecus	Flying Lemur.		
				Phascolomys	Phascolome.		
less than three sorts; want	the canine only; a leaping gait		SALTIGRADA	Kangurus	Kanguroo.		
				Hystrix.	Porcupine	Hystrix	Porcupine.
						Coendus	Coendu
				Lepus	Hare	Lepus	Hare.
						Lagomys	Pica.
				Cavia	Cavy	Hydrochærus.	
						Cavia	Agouti.
				Castor	Beaver.		
				Hydromys.			
				Sciurus	Squirrel	Pteromys	Polatouche, or Flying Squirrel.
						Sciurus	Squirrel.
				Cheiromys	Aye-Aye, or Madagascar Squirrel.		
				Mus	Rat	Arctomys	Marmot.
						Lemmus	Campagnol.
						Fiber	Ondatra.
						Mus	Rat.
						Cricetus	Hamster.
						Spalax	Mole Rat.
						Dipus	Jerboa.
						Myoxus	Dormouse.
	the incisors and canine		EDENTATA	Ornitherincus	Duckbill.		
				Myrmecophaga	Ant-eater	Myrmecophag	Ant-eater.
						Echidna	Porcupine Ant-eater
						Manis	Pangolin or Scaly Lizard.
				Orycteropus	Cape Ant-eater.		
				Dasypus	Armadillo.		
	the incisors only; slow motion		TARDIGRADA	Bradypus	Sloth	Megatherium	Megather.

UNGU-

CLASSIFICATION.

UNGULATA.—Second Order of MAMMALIA.

		FAMILIES.	GENERA.		SUB-GENERA.	
Hoofs	three at least	MULTUNGULATA	Elephas	*Elephant.*		
			Tapir	*Tapir.*		
			Sus	*Hog.*		
			Hippopotamus	*River Horse.*		
			Hyrax	*Daman*		
			Rhinoceros	*Rhinoceros*		
	two; the foot appearing as if cleft in two parts	BISULCA	Camelus	*Camel.*	Camelus	*Camel.*
					Lama	*Peruvian Camel.*
			Moschus	*Chevrotin, or Musk.*		
			Cervus	*Deer.*		
			Camelo-Pardalis	*Giraffe.*		
			Antilope.			
			Capra	*Goat.*		
			Ovis	*Sheep.*		
			Bos	*Ox.*		
	one only; the foot appearing solid	SOLIPEDA	Equus	*Horse.*		

PINNATA.—Third Order of MAMMALIA.

		FAMILIES.	GENERA.	
Posterior feet	with the toes united and turned backwards for swimming	NECTOPODA	Phoca	*Seal.*
			Trichechus	*Morse.*
	concealed in the tail	CRYPTOPODA	Manatus	*Lamantin.*
	completely obliterated, giving the animal the appearance of a fish	CETACEA	Balæna	*Whale.*
			Balenoptera	*Finned Whale.*
			Narwhalus	*Narwal.*
			Anarnacus	*Anarnak.*
			Catodon	*Cachelot.*
			Physalus	*Physalus.*
			Physeterus	*Physeter*
			Delphinus	*Dolphin.*
			Delphinapterus.	
			Hyperoodon	*Grampus.*

CLASS II. AVES.

Number of posterior toes (ORDERS.)

- two, and two anterior toes; tarsus short, and the limbs altogether constructed for climbing. — 4. SCANSORIÆ.
- one, or none; the anterior
  - entirely free; bill and claws strong and sharp; legs very muscular, and fitted for grasping. — 7. ACCIPITRINÆ.
  - united
    - entirely by broad membranes; legs short, and placed backwards, and adapted for swimming. — 6. ANSERINÆ.
    - partially,
      - all at their base; tarsus
        - moderately long and strong. — 2. GALLINACEÆ.
        - long; leg very strong, and fitted for running — 1. CURSORIÆ.
      - the two external; tarsus
        - very long, and calculated for wading — 5. GRALLATORIÆ.
        - moderately long, and slender — 3. PASSERINÆ.

CURSORIÆ.—First Order of BIRDS.

		FAMILIES.	GENERA.	
Number of anterior toes	two	DIDACTYLÆ	Struthio	*Ostrich.*
	three	TRIDACTYLÆ	Rhea	*Tougou.*
			Cassuarius	*Cassouary.*

GAL-

GALLINACEÆ.—Second Order of Birds.

The wings	Bill	Families.	Genera.		Sub-genera.	
fitted for flight; bill	ſtraight, ſoft, and deſcending towards the extremity	COLUMBINÆ	Columba	*Pigeon.*		
	hard, horny, and ſharp, with the ſuperior mandibule arched	ALECTRIDES	Tetrao	*Grous*	Tetrao	*Grous.*
					Perdrix	*Partridge.*
					Coturnix	*Quail.*
			Pavo	*Peacock.*		
			Phaſianus	*Pheaſant*	Phaſianus	*Pheaſant*
					Gallus	*Cock.*
			Numida	*Pintado.*		
			Meleagris	*Turkey.*		
			Crax	*Curaſſo*		
			Penelope	*Guans.*		
			Otus	*Buſtard.*		
very ſhort; unfit for flying, body very heavy		BRACHYPTERÆ	Didus	*Dodo.*		

PASSERINÆ.—Third Order of Birds.

Bill			Families.	Genera.		Sub-Genera.	
notched; with	one or two indentations at moſt		CRENIROSTRES	Lanius	*Shrike.*	Tyrannus	*Tyrant Flycatcher.*
				Muſcicapa	*Flycatcher.*	Muſcivora	*Moucherolle.*
						Muſcicapa	*Common Flycatcher.*
				Turdus	*Thruſh.*		
				Ampelis	*Cotinga or Chatterer.*		
				Tanagra	*Tanager.*		
	three indentations at leaſt		DENTIROSTRES	Phytotoma	*Plant-clipper.*		
				Momotus	*Motmot.*		
				Buceros	*Hornbill.*		
not notched	ſtrong and ſolid	ſtraight, elongated, compreſſed	PLENIROSTRES	Gracula	*Grakle.*		
				Corvus	*Crow.*		
				Coracias	*Roller.*		
				Paradiſea	*Bird of Paradiſe.*		
		ſlightly curved, ſhort, conic	CONIROSTRES	Oriolus	*Caſcique or Oriole.*	Cacicus	*Cacique.*
						Icterus	*Troop-Oriole.*
						Xanthornus	*Carouge or Banana Bird.*
				Sturnus	*Stare.*		
				Loxia	*Groſsbeak.*	Loxia	*Groſsbeak.*
						Cruci-roſtra	*Croſsbill.*
						Chloris	*Greenfinch.*
						Pyrrhula	*Bullfinch.*
						Colius	*Coly.*
				Fringilla	*Sparrow.*	Fringilla	*Sparrow.*
						Cælebs	*Chaffinch.*
						Carduelis	*Goldfinch.*
						Vidua	*Widow Bird.*
				Emberiza	*Bunting.*		
	feeble, flexible; ſhort	ſlender, round	SUBULIROSTRES	Parus	*Titmouſe.*		
				Pipra	*Manakin.*		
				Alauda	*Lark.*		
				Motacilla	*Wagtail.*	Silvia	*Warbler.*
						Erithacus	*Redbreaſt.*
						Ficedula	*Fig-eater.*
						Regulus	*Wren.*
						Motacilla	*Wagtail.*
		broad, flat	PLANIROSTRES	Hirundo	*Swallow.*	Hirundo	*Swallow.*
						Apus	*Martin.*
				Caprimulgus	*Goatſucker.*		
	feeble, flexible; very long and ſlender		TENUIROSTRES	Sitta	*Nuthatch.*		
				Certhia	*Creeper.*		
				Trochylus	*Humming Bird.*	Trochylus	*Humming Bird.*
						Orthorincus	*Straight-billed Humming Bird.*
				Upupa	*Hoopoe.*		
				Merops	*Bee-eater.*		
				Alcedo	*King Fiſher.*		
				Todus	*Tody.*		

SCANSORIÆ.

CLASSIFICATION.

SCANSORIÆ.—Fourth Order of Birds.

Bill	Families.	Genera.		Sub-genera.	
narrow at the baſe, not denticulated	Cuneirostres	Galbula	*Jacamar.*		
		Picus	*Woodpecker.*		
		Yunx	*Wryneck.*		
		Cuculus	*Cuckoo.*		
large at the baſe, or denticulated	Levirostres	Crotophaga	*Ani.*		
		Turacus	*Touraco.*		
		Muſophaga			
		Trogon	*Curucui.*		
		Bucco	*Barbet.*		
		Ramphaſtos	*Toucan.*		
		Pſittacus	*Parrot*	Kakatoe	*Cockatoo.*
				Pſittacus	*Parrot.*
				Ara	*Maccaw.*
				Pſittacula	*Parraket.*

GRALLATORIÆ.—Fifth Order of Birds.

Bill		Families.	Genera.		Sub-genera.	
long	ſtrong, and like a knife	Cultrirostres	Ardea	*Heron*	Hians	*Open-bill.*
					Ardea	*Heron.*
					Ciconia	*Stork.*
					Grus	*Crane.*
					Scopus	*Umbre.*
			Mycteria	*Jabiru.*		
			Tantalus	*Ibis.*		
long	weak, and flattened horizontally	Latirostres	Platalea	*Spoonbill.*		
long	ſlender, and weak	Longirostres	Recurviroſtra	*Avoſet.*		
			Charadrius	*Plover.*		
			Tringa	*Lapwing*	Tringa	*Lapwing.*
					Totanus	*Gambet.*
					Calidris	*Sandpiper.*
			Phalaropus	*Phalarope.*		
			Scolopax	*Woodcock*	Scolopax	*Woodcock.*
					Numenius	*Curlew.*
middle-ſized and compreſſed		Pressirostres	Haematopus	*Oyſter-catcher.*		
			Rallus	*Rail.*		
			Fulica	*Coot*	Fulica	*Coot.*
					Gallinula	*Water-hen.*
			Parra	*Jacana.*		
ſhort and thick		Brevirostres	Pſophia	*Trumpeter.*		
			Palamedea	*Screamer.*		
			Cancroma	*Boat-bill.*		
			Phenicopterus	*Flamingo.*		

ANSERINÆ.—Sixth Order of Birds.

Number of the anterior toes			Families:	Genera.		Sub-genera:	
four, or the poſterior toe concealed in the ſame membrane with the others			Pinnipedes	Pelecanus	*Pelican.*	Pelecanus	*Pelican.*
						Phalacrocorax	*Cormorant.*
						Fregata	*Frigate.*
						Sula	*Booby.*
				Phæton	*Tropic-bird.*		
				Plotus	*Darter.*		
three; bill	ſerrated		Serrirostres	Anas	*Duck.*		
				Mergus	*Merganſer.*		
three; bill	not denticulated; wings	very long	Longipennes	Sterna	*Tern.*		
				Larus	*Gull.*		
				Rhynchops	*Skimmer.*		
				Procellaria	*Petrel.*		
				Diomedea	*Albatroſs.*		
three; bill	not denticulated; wings	very ſhort	Brevipennes	Colymbus	*Grebe*	Colymbus	*Grebe.*
						Urinator	*Diver.*
				Alca	*Auk*	Uria	*Guillemot.*
						Alca	*Puffin.*
						Pinguin	*Penguin.*
				Aptenodyta	*Manchot.*		

ACCIPITRINÆ.—Seventh Order of Birds.

		Families.	Genera.		Sub-genera.	
The eyes lateral; head or part of the neck	without feathers	Nudicolles	Vultur	*Vulture*	Vultur	*Vulture.*
					Sarcoramphus	*Sarcoramphus.*
	with feathers	Plumicolles	Falco	*Falcon*	Gypaetos	*Griffon.*
					Aquila	*Eagle.*
					Niſus	*Sparrow-hawk.*
					Buteo	*Buzzard.*
					Milvus	*Kite.*
					Falco	*Falcon.*
					Secretarius	*Secretary.*
The eyes in the front of the head; head large, fly without noiſe; ſeek their food by night		Nycterobiæ	Strix	*Owl*	Otus	*Hibou* or *Horned Owl*
					Strix	*Common Owl.*
					Surnia	*Surnia.*

CLASS III. REPTILIA.

			Orders.
Heart	with two auricles; jaws	of horn: without teeth; a back ſhell	1. Chelonia.
		with teeth; no back ſhell	2. Sauria.
	with one auricle; body	without feet; often covered with ſcales	3. Ophidia.
		naked with two or four feet	4. Batrachia.

CHELONIA.—Firſt Order of Reptiles.

		Families.	Genera.	
The Feet	palmated	Marina	Chelonia	*Turtle.*
		Hurcatilia	Emys	
			Chelus	*Matamata.*
	with claws	Terrestria	Teſtudo	*Tortoiſe.*

SAURIA.—Second Order of Reptiles.

		Families.	Genera.	
Tail moſt commonly very long,	flattened ſuperiorly, or upon the ſide	Planicaudata	Crocodilus	*Crocodile.*
			Dracæna.	
			Tupenamlus.	
			Uroplatus.	
			Lophyrus.	
			Baſiliſcus	*Baſiliſk.*
	conic, round	Tereticaudata	Iguana	*Iguana.*
			Draco	*Dragon.*
			Agama.	
			Chamæleon	*Chameleon.*
			Gecko.	
			Stellio.	
			Analis.	
			Lacerta	*Lizard.*
			Scincus.	
			Ahalcides.	
			Seps.	

OPHIDIA.—Third Order of Reptiles.

		Families.	Genera.	
Skin	naked, or equally covered with ſcales under the belly and the tail	Homodermata .	Cæcilia.	
			Amphiſbæna.	
			Acrochordus.	
			Ophiſaurus.	
			Anguis . .	*Snake.*
	with ſcales above; plates under the belly and under the tail	Heterodermata	Hydrophis .	*Water-ſerpent.*
			Platurus.	
			Crotalus.	
			Scytale.	
			Vipera . .	*Viper*
			Coluber.	
			Boa.	
			Erpeton.	
			Erix.	

BATRACHIA.—Fourth Order of Reptiles.

			Families.	Genera.	
Body	ſhort and thick, without tail; anterior feet ſhort; both lungs and gills in the young ſtate		Anoura . .	Pipa.	
				Bufo . . .	*Toad.*
				Rana . . .	*Frog.*
				Hyla . . .	*Tree Frog.*
	elongated; with a tail; feet equal in length; both lungs and gills	in the young ſtate	Deloura .	Triton.	
				Salamandra.	
		during life	Amphibia .	Proteus.	
				Siren.	

CLASS IV. PISCES.

	Sub-classes.				Orders.
Body	with cartilaginous ſkeleton	CARTILAGINEI. Gills	with gill covers, and	with membrane; the gills being complete.	4. Teleobranchiati.
				without membrane; gill covers being free	3. Eleutheropomati.
			without gill covers, and	with membrane; reſpiring through a fiſſure	2. Chismopnes.
				without membrane; reſpiring through holes	1. Trematopnes.
	with oſſeous ſkeleton	OSSEI. Gills	with gill covers, and	with membrane; the gills being entire, or containing all their parts	5. Holobranchiati.
				without membrane; plicated breaſt	6. Sternoptyges.
			without gill covers, and	with membrane; gills concealed	7. Cryptobranchiati.
				without membrane; form of the animal between that of a ſerpent and a fiſh	8. Ophichthoides.

TREMA.

CLASSIFICATION.

TREMATOPNES.—First Order of Fishes.

Ventral fins	Families.	Genera.	
none; mouth round and at the end of the snout	Cyclostomati	Petromyzon	*Lamprey.*
		Gastrobranchus	*Myxine.*
very distinct; mouth wide and transverse	Plagiostomati	Torpedo	*Torpedo.*
		Raia	*Ray.*
		Rhinobatus.	
		Squatinus	*Angel.*
		Squalus	*Shark.*
		Aodon.	

CHISMOPNES.—Second Order of Fishes.

The posterior pair of fins under	Genera.	
the gullet	Batrachus	*Frog-fish.*
	Lophius	*Angler.*
the pectoral fins	Balistes	*File-fish.*
on the belly, behind the pectoral	Chimæra	*Sea monster.*

ELEUTHEROPOMATI.—Third Order of Fishes.

Body		Genera.	
protected by a mailed covering; mouth	without cirrhi	Pegasus	*Pegasus.*
	with cirrhi	Acipenser	*Sturgeon.*
naked and unprotected; snout as long as the body		Spatularia	*Spatula-fish.*

TELEOBRANCHIATI.—Fourth Order of Fishes.

Posterior pair of fins		Families.	Genera.	
distinct	under the pectoral; mouth elongated like a sucker	Aphyostomati	Macrorhyncus	*Macrorhyncus.*
			Centriscus	*Bellows-fish.*
	behind the pectoral-ventral fins veined	Plecopteri	Cyclopterus	*Sucker.*
			Lepidogasterus	*Lepidogasterus.*
wanting; skin covered with a coat of armour or with osseous grains		Osteodermati	Ostracion	*Trunk-fish*
			Tetraodon	*Tetraodon.*
			Diodon	*Porcupine-fish.*
			Spheroides	*Spheroides.*
			Orcides	*Orcides.*
			Cephalus	*Sun-fish.*
			Sygnathus	*Pipe-fish.*

HOLOBRANCHIATI.—Fifth Order of Fishes.

The inferior or ventral pair of fins		Sub-orders.
wanting		1. Apodes.
distinct, under	the gullet	2. Jugulares.
	the pectoral fins	3. Thoracici.
	the belly	4. Abdominales.

CLASSIFICATION.

APODES.—First Sub-order of Osseous Fishes with perfect branchiæ.

		Families.	Genera.	
The other fins beſides the ventral	all exiſt	Peropteri	Cæcilia	*Blind Eel.*
			Monopterus.	
			Leptocephalus	*Morris.*
			Aſtroblepus	*Aſtrobleps.*
			Gymnotus	*Gymnote.*
			Trichiurus	*Trichiure.*
			Trichomycterus.	
			Notopterus.	
			Ophiſurus.	
			Apteronotus.	
	altogether, or partly wanting	Pantopteri	Muræna	*Eel.*
			Ammodytes	*Land Eel.*
			Ophidium.	
			Xiphias	*Sword Fiſh.*
			Anarhichas	*Wolf Fiſh.*
			Comephorus.	
			Stromatæus.	
			Rhombus.	
			Triurus	*Triple Tail.*
			Odontognathus.	
			Macrognathus.	

JUGULARES.—Second Sub-order of Osseous Fishes with perfect branchiæ.

			Genera.	
Body	elongated; apertures of the gills	upon the neck; head thicker than the body	Callionymus	[illegible]
		lateral	Calliomorus.	
			Murenoides.	
			Uranoſcopus	*Stargazer.*
			Trachinus	*Dragenet.*
			Gadus	*Cod.*
			Batrachoides.	
			Blennius	*Blenny.*
			Oligopodus.	
	oval, compreſſed		Kurtus	*Hunchback.*
			Chr[illegible]mus.	

THORACICI.—Third Sub-order of Osseous Fishes with perfect branchiæ.

			Families.	Genera.	
Body very thin	more high than long; eyes	on each ſide	Leptosomati	Chætodon	*Chætodon.*
				Acanthinion	*Acanthinion.*
				Chetodipterus	*Chetodipterus.*
				Pomacentrus	*Pomacentrus.*
				Pomadaſys	*Pomadaſys*
				Pomacanthus	*Pomacanthus.*
				Holacanthus	*Holacanthus.*
				Enopleſus	*Enopleſus.*
				Glyphiſodon	*Glyphiſodon.*
				Acanthurus	*Acanthurus.*
				Aſpiſurus	*Aſpiſurus.*
				Acanthapodus	*Acanthapodus*
				Selene	*Selene.*
				Argyreioſus	*Argyreioſus.*
				Gallus	*Gallus.*
				Zeus	*Dory.*
				Chryſoſtoſus	*Chryſoſtoſus.*
				Capres	*Capres.*
		on one ſide	Heterosomati	Pleuronectes	*Flounder.*
				Acheirus.	
	long, and in the form of a plate or band		Petalosomati	Lepidopus.	
				Cepola	*Band Fiſh.*
				Tænioides.	
				Boſtrichus.	
				Boſtrichoides.	
				Gymnetrus.	

THORACICI.

THORACICI.—Third Sub-order of OSSEOUS FISHES with perfect branchiæ *(continued)*.

- Body thick
  - compreſſed; remarkable from having the
    - head
      - ſimple
        - lips fleſhy; gill covers
          - ſpinous or denticulated — ACANTHOPOMATI
            - Trachichthys.
            - Lutjanus . . *Lutjan.*
            - Centropomus . *Centropomi.*
            - Bodianus . . . *Bodian.*
            - Sciæna.
            - Micropterus.
            - Holocentrus.
            - Perca . . . *Perch.*
          - without ſpines or denticulation — LEIOPOMATI . .
            - Hiatula.
            - Coris.
            - Gompheſus.
            - Oſphrenemus.
            - Trichopodus.
            - Monodactylus.
            - Plectorhinchus.
            - Pegonias.
            - Labrus.
            - Cheilinus.
            - Cheilodipterus.
            - Ophicephalus.
            - Helegymnoſus.
            - Sparus . . . *Spare.*
            - Dipterodon.
            - Cheilio.
            - Mullus . . . *Surmullet.*
        - jaws, projecting and oſſeous . . . . . OSTEOSTOMATI
          - Scarus . . . *Scare.*
          - Leiognathus.
          - Oſtorhinchus.
      - in general very large . . . . CEPHALOTI . .
        - Gobieſox.
        - Aſpidophorus.
        - Aſpidophoroides.
        - Cottus . . . *Bull-head.*
        - Scorpæna.
    - dorſal fin very long . . . . LOPHIONOTI . .
      - Coryphæna . . *Dorado.*
      - Hemipteronotus.
      - Coryphænoides.
      - Tænianotus.
      - Centrolophus.
      - Æques.
    - pectoral fins with ſome ſeparate rays or digittal proceſſes . DACTYLOTI . .
      - Dactylopterus.
      - Prionotus.
      - Trigla . . . *Gurnard.*
      - Peristedion.
  - round
    - fuſiform or thickeſt in the middle . . . . ATRACTOSOMATI
      - Scomber . . *Mackarel.*
      - Scomberoides.
      - Caranx.
      - Trachinotus.
      - Caranxomorus.
      - Cæſio.
      - Cæſiomorus.
      - Scomberomorus.
      - Gaſteroſteus . . *Stickle back.*
      - Centropodus.
      - Centronotus.
      - Lepiſacanthus.
      - Cephalacanthus.
      - Iſteophorus.
      - Nomatomus.
    - cylindric; pectoral fins . . . . .
      - united . . . PLECOPODI . .
        - Gobius . . . *Goby.*
        - Gobioides.
      - diſtinct or free . ELEUTHEROPODI
        - Gobiomorus.
        - Gobiomoroides.
        - Echeneis . . *Remora.*

ABDOMINALES.

CLASSIFICATION.

ABDOMINALES.—Fourth Sub-order of OSSEOUS FISHES with perfect branchiæ.

					Families.	Genera.
[illegible]	cylindric; mouth		at the extremity of a long snout		SIPHONOSTOMATI	Fistularia. Aulostomus. Solenostomus.
			not prolonged; lips not extended		CYLINDROSOMATI	Anableps. Cobitis . . . *Loche.* Misgurnus. Fondulus. Colubrina. Amia. Butyrinus. Tripteronotus. Ompok.
	conic, or compressed; the rays of the pectoral fin	free, distinct	the first only, or the first ray of the dorsal fin, stiff, sharp, and often denticulated, and used as a weapon		OPLOPHORI	Silurus . . . *Silure.* Macropteronatus. Malapterurus. Pimelodus. Doras. Pogonathus. Cataphractus. Plotosus. Ageneiosus. [illegible] Centranodon. Loricaria. Hypostomus. Corydoras. Tachysurus.
			many, flexible; the pectoral fins appearing to be of two parts		DIMEREDES	Chalodactylus. Cirrhitus. Polynemus . . *Polyneme.* Polydactylus.
		united; the opercule	covered with scales; mouth without teeth		LEPIDOPOMATI	Mugil . . *Mullet.* Mugiloides. Chanos. Mugilomorus. Exocetus . . *Flying Fish.*
			smooth; the jaws	not remarkable — dorsal fins with osseous rays	GYMNOPOMATI	Argentina. Hydrargyra. Atherina. Stolephorus. Buro. Clupea . . . *Herring.* Mystus. Clupanodon. Gastero, elecus. Mene . . . Dorsuarius. Xyster. Cyprinus . . *Carp.*
				not remarkable — one of the dorsal fins without osseous rays	DERMOPTERI	Salmo . . . *Salmon.* Osmerus. Corregonus. Characinus. Serrasalmus.
				much prolonged	SIAGONOTI	Elops . . . *Sein Fish.* Megalops. Esox . . . *Pike.* Synodon. Sphyræna. Lepisosteus. Polypterus. Scombresox.

STERNOPTYGES.—Sixth Order of FISHES.

	Genus.	
Contains only	Sternoptyx	*Sternoptyx.*

CRYPTOBRANCHIATI.—Seventh Order of FISHES.

		Genera.	
Ventral fins	distinct; upon the abdomen	Mormyrus	*Mormyrus.*
	wanting	Stylophorus	*Stylophorus.*

OPHICHTHOIDES.—Eighth Order of Fishes.

Genera.

- Aperture of the gills
  - lateral; the single fins
    - very plain . . . Murenophis.
    - not very apparent Gymnomuræna.
    - entirely wanting Murenollenna.
  - under the gullet, being a
    - double orifice . Sphagebranchus.
    - single orifice . . Synbranchus.

CLASS V. INSECTA.

Orders.

- Wings
  - none;
    - breathe by laminæ or gills; covered
      - with a calcareous crust; the shape of the body . . . 1. Crustacea.
      - usually with a horny substance, which has the form of shells . . . . 2. Testacea.
    - breathe by spiracles and air tubes, or cells; abdomen . . . .
      - indistinct; numerous feet . . 4. Polypoda.
      - distinct, and larger than the thorax
        - six feet 5. Hexapoda.
        - eight feet 3. Octopoda.
  - four; mouth
    - with jaws; having wings
      - of two kinds; the inferior folded
        - transversely . . . 12. Coleoptera.
        - longitudinally . . . 11. Orthoptera.
      - of one kind; the nervules
        - reticulated . . . . . 10. Neuroptera.
        - veinous . . . . . . 8. Hymenoptera.
    - without jaws; forming
      - a rostrum, not ceiled . . . . 7. Hemiptera.
      - a tongue, ceiled . . . . 9. Lepidoptera.
  - two; never have jaws . . . . 6. Diptera.

CRUSTACEA.—First Order of Insects.

Families. Genera.

- Head
  - united to the corcelet; the tail
    - short; corcelet more
      - broad than long Carcinoidea . . Calappa. Hepatus. Dromia. Cancer. Matuta. Portunus. Podopthalmus. Oecypodi. Porcellana. Grapsus. Pinnotheres.
      - long than broad Oxyrinchia . . Ranina. Orithyia. Dorippe. Leucosia. Maja.
    - long in proportion to the body . . . Macroura . . Pagurus . . *Hermit.* Albunæa. Hippa. Scyllarus. Palinurus. Galathæa. Astacus . . *Craw-fish.* Penneus. Palemon. Crangon . . *Shrimp.*
  - distinct and connected to the corcelet by articulation . . Arthrocephala Mysis. Squilla. Piecanima. Thalitrus. Gammarus.

TESTACEA.

TESTACEA.—Second Order of INSECTS.

			Families.	Genera.
The body covered by	a shell	in form of a buckler	ASPIDIOTA	Limulus. Calygus. Binoculus. Ozelus. Apus.
		composed of two valves	OSTRACODA	Lyncæus Daphnia. Cypris. Cythere.
	an integument the shape of the animal		GYMNOTA	Argulus. Cyclops. Polyphemus. Zoe. Branchiopes.

OCTOPODA.—Third Order of INSECTS.

		Families.	Genera.	
Head	not distinguishable; without antennæ, having jaws	ARANEIFORMIA	Aranea	*Spider.*
			Mygale	*Mygale.*
			Scorpio	*Scorpion.*
			Phrynus	*Phrynus.*
			Chelifer	*Chelifer.*
			Galiodes	*Galeodes.*
			Phalangium	*Shepherd.*
			Hydracna	*Water spider.*
	distinct and small; pediform palpi; no jaws; the mouth a sucker	SUCTARIA	Acarus	*Mite.*

POLYPODA.—Fourth Order of INSECTS.

		Families.	Genera.	
Feet	too numerous to be easily counted; body much elongated	LONGIFORMIA	Scutigera.	
			Scolopendra	*Centipede.*
			Polyxenus.	
			Julus.	*Julus*
			Polydesmus.	
			Glomeris.	
	fourteen; usually several pair of jaws, and four antennæ; body of an oval figure	OVIFORMIA	Physodes.	
			Oniscus.	
			Armadillo.	
			Cymothoa.	

CLASSIFICATION.

HEXAOPODA.—Fifth Order of Insects.

			Families.	Genera.	
Animal in the young ſtate	not changed in form	adhere to other animals	Parasitica . .	Pediculus	*Louſe.*
				Ricinus . .	*Bird Louſe.*
		tail furniſhed with ſetæ or briſtles	Seticaudata .	Podura . .	*Spring tail.*
				Lepiſma .	*Lepiſma.*
				Forbicina.	
	metamorphoſed; extraordinary powers of leaping		Transformia . .	Pulex . .	*Flea.*

DIPTERA.—Sixth Order of Insects.

				Families.	Genera.	
A ſucker	hard, projecting from the head, long, and often bent			Sclerostomata	Empis.	
					Bombilius.	
					Myopa.	
					Conops.	
					Stomoxis.	
					Aſilus . . .	*Hornet Fly.*
					Culex . . .	*Gnat.*
					Hippoboſca .	*Horſe Fly.*
					Chingia.	
					Chryſopſis.	
					Tabanus . .	*Great Horſe Fly.*
	concealed or wanting mouth	diſtinct	fleſhy, retractile, and terminated by two lips	Sarcostomata	Stratyomis . .	*Armed Fly.*
					Ceria.	
					Nemotelus.	
					Anthrax.	
					Bibio.	
					Rhagio.	
					Sicus.	
					Hypoleon.	
					Cyrtus.	
					Syrphus.	
					Dolichopus.	
					Ceyx.	
					Tetanocerus.	
					Cerechetus.	
					Coſmius.	
					Thereva.	
					Echinomya.	
					Sargus.	
					Mulio.	
					Muſca.	
					Cenogaſter.	
					Diopſis?	
			projecting in a flat proboſcis with palpi	Hydromia . .	Tipula . . .	*Crane Fly.*
					Ceratoplatus.	
					Scatopſus.	
					Pſychodes.	
					Hirtæa.	
		replaced by three points . .		Astomata . . .	Oeſtrus . . .	*Gad Fly.*

HEMIPTERA.—Seventh Order of Insects.

Elytra, or superior wings,		Families.	Genera.	
semi-coriaceous, cressed, and	broad; rostrum arising from the anterior part of the head	Frontirostria	Pentatoma.	
			Scutellera.	
			Podicerus.	
			Acanthia	*House Bug, and some others.*
			Cimex . .	*Bug.*
			Coreus.	
			Lygæus.	
			Gerris.	
			Hydrometra.	
			Reduvius.	
			Miris.	
			Ploiera.	
	very narrow; tarsi ending in vesicles	Physapoda . . .	Thrips.	
similar to the inferior wings, and not cressed	rostrum appearing to rise from the neck	Collirostria	Fulgora . .	*Fire Fly.*
			Tettigonia	*Small Grass-hopper.*
			Membracis.	
			Flata.	
			Cicadella.	
			Premecopsis.	
			Cercopes.	
			Delphax.	
	wings plain and extended	Planipennia .	Aphis . .	*Plant Louse.*
			Aleirodes.	
			Chermes .	*Gall Insect.*
			Coccus . .	*Cochineal Insect.*
			Psylla.	
hard and coriaceous; antennæ short; and posterior feet fitted for swimming		Remitarsea .	Ranatra . .	*Frog-hopper.*
			Nepa . .	*Water-Scorpion.*
			Naucoris.	
			Sigara.	
			Notonecta .	*Boat Fly.*

HYMENOPTERA.—Eighth Order of Insects.

Families: Genera.

- Abdomen
  - ſeſſile; a terebra projecting from the anus of the females . . . . SERRICAUDATA . . Urocerus *Tailed Waſp*. Tenthredo *Saw Fly*. Oryſſus. Sirex. Cymbex.
  - pedunculated; the inferior lip
    - longer than the mandibules; abdomen on a ſhort footſtalk . . . APIFORMIA . . Apis . . *Bee*. Eucera. Nomada. Andrœna. Hylæus. Bembex.
    - ſhort; abdomen
      - concave inferiorly; body metallic colour . . . . . . CHRYSIDA . . Chryſis . . *Golden Fly, or Gilded Waſp*. Panorpes.
      - not concave; ſuperior wings
        - folded, antennæ diffracted . . . . PENNIPLICATA . Veſpa . . *Waſp*. Maſaris.
        - not folded; antennæ
          - diffracted or filiform; abdomen round . . MYRMECEA . . Dorylus. Formica . . *Ant*. Mutilla.
          - neither diffracted nor filiform; number of joints
            - thirteen at moſt; abdomen
              - round, conic; live upon flowers . . ANTHOPHILA . . Philanthus. Scolia. Crabro. Mellinus.
              - compreſſed, enlarged, larvæ concealed in vegetable excreſcences . NEOTTOCRYPTA . Leucopſis. Chalcis. Diplolepis. Diapria. Cynips . . *Gall Fly*. Eulophus.
            - more than thirteen,
              - 17 to 30; deſtroy other inſects . ENTOMOTILLA . . Evania. Ichneumon *Ichneumon*. Fœnus. Ophion. Banchus.
              - 14 to 17; burrow in the earth . ORYCTERA . . Larra. Sphex . . *Savage, or Solitary Waſp*. Tiphia. Pompilus.

LEPIDOPTERA.—Ninth Order of Insects.

Families. Genera.

- Antennæ
  - enlarged . .
    - at the extremity . . . BACULICORNIA . Papilio . . *Butterfly*. Heſperia. Heteropterus.
    - in the middle like a ſpindle . FUSICORNIA . . Sphinx. . . *Hawk Moth*. Seſia. Zygæna.
  - not enlarged
    - filiform, often pectinated . FILICORNIA . . Bombix. Coſſus. Hepialus.
    - ſetaceous . . . . . . SETICORNIA . . Lithoſia. Crambus. Noctua. Phalæna . . *Moth*. Pyralis. Tinea. Allucita. Pterophorus.

CLASSIFICATION.

NEUROPTERA.—Tenth Order of Insects.

			Families.	Genera.	
The mouth	very visible	covered by the inferior lip; wings extended in repose	Odonata . .	Libellula . .	*Dragon-fly*
				Aeſhna.	
				Agrion.	
		projecting; wings covering the body when the inſect reſts	Stegoptera	Perla.	
				Termes . .	*Ticking Inſect.*
				Hemerobius	*Golden-eye.*
				Semblis.	
				Myrmeleon	*Lion-ant.*
				Aſcalaphus.	
				Panorpa .	*Scorpion-fly.*
				Raphidia.	
				Pſocus.	
	hardly to be diſtinguiſhed; no mandibles		Agnatha . .	Phryganea .	*Cadow-fly.*
				Ephemera .	*Day fly.*

ORTHOPTERA.—Eleventh Order of Insects.

				Families.	Genera.	
Poſterior legs	extremely long and ſtrong, for leaping			Grylliformia	Locuſta . .	*Locuſt.*
					Acheta . .	*Cricket.*
					Achrydium.	
					Gryllus . .	*Graſshopper.*
					Truxalis.	
					Tridactylus.	
					Gryllo-talpa	*Mole-cricket.*
	proportionate to the others; number of the articulations of the tarſus	five; corcelet	longer than broad . .	Deformia . .	Mantis . .	*Soothſayer.*
					Phyllium .	*Walking-leaf.*
					Phaſma . .	*Spectre.*
			broad, covering the head	Blatta . . .	Blatta . .	*Cockroach.*
		three; abdomen terminated by forceps		Labidoura . .	Forficula .	*Earwig.*

COLEOPTERA.—Twelfth Order of Insects.

				Sub-orders.
Number of joints or pieces in the poſterior tarſi	five to all the feet			1. Quinquetarsea.
	leſs than five;	four; the anterior with	five . .	2. Diversitarsea.
			four . .	3. Quadritarsea.
		three, and the ſame to all the other feet		4. Tritarsea.

QUINQUE-

QUINQUETARSEA.—Firſt Sub-order of Coleopterous Insects.

Families. — Genera.

- **Wing ſheaths**
  - **hard**
    - very ſhort, not covering the belly; antennæ moniliform . . . . **Brevipennia** . .
      - Staphylinus . . *Rove Beetle.*
      - Pæderus.
      - Oxyporus.
      - Stenus.
    - long, covering the belly; antennæ
      - ſetaceous or filiform; body
        - flat; the antennæ
          - not denticulated; tarſi
            - ſimple; prey upon other animals in the larva ſtate **Carnivora** . .
              - Anthia.
              - Cychrus.
              - Tachypus.
              - Carabus.
              - Caloſoma.
              - Brachinus.
              - Cicindela.
              - Colliurus.
              - Manticora.
              - Drypta.
              - Elaphrus.
              - Bembidion.
              - Olivina.
              - Scarites.
              - Nothiophilus.
              - Omophron.
            - for ſwimming . . **Remipedia** . .
              - Dytiſcus.
              - Hyphydius.
              - Haliplus.
              - Gyrinus.
          - denticulated; corcelet or ſternum pointed **Sternoxia** . .
            - Atopa.
            - Cebrio.
            - Elater.
            - Threſcus.
            - Bupreſtis.
            - Trachys.
        - round and elongated; their larvæ deſtroy wood . . **Teredilia** . .
          - Anobium.
          - Ptelinus.
          - Ptinus.
          - Melaſis.
          - Tillus.
          - Lymexylon.
      - club-ſhaped . .
        - laminated . . . . .
          - at one ſide, or ſerrated **Serricornia** . .
            - Lucanus . . *Stag Beetle.*
            - Platycerus . . *Elk Beetl*
            - Paſſalus.
            - Synodendron.
          - at the extremity . . **Lamellicornia** .
            - Geotrupes.
            - Copris . . *Dung Beetle.*
            - Aphodius.
            - Scarabæus . . *Ball-comber.*
            - Melolontha . *May Beetle.*
            - Cetonia.
            - Trichius . . *Hairy Beetle.*
            - Trox.
        - not laminated . . .
          - round and ſolid . . . **Solidicornia** . .
            - Hiſter.
            - Lethrus.
            - Anthrenus.
          - long, perfoliate . . . **Clavicornia** . .
            - Nicrophorus *Interrer, or Corpſe-Carrier.*
            - Silpha . . . *Protector.*
            - Nitidula.
            - Elophorus.
            - Hydrophilus . *Diver.*
            - Sphæridium.
            - Scaphidium.
            - Peltis.
            - Parnus.
            - Dermeſtis.
            - Byrrhus.
  - **ſoft**; corcelet flat; antennæ filiform, variable . . . . **Mollipennia** . .
    - Drillus.
    - Lycus.
    - Omalyſus.
    - Melyris.
    - Lampyris.
    - Malachius.
    - Telephorus.

DIVERSI-

CLASSIFICATION.

DIVERSITARSEA.—Second Sub-order of COLEOPTEROUS INSECTS.

Wing sheaths—

- soft, flexible; antennæ very variable; many blifter the fkin . . . . . . **FAMILY:** VESICATORIA . — **GENERA:** Dafytes. Sagria. Anthicus. Notoxus. Meloe. Lytta . . . *Bliftering Fly.* Cerocoma. Mylabris. Apalus. Zonitis.
- hard antennæ
  - filiform, often denticulated; wing sheaths
    - narrow . . . . . **FAMILY:** ANGUSTIPENNIA — **GENERA:** Sitaris. Oedemera. Necydalis. Ripiphorus. Mordella. Anafpis.
    - broad; inhabit woods . **FAMILY:** ORKEPHILA . . — **GENERA:** Helops. Sinopalpus. Ciftela. Calepus. Pyrochroa. Heria.
  - moniliform; fuperior wings or elytra
    - not confolidated; antennæ ending in a club
      - elongated; avoid the light **FAMILY:** LYGOPHILA . . — **GENERA:** Upis. Tenebrio. Opatrum. Pedinus. Sanotrium.
      - rounded; many live on fungi **FAMILY:** FUNGIVORA . . — **GENERA:** Boletopagus. Hypophlæus. Anitoma. Agathidium. Diaperis. Cnedulon. Tetratoma.
    - fo clofely applied to each other as to feem but one; the inferior or true wings wanting **FAMILY:** SOLIDIPENNIA . — **GENERA:** Elaps. Pimelia. Eurychora. Atris. Scaurus. Lepidium Erodius. Zaphofis [illegible]

CLASSIFICATION.

QUADRITARSEA.—Third Sub-order of Coleopterous Insects.

Antennæ			Families.	Genera.	
borne upon the ſnout or prolongation of the front			Rostricornia	Curculio	*Weevil.*
				Attelabus.	
				Brentus.	
				Anthribus.	
				Brachycerus.	
				Rhinomacer.	
				Bruchus.	
				Oxyſterna.	
				Ramphus.	
				Rhynchænus.	
not ſuſtained upon the roſtrum and	clavate in general; body	cylindric	Teretiformia	Boſtrichus.	
				Clerus.	
				Apate.	
				Scolytus.	
				Necrobia.	
		flat	Planiformia	Colydium.	
				Lyctus.	
				Trogoſſita.	
				Ips.	
				Mycetophagus.	
				Cucugus	
				Heterocerus.	
	commonly ſetaceous; larvæ live in wood		Lignivora	Prionus.	
				Lamia.	
				Cerambix	*Goat Chaffer.*
				Saperda.	
				Callidium.	
				Spondilis.	
				Rhagium.	
				Leptura	*Wood Beetle.*
				Donacia.	
				Melorchus	*Carrion Eater.*
	filiform; commonly live in ſociety upon the leaves of plants		Herbivora	Donacia.	
				Caſſida	*Tortoiſe Beetle.*
				Chryſomela.	
				Galeruca.	
				Altica	*Earth Flea.*
				Cryptocephalus.	
				Crioceris	
				Luperus.	
				Hiſpa	*Spinous Beetle.*
				Helodes.	
				Clythia.	
				Alurnus.	
				Erotylus.	
	of two joints, of which the laſt is extremely enlarged like a ball and furniſhed with a hooked proceſs		Globulicornia	Pauſus.	

TRITARSEA.—Fourth Sub-order of Coleopterous Insects.

Antennæ			Genera.	
long	clavate	villous, elongated	Daſycerus.	
		naked, perfoliate	Eumorphus.	
	nearly filiform		Eudomychus.	
ſhorter than the corcelet which is		applied to the wing ſheaths	Coccinella	*Lady bird.*
		ſeparate from the wing ſheaths	Scymnus.	

Supplementary Table ſhewing the Orders to which thoſe Inſects belong, which are without wings; but which are not the true Aptera.

Mouth			Orders.
with jaws; abdomen	ſeſſile	with elytra; jaws without the *galea*	Colioptera.
		with or without elytra; jaws covered with the *galea*	Orthoptera.
	pediculated tarſi with	five articulations	Hymenoptera.
		leſs than five articulations	Neuroptera.
without jaws	with a jointed ſnout; claws of the tarſi	turned round	Diptera.
		not turned round	Hemiptera.
	ſpiral tongue	ſcaly body	Lepidoptera.

CLASSIFICATION.

CLASS VI. MOLLUSCA.

		Orders.
Head	visible	Cephala.
	indistinct or confounded with the rest of the body	Acephala.

CEPHALA.—First Order of Mollusca.

Sexual organs almost universally united in the same individual; instruments of locomotion

	Sub-orders.		Genera.		Sub-genera.
[illegible] instruments of locomotion long tentacula placed around the head	Cephalopoda	Naked	Sepia . .	*Cuttle fish.*	Sepia . . *Cuttle fish.* Loligo . . *Calmar.* Octopus . *Pulp.*
			[illegible]nauta .	*Pa[illegible]r Nautilus.*	
		Testaceous	Nautilus .	*Pearl Nautilus.*	
			Spirula . .	*Spirule.*	
membranes serving for fins	Peteropoda	Naked	Pterotrachea	*Firole.*	
			Clio . . .	*Clio.*	
			Pneumoderma	*Pneumoderme.*	
		Testaceous	Hyalæa . .	*Hyaline.*	
the lower part of the body contracted for crawling	Gastropoda	Naked; or the shell concealed by the flesh	Scylæa.		
			Doris		Doris . . *Sea lemon.* Tritonia. Eolia.
			Phyllidia.		
			Thetis.		
			Limax . .	*Slug.*	
			Testacella.		
			Sigaretus.		
			Aplysia . .	*Stinking Sea Snail.*	
		Testaceous; the shell — In several pieces — Multivalves	Chiton.		
		Testaceous; the shell — Conical . Conivalves	Patella . .	*Limpet*	Fissurella. Patella . *Limpet.* Crepidula. Calyptræa.
		Testaceous; the shell — Spiral . . Spirivalves	Halyotis .	*Sea ear.*	
			Nerita . .	*Sea Snail*	Nerita. Nautica.
			Turbo . .	*Perriwinkle*	Turbo . . *Perriwinkle.* Cyclostoma. Turritella *Staircase-shell.*
			Vermetus.		
			Trochus .	*Top-shell*	Pyramidella. Trochus . *Top.* Monodonta. Solarium.
			Bulla . .	*Dipper-snail.*	
			Helix . .	*Snail-shell*	Planorbis. Helix . . *Snail.* Ampullaria. Melania. Bulimus. Achatina.
			Voluta . .	*Volute*	Voluta. Mitra . *Mitral volute.* Columbella. Marginella. Ancilla. Oliva . . *Olive shell.*
			Ovula.		
			Cypræa . .	*Cowry or Porcelain Shell.*	
			Conus . .	*Cone.*	
			Terebellum.		
			Murex		Cerithium. Pleurotoma. Fusus. Fasciolaria. Pyrula. Murex. Turbinella.
			Strombus		Strombus. Pterocera. Rostellaria.
			Buccinum .	*Whelk*	Cassidea . *Helmet-shell.* Harpa. Buccinum . *Whelk.* Terebra. Purpura . *Purple fish.* Nassa.

ACEPHALA.

ACEPHALA.—Second Order of Mollusca.

Sexual organs		Sub-orders.		Genera.		Sub-genera.	
none; instruments for locomotion	none	A oda	Naked	Ascidia.			
				Salpa.			
				Thalia.			
			Testaceous	Ostrea	Oyster	Ostrea	Oyster.
						Pedum.	
				Lazarus.			
				Spondylus	Thorny-oyster.		
				Placuna.			
				Anomia.			
				Pecten	Scallop.		
	a process of the body, called a foot, sometimes used for crawling, but more commonly for spinning	Monopoda	Testaceous	Anodontites.			
				Unio.			
				Lima.			
				Perna.			
				Avicula		Avicula	Swallow-tail shell.
						Malleus	Hammer-shell.
				Mytilus	Muscle	Mytilus.	
						Modiolus.	
				Pinna.			
				Tellina.			
				Cardium	Cockle	Cardium	Cockle.
						Isocardia.	
				Mactra		Mactra.	
						Lutraria.	
						Crassatella.	
				Venus		Venus.	
						Meretrix.	
						Cyclas.	
						Paphia.	
						Capsa.	
				Donax.			
				Chama		Cardita.	
						Tridacna.	
						Hippopus.	
				Arca		Arca.	
						Petunculus.	
						Nucula.	
				Solen	Razor-shell	Solen	Razor-shell
						Sanguinolaria.	
				Mya	Gaper	Mya	Gaper.
						Glycimeris.	
						Cyrtodaria.	
				ho las	Piddock	Pholas	Piddock.
						Giœnia.	
				Teredo	Pipe-worm	Teredo	Pipe-worm.
						Fistulana.	
	two ciliated arms, rolled into a spiral form	Brachiopoda	Testaceous	Terebratula		Terebratula.	
						Calceola.	
				Lingula.			
				Orbicula.			
hermaphrodite; horny articulated tentacula ranged in pairs		Cirropoda	Testaceous	Anatifa	Barnacle-shell.		
				Balanus.			

CLASS VII. VERMES.

		Orders.
Blood vessels and nerves	visible; inhabit the water or the earth	1. Exoterici.
	not discoverable; live in the interior of other animals	2. Esoterici.

CLASSIFICATION.

EXOTERICI.—Firſt Sub-diviſion of Worms.

		Sub-Orders.			Genera.
Organs of reſpiration	viſible externally	Delobranchiati			Aphrodita . *Aphrodite.*
					Terebella.
					Nereis.
					Serpula.
					Penicillus.
					Siliquaria.
					Amphitrite.
					Dentalium . *Toothſhell.*
	internal or concealed	Endobranchiati	ſetæ upon the ſides of the body	Setegiri	Nais.
					Lumbricus . *Common Worm.*
					Thalaſſema.
			without ſetæ upon the ſides of the body	Glabri	Hirudo . *Leech.*
					Faſciola . *Fluke.*
					Planaria.
					Gordius . *Amminated Hair.*

ESOTERICI.—Second Sub-diviſion of Worms.

		Sub-orders.	Genera.
Figure	round and elongated; an alimentary tube the ſhape of the body	Teretiformes	Echinorincus.
			Aſcaris.
			Hæruca.
			Caryophyllæus.
			Cucullanus.
			Strongylus.
			Uncinaria.
			Tricocephalus.
			Crino.
			Filaria.
			Tentacularia.
			Scolea.
			Proboſcidea.
	compreſſed; a marginal canal to contain the nutritious fluid	Planiformes	Tænia.
			Faſciola.
			Ligula.
			Linguatula.
	veſicular; the young developed in the interior of the ſac	Sacciformes	Hydatis.

CLASS VIII. ZOOPHYTA.

		Orders.
A body	The parts of which, more eſpecially the internal organs, arranged in a radiated manner	1. Actinoidea.
	of gelatinous ſubſtance, propagated by ſhoots or branches, ſo as to form compound animals	2. Composita.
	of various forms, ſometimes even in the ſame individual; generally inviſible to the naked eye; inhabit infuſions and ſtagnant waters	3. Infusoria.

ACTINOIDEA.—Firſt Order of Zoophytes.

		Families.	Genera.		Sub-genera.	
Body	with a prickly calcareous or coriaceous integument	Echinodermata	Echinus	*Urchin.*	Echinus	*Urihin.*
					Briſſus	*Flower-like Echinus.*
					Spatagus	*Sea egg.*
			Aſterias . .	*Star-fiſh.*		
			Holothuria .	*Holothuria.*		
			Sipunculus .	*Sipuncule.*		
	often reſembling in colours and form ſome flowers	Zoanthina	Actinia . .	*Sea Anemone.*		
			Zoanthus .	*Animal flower.*		
	tranſparent, gelatinous, and of ſimple organization	Hyalina	Meduſa . .	*Sea Nettle.*		
			Beroe . . .	*Beroe.*		
			Rhizoſtoma .	*Rhizoſtome.*		

COMPOSITA.

COMPOSITA.—Second Order of ZOOPHYTES.

The animals		Families.	Genera.	
unprotected; able to change from one place to another		POLYPINA	Hydra	*Brachiated Polyp.*
			Vorticella	*Flower Polyp.*
furnished with a habitation, into which they can retreat; in almost every instance incapable of locomotion	animal substance; traverses a horny axis, and terminates in polypes upon its branches	ZOOPHYTA (properly so called)	Flosculraia.	
			Tubularia	*Tubular Coralline.*
			Capsularia.	
			Sertularia	*Sea Moss.*
	polypes contained in horny or calcareous cells, without being connected to a medullary axis	ESCARA	Cellularia.	
			Flustra	*Sea Mat.*
			Corallina	*Common Coralline.*
	a solid axis covered with sensible substance, containing hollows from which the polypes proceed	CERATOPHYTA	Antipathes	*Black Coral.*
			Gorgonia	*Gorgon.*
			Corallium	*Coral.*
			Isis	*Jointed Coral.*
			Pinnatula	*Feather Coralline.*
			Veretillum.	
			Umbellula	*Umbelliferous Coralline.*
	polypes inside in cavities formed in a stony axis or basis	LYTHOPHYTA	Tubipora	*Pipe Coral.*
			Madrepora	*Madrepore.*
			Fungites.	
			Meandrites.	
			Astroites.	
			Porites.	
			Millepora	*Millepore.*
			Nullipora	*Nullipore.*
	The basis spongy, friable, or fibrous	SPONGIA	Alcyonium.	
			Spongia	*Sponge.*

INFUSORIA.—Third Order of ZOOPHYTES.

Body	Families.	Genera.	
furnished with different external organs, or members	ORGANIFERA	Cercaria	*Cercaria.*
		Vorticella	*Wheel Animal.*
		Himantopus	*Urceolares.*
		Brachionus	*Brachionus.*
		Trichoda	*Trichoda.*
		Leucophras	*Leucophra.*
		Kerona	*Kerona.*
		Trichocerchus	*Trichocerchus.*
without members	INORNATA	Colpoda	*Colpoda.*
		Velrio	*Velrio.*
		Velrox	*Velrox.*
		Proteus	*Proteus.*
		Monas	*Monad.*
		Baccillaria	*Baccillaria.*
		Enchelis	*Enchelis.*
		Cyclidium	*Cyclidium.*
		Parmecium	*Parmecium.*
		Bursaria	*Bursaria.*
		Gonium	*Gonium.*

Classification, in *Botany*, is that proceſs by which plants are diſtributed into claſſes, to facilitate the ſtudy of them, and to fix them more firmly in the memory. Many ſchemes have been deviſed for this purpoſe, which have generally obtained the name of methods. The framers of theſe are diſtinguiſhed by Linnæus into heterodox and orthodox. The heterodox are thoſe who have not founded their methods on any of the parts of fructification. Of theſe the *Alphabetarii* have arranged plants according to the alphabetic order of their names; the *Rhizotomi* have taken for their guide the ſtructure of the roots; the *Phylophili* have attended ſolely to the form of the leaves; the *Phyſiognomi*, to the general habit of the plant; the *Chronici*, to its time of flowering; the *Topophili*, to its native place of growth; the *Empirici*, to its real or ſuppoſed medicinal virtues; and the *Seplaſtarii*, to the ſituation which it occupies in pharmacopœias. The orthodox, in the conſtruction of their various methods, have confined themſelves to ſome of the parts of fructification. They have either formed ſyſtems profeſſedly artificial, or have attempted to make ſome approximation to a method perfectly natural. Artificial ſyſtems unavoidably unite plants ſtrikingly different from each other, if they do but poſſeſs, in common, that ſingle character which has been ſelected for the baſis of the ſyſtem. They have been founded by different authors on the fruit, the corolla, the calyx, and the ſexual, or eſſential parts of the fructification. A method which aſpires to the elevated ſtation of a natural one, admits into any particular claſs, only thoſe plants which reſemble each other in a great number of particulars, or in ſuch as are of the greateſt importance, and the leaſt liable to variation.

In the article Botany, we have given a conciſe hiſtory of the ſcience, and of the improvements which have been gradually made in its progreſs to its preſent advanced ſtate. We alſo laid before our readers a detailed account of the ſyſtem of Linnæus, which we profeſſedly follow in this department of our work, admitting only thoſe occaſional alterations which more recent obſervations, and the diſcovery of a vaſt number of plants, unknown to the great Swediſh naturaliſt, ſeem to render expedient. We ſhall now, in fulfilment of the engagement there made to the public, lay before them a ſynoptic view of the other principal methods or ſyſtems. Linnæus, in his "Philoſophia Botanica," has arranged them according to the parts of fructification, which form their diſtinguiſhing character. But it appears to us, that a chronological order will be more advantageous, as it will ſet, in a clearer point of view, the aſſiſtance which each author has derived from his predeceſſors. We will only beg leave to correct, *en paſſant*, a material error in the ſynoptic table of the Linnæan claſſes. The general character of the ſixteenth, ſeventeenth, eigthteenth, nineteenth, and twentieth claſſes, ought to ſtand thus: "Stamens united in ſome of their parts, or attached to the piſtil."

I. *Cæſalpinus's method, publiſhed in* 1583.

Trees and ſhrubs	with the corculum, or embryo	at the apex of the ſeed	1.
		at the baſe of the ſeed	2.
Under ſhrubs and herbs	with ſolitary	ſeeds	3.
		berries	4.
		capſules	5.
	with two	ſeeds	6.
		capſules	7.
	with a triple principle	not bulbous	8.
		bulbous	9.
	with four ſeeds		10.
	with numerous ſeeds	Anthemides	11.
		Cichoraceæ, ſ. Acanaceæ	12.
		with a common flower	13.
		in follicles	14.
	deſtitute of both flower and fruit		15.

Cæſalpinus is the firſt botaniſt who availed himſelf of the hints thrown out by Geſner, and attempted a truly ſcientific arrangement of plants, founded on the parts of fructification. On this account he will always be entitled to our grateful reſpect; but we may alſo add, in concurrence with La Marck, that whatever may be the defects of his method, much worſe have ſince been ſubmitted to the judgment of the public. He is ſtiled by Linnæus a Fructiſt; and would have been completely ſo, if he had formed his claſſes with a little more logical preciſion. His eighth and ninth claſſes are properly one, with the common character of a three-celled capſule, or, as he quaintly ſtiles it, a triple principle; the difference of their roots might have given riſe to a ſubdiviſion, but ſhould by no means have been elevated to a claſſical diſtinction. The ſame may be ſaid of his eleventh, twelfth, and thirteenth claſſes. In the eleventh, the compound flower is radiate, conſiſting of ligulate florets in the ray, and of tubular ones in the diſk; in the twelfth, it is without a ray, and conſiſts entirely of ligulate florets; in the thirteenth, it is alſo without a ray, but conſiſts entirely of tubular florets. Theſe varieties in the form of the compound flower, afford obvious and convenient ſubdiviſions; but in all of them the claſſical character is exactly the ſame. The grand imperfection of this method, which it has in common with many ſucceeding ones, is the ſeparation of trees from herbaceous plants. Unable to relinquiſh a diſtinction as old as the age of Theophraſtus, and become venerable from its antiquity; at the ſame time unwilling, as it ſhould ſeem, to give ſimilar claſſical characters to plants of both his primary diviſions, Cæſalpinus has paſſed over what, at the firſt view, is moſt ſtriking in the fruit of trees, and has taken his character of the two claſſes from the ſituation of the corculum, or rudiment of the future plant, as it ſprings either from the apex, or from the baſe of the ſeed; differences which are always of difficult inveſtigation, and entirely beyond the reach of the common obſerver. In this, however, he has ſtrictly adhered to his leading principle as a Fructiſt.

II.—*Moriſon's method, firſt publiſhed at Paris,* 1669, *in a ſecond edition of Breyner's Hortus Regius Bleſenſis.*

Woody Plants.	Trees	1.
	Shrubs	2.
	Under-ſhrubs	3.
Herbaceous Plants.	Scandent or climbing	4.
	Leguminous	5.
	Siliquoſe	6.
	Tricapſular	7.
	Deriving their name from the number of capſules	8.
	Corymbiferous	9.
	Lacteſcent or pappous	10.
	Culmiferous	11.
	Umbelliferous	12.
	Tricoccous	13.
	Galeatæ or helmeted	14.
	Many-capſuled	15.

Herbaceous

Herbaceous Plants.	Bacciferous - -	16.
	Capillary or ferns -	17.
	Heteroclitæ, reducible to no clafs -	18.

Morifon's method is much inferior to that of Cæfalpinus, being farther removed from fimplicity, without approaching at all nearer to a really natural arrangement. His three claffes of woody plants are altogether unfcientific. His fourth clafs, which he places among the herbaceous plants, is a very heterogeneous affemblage of genera, without any refemblance to each other in the flower or fruit: and many of them with truly woody ftems. His fifth, fixth, feventh, eighth, thirteenth, fifteenth, and fixteenth are founded on the fruit; the fourteenth on the form of the corolla; the twelfth on the mode of inflorefcence; the eleventh on the general habit; the ninth and tenth fhould be united; as they now ftand, it is impoffible to determine on what principles they are feparated; the eighteenth includes the moffes, algæ, fungi, and corals.

III.—*Ray's firft method, publifhed in* 1682, *in a work entitled, "Methodus Plantarum Nova Synoptica, in Tabulis exhibita."*

Woody Plants.	Trees - -	1.
	Shrubs. - -	2.
Herbaceous Plants.	Imperfect - -	3.
	Without a flower -	4.
	Capillary - -	5.
	Graffy - -	6.
	With one naked feed -	7.
	Umbellate - -	8.
	Verticillate - -	9.
	Rough-leaved -	10.
	Stellate - - -	11.
	Pome-bearing -	12.
	Berry-bearing -	13.
	Many-podded -	14.
	With one regular petal	15.
	With one irregular petal	16.
	Tetrapetalous, filiquofe	17.
	Tetrapetalous, filiculofe	18.
	Papilionaceous -	19.
	Pentapetalous -	20.
	Frumenta, or the different kinds of corn, which afford food to men - -	21.
	Graffes - -	22.
	Grafs-leaved plants	23.
	Bulbous - -	24.
	Allied to the bulbous	25.

This method, like all the other productions of its great author, has uncommon merit. Its chief excellence arifes from its being a nearer approximation to a natural arrangement than the fcientific world had then feen. For this purpofe, though he paid particular attention to the fruit, which he thought of primary importance, he judged it expedient fometimes to feek for claffical characters from other parts of a plant. The 7th, 12th, 13th, and 14th claffes or families are founded entirely on the fruit. Ray very illogically calls them genera; fince he has, under each of them, fubordinate genera, analogous to thofe of Linnæus and all modern botanifts. The 17th and 18th are characterized partly from the fruit, and partly from the flower. The 15th, 16th, 19th and 20th depend entirely on the flower; the 8th and 9th on the mode of inflorefcence; the 10th on the texture; and the 11th on the pofition of the leaves; the 21ft and 22d on the general habit; the 24th and 25th on the root.

Of the defects of his fyftem no one was more fenfible than himfelf. Superior to the blind partiality which fo fondly attaches moft authors to the offspring of their own brains, he was always ready to give up what a fuller inveftigation of the fubject led him to difapprove. In fact, he never reduced this firft method to practice in all its parts. Of this we have fufficient proof in the alterations introduced into the "Hiftoria Plantarum," publifhed four years afterwards in 1686; and in the additional ones inferted in the "Synopfis Stirpium Britannicarum," the firft edition of which appeared in 1690. The moft glaring impropriety, in the original fketch, is the feparation of corn from the other claffes. This the author himfelf foon perceived, and in his letter to Rivinus, affixed to the fecond edition of his "Synopfis," frankly acknowledges. It is accordingly corrected in all his fubfequent works. The 17th and 18th claffes divide one natural family into two. This error alfo is found no where, but in the delineation of his firft method. The third clafs contains the fungi, lichens, and fubmarine plants; including corallines and other organized bodies, then fuppofed to be vegetables, but now univerfally affigned to the animal kingdom. The fourth clafs confifts of the proper moffes; the fifth of the ferns; thefe, agreeing with each other in having no confpicuous flower, he afterwards united; but the alteration can fcarcely be called an improvement. Not having had the good fortune to meet with the work, in which this method was firft offered to the public, we are not able to determine, with certainty, what he means by the vague epithet gramineæ or graffy, of which there are no traces to be found either in the "Hiftoria Plantarum" or the "Synopfis;" but, from its fituation in the original arrangement, compared with what occupies its place in thofe works, we fufpect that he intended by it what he afterwards called herbaceous plants, with an imperfect or ftamineous flower, in which are included humulus-lupulus, or hop; cannabis, or hemp; urtica, or nettle; rumex, or dock; polygonum, &c. &c. Thefe have a fingle feed in each flower, and leaves which, being generally entire, may, with fome grains of allowance, be ftiled graffy. We are the more inclined to adopt this idea, becaufe we can fcarcely think it poffible, that the found judgment of Ray fhould place this heterogeneous mixture in the fame clafs with the compound flowers. On this fuppofition it is not proper to make a fingle naked feed, the diftinguifhing character of the next clafs. In fact this character was foon dropt, and the term compound flowers fubftituted for it. In the "Hiftoria Plantarum" and "Synopfis" thefe compound flowers are diftributed among four diftinct claffes; but this alfo we can by no means think an improvement; they ought to have been only fubdivifions.

IV.—*Chriftopher Knaut's method, publifhed in* 1687.

Herbs with petals, and a flefhy fruit - -	Berry-bearing	1.
With membranous fruit.	Monopetalous	2.
	Tetrapetalous, with a regular flower	3.
	Tetrapetalous, with an irregular flower	4.
	Pentapetalous	5.
	Hexapetalous	6.
	Polypetalous	7.
	Many-capfuled	8.

Herbs

Herbs with naked fruit.	Gymnoſpermous	9.
	Solid	10.
	Pappous	11.
Herbs without petals.	Apetalous	12.
	Stamineous	13.
	Inconſpicuous	14.
	Imperfect	15.
Woody plants.	Trees	16.
Shrubs.	Shrubs	17.

This method is that of Ray, a little ſimplified, and placed in an inverted order. It has been applied only to the plants which are found in the neighbourhood of the Saxon Halle. There is an evident abſurdity in giving the epithet apetalous to one diviſion of apetalous plants in contradiſtinction to the others. But moſt theoretical botaniſts, and, indeed, naturaliſts in general, betray a lamentable ignorance of the rules of logic.

V.—*Herman's method, publiſhed in* 1687.

Herbs with petals, and a naked ſeed.	one-ſeeded,	Simple	1.
		Compound	2.
	two-ſeeded,	Stellate	3.
		Umbellate	4.
	four-ſeeded,	Rough-leaved	5.
		Verticillate	6.
	many-ſeeded		7.
With ſeeds in a pericarp,	bulbous,	three-capſular	8.
	capſule	Univaſcular	9.
		Bivaſcular	10.
		Trivaſcular	11.
		Quadrivaſcular	12.
		Quinquevaſcular	13.
		Siliquoſe	14.
		Leguminous	15.
		Many-capſuled	16.
	Fleſhy,	bearing berries	17.
		Bearing pomes	18.
Without petals,	calycled,	apetalous	19.
	glumoſe,	ſtamineous	20.
	naked,	muſcoſe	21.
Trees . . incomplete . . .		amentaceous	22.
	fruit fleſhy,	umbilicate	23.
		not umbilicate	24.
	not fleſhy, dry		25.

This is an elegant arrangement, founded almoſt entirely on the fruit. We are weary of pointing it out, but the diſcerning reader will at once perceive a ſimilar want of logical preciſion in the diſtribution of the apetalous plants. It would have ſtood better thus :

Apetalous, flowers with a calyx		19.
with glumes,	graſſes	20.
naked,	moſſes	21.

The 19th is a very multifarious claſs. The 21ſt, though only moſſes are mentioned, muſt include the whole of the Linnæan *cryptogamia.* The arrangement would have been more neat, and its author would have better ſupported his character as a Fructiſt, if he had not admitted the preſence and abſence of a corolla into his primary diviſion. The flowers, with only a calyx, would then have been diſtributed among the preceding claſſes, according to the nature of their fruit ; thoſe with glumes would have been placed among the plants with a ſingle naked ſeed, and might with propriety have been made a diſtinct order ; thoſe with naked flowers would have ſtood in their proper place at the foot of the ſeries. If the bulbous roots, which, as ſuch, are an embarraſſment to every method, had been equally diſregarded, Herman would have been completely a Fructiſt.

VI.—*Rivinus's method, publiſhed in* 1690.

Flowers perfect, ſimple, regular.		Monopetalous	1.
		Dipetalous	2.
		Tripetalous	3.
		Tetrapetalous	4.
		Pentapetalous	5.
		Hexapetalous	6.
		Polypetalous	7.
compound ;	florets regular		8.
	florets regular and irregular		9.
	florets irregular		10.
	irregular,	Monopetalous	11.
		Dipetalous	12.
		Tripetalous	13.
		Tetrapetalous	14.
		Pentapetalous	15.
		Hexapetalous	16.
		Polypetalous	17.
Flowers imperfect			18.

Rivinus has the honour of being the firſt Corolliſt. His method is very ſimple, and apparently eaſy ; but as it is entirely artificial, it has the diſadvantage of diſturbing natural affinities, and will occaſion great perplexity to the botanical ſtudent who attempts to reduce it to practice. He was alſo the firſt who perceived that the diſtinction of plants into trees, ſhrubs, under-ſhrubs, and herbaceous, is not ſtrictly ſupported by nature, and that, in a botanical point of view, it is of no uſe. In our preſent advanced ſtate of knowledge, it cannot but be ſurpriſing, that Ray was not convinced by the ſtrong, and as they appear to us, unanſwerable arguments addreſſed to him by Rivinus, in a letter printed in the ſecond edition of the " Synopſis ;" and that he perſevered to the laſt in keeping the trees and ſhrubs ſeparate, although he found himſelf compelled by incontrovertible facts to unite the under-ſhrubs with the herbaceous plants. In vain did Rivinus urge that the production or non-production of buds, by which Ray diſtinguiſhed the ſhrubs from the under-ſhrubs, was by no means a certain characteriſtic, and that nature does not warrant their ſeparation : our great naturaliſt perſiſted in his opinion with invincible obſtinacy. The hiſtory of ſcience ſcarcely affords a more ſtriking inſtance of the influence of preſcriptive authority and long prevailing habit, on a mind uncommonly enlightened, poſſeſſed of vigorous powers, and particularly eminent for the acuteneſs of its penetration. It is a conſolation to ſuch of us as cannot avoid feeling for the honour of our illuſtrious countryman, that Tournefort, his great antagoniſt, was equally blind. Both of them were in this reſpect ſo accuſtomed to darkneſs, that they could not endure the light of day.

VII.—*Tourne-*

VII.—*Tournefort's method, publiſhed in* 1694.

Herbaceous plants and under-ſhrubs.	Petalled.	Simple.	Monopetalous.	Regular.	Bell-ſhaped	1.
					Funnel-ſhaped	2.
				Irregular.	Perſonate	3.
					Labiate	4.
			Polypetalous.	Regular.	Cruciform	5.
					Roſaceous	6.
					Umbelliferous	7.
					Caryophylleous	8.
					Liliaceous	9.
				Irregular.	Papilionaceous	10.
					Anomalous	11.
		Compound.	-	-	Floſculous	12.
					Semifloſculous	13.
					Radiate	14.
	Apetalous.	-	-	-	Apetalous	15.
					Without flowers	16.
					Without flowers and fruit	17.
Trees and ſhrubs.	Apetalous	-	-	-	Apetalous	18.
					Amentaceous	19.
	Petalled.		Monopetalous.	-	-	20.
			Polypetalous.	Regular.	Roſaceous	21.
					Papilionaceous	22.

Tournefort was profeſſedly a Corolliſt, and ſeldom forſook his favourite principle. In the conſtruction of his 7th, 9th, and 17th claſſes he has called in the aid of the fruit; and in the 19th has had recourſe to the mode of infloreſcence; but, in all the reſt, the corolla, as it is either preſent or abſent, is the ſole object of his attention; conſidering alſo that his ſyſtem is truly artificial, he has broken natural families and united with them diſcordant plants much leſs than might have been expected. His 4th, 5th, 7th, 9th, 10th, 12th, 13th, and 14th claſſes are natural aſſemblages, with the exception of a few plants of a very different general character, which he has been induced to annex to ſome of them on account of the form of the corolla. Thus, for inſtance, in his fifth claſs he has inſerted chelidonium, epimedium, and potamogeton, which belong to widely different families, and in which the corolla itſelf is but imperfectly cruciform. It may be objected to the firſt claſs, that it not only makes ſad havock among natural affinities, but alſo contains plants with very differently formed corollas. No one would ſuppoſe *à priori*, that the ſhape of the flowers of campanula, convolvulus, tithymalus, (euphorbia, Linn.) glaux, ruſcus, malva, and galium can be properly expreſſed by the ſame word. It is alſo impoſſible to draw a deciſive line of diſtinction between this claſs and the next. The bell-ſhaped and funnel-ſhaped flowers approach each other ſo nearly that, independent of their interference with each other in regard to natural affinities, they cannot be ſcientifically ſeparated. The ſixth claſs is a motley collection diſtinguiſhed by very different prominent characters; and as La Marck obſerves, is of ſo diſproportionate a magnitude, that it includes nearly one-fourth of the perfect plants. The ninth claſs does not properly fit the place aſſigned it in the ſyſtem, ſince all its genera are not polypetalous, nor have they all regular corollas. The eleventh claſs is a receptacle for vagrants, collected together from all quarters, and for whom a legal ſettlement cannot be found. This, however, is an imperfection common to moſt artificial ſyſtems.

But whatever may be the defects of this celebrated method, it cannot be denied the praiſe of uncommon excellence. It is juſtly the boaſt of every ſcientific Frenchman, and, making due allowance for the time in which it was formed, can ſcarcely be too much admired. Its ſections or orders are taken from the ſituation of the germen; when it is inferior, in Tournefort's idea, *calyx abit in fructum;* the calyx finally becomes the fruit; when it is ſuperior, *piſtillum abit in fructum;* the piſtil finally becomes the fruit.

The celebrity of this ſyſtem has induced us to give a ſeries of figures to illuſtrate its general principles, as had formerly been done in the folio edition. And from the well-known excellence of the artiſts employed, we flatter ourſelves that it will be thought by our general readers as ornamental to our work as it will be inſtructive to thoſe who wiſh to ſtudy the ſubject. In all the figures, the letter *a* denotes the flower, *b* the fruit, and *c* the ſeeds. The numbers, prefixed to each, point out the plants which have been ſelected as moſt known, and beſt calculated to exhibit the particular characters of the plants contained in each claſs. Of theſe it may be neceſſary to give the following explanation. Cl. 5. Cruciform, fig. 1. Raphaniſtrum; Tour. (Raphanus Raphaniſtrum; Linn.) Jointed Charlock. 2. Burſa paſtoris; Tourn. (Thlaſpi Burſa Paſtoris; Linn.) Shepherd's purſe, &c.

VIII.—*Ray's fecond method, publifhed in* 1703.

Herbaceous plants and underfhrubs, not bearing buds.	Imperfect, or without vifible flowers.		Submarine - -	1.
			Funguses - -	2.
			Moffes - -	3.
			Capillary - -	4.
			with an appendix of anomalous plants.	
	Perfect, Dicotyledonous.		Stamineous *i. e.* Apetalous, with or without a calyx	5.
	Flower compound		Planipetalous, lactefcent -	6.
			Difcoid with a pappous feed	7.
			Corymbiferous -	8.
			Capitate - -	9
	Flower fimple	with one naked feed.	Monofpermous -	10.
		with two naked feeds.	Umbelliferous - -	11
			Stellate - - -	12.
		with four naked feeds	Rough-leaved - -	13.
			Verticillate - -	14.
		with many naked feeds.	Polyfpermous - -	15.
		feeds covered with a pulp.	Pomiferous - -	16.
			Bacciferous - -	17.
		in feveral diftinct veffels.	Multifiliquous -	18.
		in a fingle veffel.	Monopetalous and Dipetalous	19.
			Siliquofe - -	20.
			with an appendix of anomalous plants.	
			Leguminous - -	21.
			Pentapetalous - -	22.
	Grafs-leaved,	bearing flowers	Bulbous or not bulbofe	23.
		without proper flowers. . .	Stamineous graffes -	24.
			Anomalous - -	25.
Trees and fhrubs bearing buds.	Monocotyledenous, with arundaceous leaves.		Palms - - -	26.
	Dicotyledonous, flowers remote from the fruit.		Apetalous.	
			Coniferous -	27.
			Not coniferous -	28.
	Flowers contiguous to the fruit.	Fruit . . .	Umbilicated -	29.
			Not umbilicated -	30.
			Dry, not filiquofe -	31.
			Siliquofe - -	32.
			Papilionaceous - -	33.
			Anomalous - -	34.

Linnæus tells us that Ray began with being a Fructift, and finally became a Corollift. But on a comparifon of his two methods, as they are contrafted with each other by Linnæus himfelf in his "Philofophia Botanica," the obfervation fcarcely appears to be well-founded. In both his methods, Ray drew the character of his primary divifions, fometimes from the fruit, fometimes from the flower, and fometimes from other parts of the plant, as each of them in its turn feemed to himfelf to afford the moft ftrongly marked diftinctions. It is poffible that, irritated by Tournefort's numerous criticifms, he might feel a wifh to outdo his rival in his own way; but this wifh, if it ever really exifted, does not appear to have materially affected his general views.

In the fecond method, the fubmarine plants and the fungi correfpond with the imperfectæ, conftituting a fingle clafs in the firft. The mufci of the one, and the flore carentes of the other, are the fame. Thefe and the capillares, which had been united in the "Hiftoria Plantarum" and the "Synopfis," are again very properly feparated. We have already hazarded a conjecture that the apetalæ of the fecond method are the gramineæ of the firft. The planipetalæ, difcoidæ, corymbiferæ, and capitatæ of the former are all included in the gymnomonofpermæ of the latter. The tenth clafs of the fecond method, confifting of flowers with a folitary feed, has nothing equivalent to it in the firft. It was profeffedly formed to accommodate a few plants which have no other common character, and for which the author could not find another convenient place. It contains valeriana, dentellaria (plumbago, Linn.), limonium (ftatice, Linn.), mirabilis peruviana, linaria adulterina (thefium linophyllum, Linn.), pafferina tragi (ftellera, Linn.), agrimonia, and pimpinella fanguiforba (poterium, Linn.) This motley collection firft appears as a diftinct clafs in the "Synopfis," with the addition of thalictrum and fumaria. In the "Hiftoria Plantarum," and probably in the firft method, it was blended with the umbellatæ. The umbellatæ, verticillatæ, afperifoliæ, ftellatæ, pomiferæ, bacciferæ, multifiliquæ, leguminofæ, and pentapetalæ, have a place in both methods. The fifteenth clafs of the new method, or polyfpermæ, firft appears as a diftinct clafs in the

"Historia Plantarum." It there contains ranunculus, anemone, adonis, helleborus, malva, &c. geum and potentilla. In the new method, alisma, sagittaria, tormentilla, spirea filipendula, and clematis, are added, and the malvaceous plants removed to the 19th class, or monopetalæ. Linnæus has made a gross mistake in supposing that Ray intended the dipetalæ to form a distinct class. In fact, the dipetalæ in the new method are an anomalous appendage to the monopetalæ. Alisma and sagittaria, which are tripetalous, are placed in the 19th class. The 21st of the second method very properly unites the 17th and 18th of the first. The 23d class contains the bulbosæ and other liliaceous plants, with the addition of the bulbosis affines, which, with much greater propriety, had been kept separate in the first method. These consist of the orchideæ and scitamineæ. The 23d, with equal impropriety, unites the gramina and graminifoliæ, which form separate classes in the first method. The 25th class, or anomalæ, is peculiar to the new method; but the outlines of it first appeared, though with considerable variation, in the "Historia Plantarum." The 26th, or arundinaceæ, consists of the palmæ, which here appear for the first time in a professed method; they had already been noticed by Ray in the "Historia Plantarum," but are entirely omitted by Tournefort. The arrangement of the other trees, according to the difference of their fructification, which seems to have been entirely neglected in the first method, appears with considerable advantage in the second; but it does not materially differ from what had already been done by Tournefort, as well as by himself in his intermediate publications.

The chief glory of the second method arises from its taking the lead in distributing plants according to the number of their cotyledons. This, indeed, no one would suspect from the tabular view of it, as it stands in the "Philosophia Botanica;" nor does it appear in Ray's own table of contents, which Linnæus has very carelessly transcribed, and unwarrantably abridged. But the distinction is clearly pointed out and explained in the work itself, into which, one would think, Linnæus had never looked. "Floriferas dividemus" is the perspicuous language of Ray, "*in dicotyledones*, quarum semina sata binis foliis anomalis, seminalibus dictis, quæ cotyledonum usum præstant, è terra exeunt, vel in binos saltem lobos dividuntur, quamvis eos supra terram foliorum specie non efferant; & *monocotyledones*, quæ nec folia seminalia bina efferunt, nec lobos binos condunt. Hæc divisio ad arbores etiam extendi potest; siquidem palmæ & congeneres hoc respectu eodem modo à reliquis arboribus differunt quo monocotyledones à reliquis herbis." It is with peculiar satisfaction that we thus do justice to our great British naturalist, and restore to him the honour of which he has in a great measure been deprived. We readily acknowledge that we are proud of being able to call him our countryman, for he was in all respects as good as he was great. How far we may be unduly biassed by natural patriotic feelings, it is not in our power to determine: but, while our present convictions continue, we cannot allow a decided pre-eminence to Tournefort. Both of them, indisputably, possessed supereminent excellence, and we cannot but lament that they were not better friends. But *irritabile genus* is a character, which might have been extended by the poet much beyond his own fraternity.

IX.—*Boerhaave's method, published in* 1710.

Herbs.	Imperfect.		Submarine.	1.
			Terrestrial.	2.
			Capillary.	3.
	Dicotyledonous,	with many naked seeds.	Gymnopolyspermous.	4.
		with four naked seeds.	Verticillate.	12.
			Rough-leaved.	13.
			Tetrapetalous.	14.
		with two naked seeds.	Umbelliferous.	5.
			Stellate.	11
		with one naked seed.	Simple.	6.
			Planipetalous.	7.
			Radiate.	8
			Naked.	9
			Capitate.	10.
		with one capsule.	Monangiæ.	15
		with two capsules.	Diangiæ	16.
		with three capsules.	Triangiæ.	17.
		with four capsules.	Tetrangiæ.	18.
		with five capsules.	Pentangiæ.	19.
		with many capsules.	Polyangiæ.	20.
		with many siliques.	Multisiliquæ.	21.
		Siliquose.		22
		Tetrapetalous cruciform.		23.
		Leguminous.		24.
		Bacciferous.		25.
		Pomiferous.		26.
		Apetalous.		27.
	Monocotyledonous.	Bracteate.		28
		Apetalous.		29.
Trees.	Monocotyledonous.			30.
	Dicotyledonous.	Apetalous.		31.
		Amentaceous.		32.
		Monopetalous.		33.
		Rosaceous.		34.

Boerhaave is ſaid to have combined the ſecond method of Ray with thoſe of Herman and Tournefort. With the former he diſtinguiſhes the monocotyledones from the dicotyledones; but is more indebted to Herman than to Tournefort. His prevailing character is certainly that of a Fructiſt. His method was employed only in arranging the plants in the botanic garden at Leyden, and does not appear to have excited that attention which might have been expected from the extenſive medical fame of its excellent author. Its greateſt defect is the want of ſimplicity.

X. *Chriſtian Knaut's method, publiſhed in* 1716.

Monopetalous. - -	Uniform.	1.
	Difform.	2.
Aggregate. - -	Uniform.	3.
	Difform.	4.
	Uni-difform.	5.
Dipetalous. - -	Uniform.	6.
	Difform.	7.
Tripetalous. - -	Uniform.	8.
	Difform.	9.
Tetrapetalous - -	Uniform.	10.
	Difform.	11.
Pentapetalous. - -	Uniform.	12.
	Difform.	13.
Hexapetalous. - -	Uniform.	14.
	Difform.	15.
Polypetalous. - -	Uniform.	16.
	Difform.	17.

Chriſtian Knaut is a ſturdy Coralliſt. He poſitively denies the exiſtence of any apetalous flower, and of any naked ſeed. The former poſition is clearly contradicted by facts. The latter is nothing but a diſpute about the meaning of a term. Every one is acquainted with the integument of thoſe ſeeds uſually ſtiled naked. The only diſpute is, whether it ſhould be conſidered as part of the ſeed itſelf, or as properly its pericarp. In a ſtrictly philoſophical point of view, the latter opinion may be right; but to the practical botaniſt the former has a manifeſt uſe, and ought not to be entirely diſcarded.

XI. *Pontedera's Method, publiſhed in* 1720.

Uncertain.	- -	- - -	- -	- - - -	- -	1.
Certain.	Without buds	Without flowers.	- -	- - - -	- -	2.
		With flowers.	Imperfect.	- - -	- -	3.
			Perfect.	Monopetalous, ſimple.	Anomalous.	4.
					Labiate.	5.
					Campaniform.	6.
					Hypocrateriform.	7.
					Rotate.	8.
					Funnel-ſhaped.	9.
				Conglobate. -	Floſculous.	10.
					Ligulate.	11.
					Radiate.	12.
				Polypetalous. -	Anomalous.	13.
					Papilionaceous.	14.
					Liliaceous.	15.
					Caryophylleous	16.
					Cruciform.	17.
					Roſaceous.	18.
					Umbellate.	19.
	With buds.	Flowers imperfect.	-	- - -	Filamentous.	20.
					Apetalous.	21.
		Perfect.		Monopetalous. -	Anomalous.	22.
					Campaniform.	23.
					Rotate.	24.
					Funnel-ſhaped.	25.
				Polypetalous -	Papilionaceous.	26.
					Roſaceous.	27.

Pontedera was purely a Coralliſt, and profeſſed to combine the method of Tournefort with that of Rivinus. But he followed Ray in diſtinguiſhing trees and ſhrubs from underſhrubs and herbaceous plants, by their producing, or not producing buds.

XII. *Magnol's method, publiſhed in* 1720.

Herbs.	Calyx external.	Including a flower.	Unknown.	1.
			Stamineous.	[illegible]
			Monopetalous.	[illegible]
			Polypetalous.	[illegible]
			Compound.	[illegible]
		Supporting a flower.	Monopetalous.	[illegible]
			Polypetalous.	[illegible]
	Calyx internal only.	-	- -	[illegible]
	Calyx external and internal.		Monopetalous.	[illegible]
			Di-tripetalous.	10.
			Tetrapetalous.	11.
			Polypetalous.	12.
Trees.	Calyx external only.	- -	- -	1[illegible]
	Calyx internal only.	- -	- -	14.
	Calyx external and internal.		- -	15.

Magnol was a Calyciſt; but he included under the term calyx both the perianth and the pericarp. Hence he is ſaid by Linnæus to be a Calyciſt combined with the Fructiſts.

XIII. *Linnæus's ſexual method* was introduced to the world in the firſt ſketch of his "Syſtema Naturæ," publiſhed in 1735; and farther developed and improved in the ſubſequent editions of that work, and alſo in the "Philoſophia Botanica," and the "Genera Plantarum." For a particular account of this renowned ſyſtem, ſee BOTANY; and for a critical examination of its excellencies and defects, chiefly reſpecting its preſervation or violation of natural affinities, ſee the names of its claſſes, Monandria, &c.

XIV. *Ludwig's method, publiſhed in* 1737.

Perfect flowers.	Petalous.	Regular.	Simple.	Monopetalous.	1.
				Dipetalous.	2.
				Tripetalous.	3.
				Tetrapetalous.	4.
				Pentapetalous.	5.
				Hexapetalous.	6
				Polypetalous.	7.
			Compound	florets regular.	8.
				Regular and irregular.	9.
				Irregular.	1[illegible]
		Irregular.		Monopetalous.	11.
				Dipetalous.	[illegible]
				Tripetalous.	[illegible]
				[illegible]	[illegible]
				Pentapetalous.	[illegible]
				Hexapetalous.	[illegible]
	Apetalous, furniſhed with a perianth.			Dubious.	[illegible]
Imperfect flowers.				Stamineous.	[illegible]
				Amentaceous.	[illegible]
				Powdery.	20.

Ludwig combined the very different methods of Rivinus and Linnæus. His principal diviſions are accordingly founded on the regularity and the number of the petals; his ſubordinate ones on the number of the ſtamens and piſtils. It is obvious, at firſt ſight, that his method muſt be altogether artificial.

XV. *Royen's method, publiſhed in* 1740

	Monocotyledonous.				
Calyx ſpathaceous.	- - - -			Palms.	1.
None.	- - - -			Lilies.	2.
Glumoſe.	- - - -			Graſſes.	3
	Polycotyledonous.				
Calyx common.	An ament.	- - -		Amentaceous.	4.
	An involucre.	- - -		Umbellate.	5.
	A perianth.	Anthers connate.	- -	Compound.	6.
		Anthers diſtinct.	- -	Aggregate.	7.
Calyx proper.	Fruit three-celled.	Seeds ſolitary.	- -	Tricoccæ.	8.
	Fruit various.	Calyx and corolla, one abſent.	- -	Incomplete.	9.
		both preſent. Anthers	on the germen.	Fructiflorous.	10.
			on the perianth.	Calyciflorous.	11.
			two longer. -	Ringent.	12.
			four longer. -	Siliquoſe.	13.
			united into one.	Columniferous.	14.
			united into two.	Leguminous.	15.
			not more than the diviſions of the corolla.	Oligantherous.	16.
			twice as many.	Diploſantherous.	17.
			much more numerous.	Polyantherous.	18.
Flowers inconſpicuous.	Herbaceous	- - -	- -	Crytantherous.	19.
	Stony.	- - -	- -	Lithophytes.	20.

This is a happy eſſay towards a natural method founded on the cotyledons, the calyx, the corolla, the ſtamens, and the fruit. It manifeſts an attentive and deep inveſtigation of the ſubject; and is inferior to ſeveral which ſucceeded it only through its want of ſimplicity. Linnæus gave it the preference both to that of Haller and of Wachendorf, if we may form a judgment from the adverbs with which he qualifies them. Naturalem methodum in cotyledonibus, calyce, ſexu, aliiſque Royenus *pulchre*, Hallerus *erudite*, Wachendorfius *græce* quæſiverunt.

XVI. *Haller's Method, publiſhed in* 1742.

Fungi (funguſes) - - - -	1.
Muſci (moſſes) - - - -	2.
Epiphylloſpermæ (ferns) - - -	3.
Apetalæ (without petals) - - - -	4
Gramina (graſſes) - - - - -	5.
Graminibus affines (allied to the graſſes) - -	6.
Monocotyledones petaloides (monocotyledonous plants with petals) - - -	7.

Polyſtemones

Polyſtemones (ſtamens much more numerous than the petals) - - - - 8.
Diploſtemones (ſtamens twice as many as the petals) 9.
Scoſtemones (ſtamens equal in number to the petals) 10.
Mejoſtemones (ſtamens fewer than the petals) - 11.
Staminibus ſeſquialteris (ſtamens half as many more as the petals) - - - 12
Staminibus ſeſquitertiis (ſtamens one-third more than the petals) - - - 13
Quatuor ringentes (four-ringent) - - - 14.
Congregatæ (aggregate and compound) - - 15.

Whatever merit this method may poſſeſs in other reſpects, and notwithſtanding the indiſputable abilities and well merited reputation of its author, we cannot but regard it as a feeble attempt towards a natural one. It unites plants which nature has decidedly ſeparated, and ſeparates others which ought to be united. The 8th claſs, for inſtance, in which the ſtamens are much more numerous than the petals, muſt include the icoſandria, and polyandria of Linnæus, plants of widely different families: while ribes, which, in a natural arrangement, clearly belongs to icoſandria, muſt here be referred to the tenth, on account of the equal number of its ſtamens and petals.

XVII. *Wachendorf's method, publiſhed in* 1747.

Gymnoſpermæ (with naked ſeeds) - - - 1.
Homojodiperianthæ (with two equal perianths) - - 2.
Anomojodiperianthæ (with two unequal perianths) - 3.
Pollapleſtemonopetalæ (with more ſtamens than petals) 4.
Aniſoſtemonopetalæ (ſtamens and petals unequal in length) - - - - - - - - - 5.
Cylindrobaſioſtemones (filaments united into a cylinder at the baſe) - - - - - 6.
Dimacroſtemones (ſtamens two long and two ſhort) - 7.
Tetramacroſtemones (ſtamens four long and two ſhort) 8.
Diſtemonoplerantheræ (filaments united at the baſe into two bodies) - - - - - 9.
Eleutherantheræ (anthers free, as in aggregate flowers) 10.
Cylindrantheræ (anthers united into a cylinder) - - 11.
Monoperianthæ (without petals) - - - 12.
Monophythanthæ (monoicous) - - - 13.
Diphythanthæ (dioicous) - - - 14.
Acalyces (without a calyx) - - - 15.
Calycinæ (with a calyx and one cotyledon) - - 16.
Spathaceæ (calyx a ſpathe) - - - - 17.
Glumoſæ (graſſes) - - - - 18.
Cryptanthæ (flowers concealed) - - - 19.

We agree with Linnæus in thinking that the ſeſquipedalian Greek names, of this method, are its moſt diſtinguiſhing characteriſtic. To the honour of a natural method, it has few pretenſions. Lucidus ordo is not one of its excellencies.

XVIII. *Linnæus's fragments of a natural method, publiſhed in* 1751

1 Piperitæ. 2. Palmæ. 3. Scitamina. 4. Orchideæ. 5. Enſatæ. 6. Tripetalodeæ. 7. Denudatæ. 8. Spathaceæ. 9. Coronariæ. 10. Liliaceæ. 11. Muricatæ. 12. Coadunata. 13. Calamariæ. 14. Gramina. 15. Coniferæ. 16. Amentaceæ. 17. Nucamentaceæ. 18. Aggregatæ. 19. Dumoſæ. 20. Scabridæ. 21. Compoſiti. 22. Umbellatæ. 23. Multiſiliquæ. 24. Bicornes. 25. Sepiariæ. 26. Culmineæ. 27. Vaginales. 28. Corydales. 29. Contorti. 30. Rhæades. 31. Putaminea. 32. Campanacei. 33. Luridæ. 34. Columniferæ. 35. Senticoſæ. 36. Comoſæ. 37. Pomaceæ. 38. Drupaceæ. 39. Arbuſtiva. 40. Calycanthemæ. 41. Heſperideæ. 42. Caryophyllei. 43. Aſperifoliæ. 44. Stellatæ. 45. Cucurbitaceæ. 46. Succulentæ. 47. Tricoccæ. 48. Inundatæ. 49. Sarmentaceæ. 50. Trihilatæ. 51. Preciæ. 52. Rotaceæ. 53. Holoraceæ. 54. Vepreculæ. 55. Papilionaceæ. 56. Lomentaceæ. 57. Siliquoſæ. 58. Verticillatæ. 59. Perſonatæ. 60. Perforatæ. 61. Statuminatæ. 62. Candelares. 63. Cymoſæ. 64. Filices. 65. Muſci. 66. Algæ. 67. Fungi. 68. Vagæ, natural order not determined.

In 1764 Linnæus delivered a courſe of lectures on theſe natural orders, of which a MS. copy was taken by the celebrated entomologiſt J. C. Fabricius. In 1771, at the requeſt of his favourite pupil Giſeke, he delivered another courſe, the ſubſtance of which has been publiſhed by Giſeke ſince the death of Linnæus. In this laſt courſe, the relative ſituation of the natural orders is greatly changed, with ſeveral omiſſions and additions. They now ſtand thus: 1. Palmæ. 2. Piperitæ. 3. Calamariæ. 4. Gramina. 5. Tripetaloideæ. 6. Enſatæ. 7. Orchideæ. 8. Scitamineæ. 9. Spathaceæ. 10. Coronariæ. 11. Sarmentoſæ. 12. Holoraceæ. 13. Succulentæ. 14. Gruinales. 15. Inundatæ. 16. Calyciſloræ. 17. Calycanthemæ. 18. Bicornes. 19. Heſperideæ. 20. Rotaceæ. 21. Preciæ. 22. Caryophylleæ. 23. Trihilatæ. 24. Corydales. 25. Putamineæ. 26. Multiſiliquæ. 27. Rheadeæ. 28. Luridæ. 29. Campanaceæ. 30. Contortæ. 31. Vepreculæ. 32. Papilionaceæ. 33. Lomentaceæ. 34. Cucurbitaceæ. 35. Senticoſæ. 36. Pomaceæ. 37. Columniferæ. 38. Tricoccæ. 39. Siliquoſæ. 40. Perſonatæ. 41. Aſperifoliæ. 42. Verticillatæ. 43. Dumoſæ. 44. Sepiariæ. 45. Umbellatæ. 46. Hederaceæ. 47. Stellatæ. 48. Aggregatæ. 49. Compoſitæ. 50. Amentaceæ. 51. Coniferæ. 52. Coadunatæ. 53. Scabridæ. 54. Miſcellaneæ. 55. Filices. 56. Muſci. 57. Algæ. 58. Fungi.

In this enumeration, N^{os} 7, 10, 11, 17, 26, 27, 36, 38, 39, 60, 61, 62, and 63, of the former one are omitted. N^{os} 14, 16, 46, and 54 are added. For a more particular account of theſe orders, ſee their reſpective names.

XIX. *Linnæus's calycine method, publiſhed in* 1751.

Calyx, a ſpathe - - - -	Spathaceous	1.
a glume - - - - -	Graſſes	2.
an ament - - - - -	Amentaceous	3.
an involucre, whether preſent or not, provided its place be there -	Umbellate	4.
a perianth many-flowered - -	Common	5.
one-flowered, double -	Double	6.
ſingle receptacle diffuſed within it, and attached to its ſides -	Flowering	7.
crowning the germen		8.
encloſing the germen; differing in form from the co[illegible] - - -	Anomalous	9.
different in different flowers of the ſame plant - - - -	Difform	10.
uniform, with the corolla - - -	Caducous	11.
perſiſting, circumference equal, one-petalled - - - -		12.
with more than one petal - - -		13.
circumference unequal with one petal - - - - - -		14.
with more petals - - - - - -		15.
Perianth or corolla falling off, when the floreſcence is perfected -	Incomplete	16.
when the fruit is perfected-	Apetalous	17.
naked - - - - - -		18.

Linnæus

Linnæus did not profeſs to have conſtructed this method with a view to practical uſe, but only that ſtudents might become well acquainted with all the primary ſpecies, differences, and properties of the calyx. With this view he has broken the natural families without ſcruple.

XX.—*Bernard Juſſieu's method, firſt practiſed in* 1759.

Acotyledonous			1.
Monocotyledonous.	Stamens inſerted under the piſtil.	Hypogynous	2.
	about the piſtil.	Perigynous.	3.
	upon the piſtil.	Epigynous.	4.
Dicotyledonous.		Hypogynous.	5.
		Perigynous.	6.
		Epigynous.	7.

This method, founded on the relative ſituation of the ſtamens with reſpect to the piſtil, was employed in arranging the plants in the royal botanic garden at Trianon, under the patronage of Louis XV. but was not formally publiſhed to the world. It contains the germ of the more elaborate method, ſince formed by his well-known nephew, the preſent Anthony Laurence Juſſieu.

XXI.—*Gleditſch's method, publiſhed in* 1764.

Stamens on the receptacle.	Thalamoſtemonis.	1.
on the corolla.	Petaloſtemonis.	2.
on the calyx.	Calycoſtemonis.	3.
on the ſtyle.	Styloſtemonis.	4.
inconſpicuous.	Cryptoſtemonis.	5.

Gleditſch had evidently acquired ſome imperfect idea of the principle on which Bernard Juſſieu arranged the plants in the garden of Trianon. Willdenow, in his "Elements of Botany," erroneouſly gives him the honour of being the firſt who attempted an arrangement, founded on the ſituation of the ſtamens. His orders are taken from the number of the ſtamens.

XXII.—*Crantz's method, publiſhed in* 1766.

Cryptanthous.	1.
Incomplete.	2.
Compound.	3.
Graſſes.	4.
Palms.	5.
Liliaceous.	6.
Ringent.	7.
Papilionaceous.	8.
Cruciform.	9.
Umbelliferous.	10.
Columniferous.	11.
Calyciflorous, *i. e.* ſtamens and corolla, when preſent, inſerted in the calyx,	12.
Fructiferous, *i. e.* fruit beneath the flower.	13.
With few ſtamens.	14.
With many ſtamens.	15.

Moſt of the claſſes in this method are natural ones.

XXIII.—*Werniſcheck's method, publiſhed in* 1766.

Monopetalous.	Simple.	Two-lipped.	1.
		Four-cleft.	2.
		Five-cleft.	3.
		Six-cleft.	4.
		Anomalous.	5.
	Compound.	Tubular.	6.
		Ligulate.	7.
		Radiate.	8.
Polypetalous.		Petals, 2, 4, and 8.	9.
		4, cruciform.	10.
		3 and 6.	11.
		5 and 10.	12.
		Umbellate.	13.
		Papilionaceous.	14.
		Stamens more than 10.	15.
		Columniferous.	16.
Apetalous.		Calyx taking the place of a corolla.	17.
		Rude, or none.	18.
		Glumous, graſſes.	19.
		Clandeſtine.	20.

Werniſcheck is a Corolliſt, and, with the exception of his 13th, 15th, and 16th claſſes, has ſtrictly adhered to his principle. His arrangement is juſtly entitled to the praiſe of perſpicuity and elegance.

XXIV.—*Laurence Juſſieu's method, firſt publiſhed in* 1774.

Acotyledononous.	Cotyledons not exiſting, or inconſpicuous.			1.
Monocotyledonous.		Stamens	Hypogynous.	2.
			Perigynous.	3.
			Epigynous.	4.
Dicotyledonous.	Without a corolla.	Stamens	Hypogynous.	5.
			Perigynous.	6.
			Epigynous.	7.
	Corolla monopetalous.		Hypogynous.	8.
			Perigynous.	9.
			Epigynous.	
		Anthers	united.	10.
			Diſtinct.	11.
	Polypetalous.	Anthers	Epigynous.	12.
			Hypogynous	13.
			Perigynous.	14.
	Apetalous.	Monoicous or Dioicous.		15.
	Undetermined.			16.

This celebrated method is a much nearer approximation to a natural one, than any which had ever been before conceived; but it can be reported only as in a ſtate of progreſs, and cannot juſtly boaſt of perfection. In ſome points of view it is ſtill artificial. Its unrivalled excellence, however, inconteſtibly entitles it to an examination in full detail. But, as its very able author has been long employed in preparing a new edition, with conſiderable alterations, we ſhall refer our readers to the article NATURAL *Orders*, hoping that, before that part of our work goes to the preſs, we ſhall be able to lay before them his gradual advances towards a truly natural arrangement, with his lateſt ideas on the ſubject.

XXV.—*La Marck's method, publiſhed in* 1786.

1. Polypetalous.	Thalamiferous.	1.
	Calyciflorous.	2.
	Fructiflorous.	3.
2. Monopetalous.	Fructiflorous.	4.
	Calyciflorous	5.
	Thalamiferous angioſpermous.	6.
	gymnoſpermous.	7.
3. Compound.	Diſtinct.	8.
	Syngeneſious tubular.	9.
	ligulate.	10.
4. Incomplete.	Thalamiflorous.	11.
	Calyciflorous.	12.
	Diclynous.	13.
	Gynandrous.	14.
5. One-lobed.	Fructiflorous.	15.
	Thalamiferous.	16.
6. Cryptogamous.		17.

The

The fix claffes of this very elegant method are founded on the prefence or abfence of the corolla, with other characters of that organ, and have the fingular advantage of defcending, in a regular and confpicuous gradation, from thofe plants to which the author of nature has given, what may be called the moft numerous and the higheft endowments, to thofe which are but one degree removed from the mineral kingdom. The firft clafs La Marck confiders as the maximum of vegetable organization; moft of its genera have a calyx, a polypetalous corolla, a great number of ftamens, and often many piftils. It contains almoft all the plants which poffefs a remarkable irritability, as mimofa pudica, &c. hedyfarum gyrans, oxalis fenfitiva, dionæa mufcipula, the different fpecies of drofera, &c. and may be confidered as holding the fame rank in the vegetable creation as the Linnæan clafs *mammalia* does among the animal tribes. The fecond clafs is one degree lower. There is rarely found in it an indefinite number of ftamens and piftils in the fame flower. Its ftamens very feldom exceed ten, and in about two thirds of its genera are not more than five. Nearly all of them are attached to the corolla; whereas in the preceding clafs, they are generally inferted into the calyx or the receptacle. The lively imagination of the French naturalift is pleafed with tracing out its analogy to the animal clafs *aves*.

The third clafs betrays a ftill greater diminution either in the number or perfection of the effential organs. The proper flowers are almoft all unprovided with a feparate calyx, have only one naked feed, and are in many cafes abortive, in fome entirely deftitute of a piftil. In a fcale of comparative elevation, they are on a level with the *amphibia*.

The fourth clafs conftantly wants fome of the parts which conftitute a complete flower. The plants arranged under it have generally only a calyx, or nothing but fcales which imperfectly fuftain the office of a calyx. Its flowers are moft commonly fmall, without beauty, and difficult to inveftigate. Its ftamens and piftils are, moreover, frequently feparate from each other in diftinct flowers, and in fome cafes are not found on the fame plant. In point of relative completenefs, it may be fuppofed to occupy a ftation fimilar to that of the /.

The fifth clafs has, in feveral refpects, a ftill inferior character. Its feeds have only one lobe or cotyledon, and furnifh a fmaller quantity of nutritive matter to the rifing plumula. The full-grown plants are, in confequence, conftitutionally weaker, have frequently hollow ftems, and are more eafily crufhed or broken.

The fixth clafs is the minimum of vegetable excellence and dignity. Its plants have a fimpler organization; and, in the greater number of them, neither ftamens nor piftils have been difcovered. Connected with the preceding one by the affinity of the ferns to the palms, it defcends to the loweft degradation of organized matter. The algæ and the fungi can be compared only with the corallines, madrepores, &c. and like them can barely be faid to live. A more particular account of the fubdivifions of this method, and of its 94 natural families, will be found under the names of its claffes.

XXIV.—*Moench's method, publifhed in* 1794.

1. Thalamoftemon.	Stamens on the receptacle	
2. Petaloftemon.	- -	on the corolla.
3. Parapetaloftemon.	-	on leaves fimilar to petals.
4. Calycoftemon.	- -	on the calyx.
5. Allagoftemum.	- -	alternately on the calyx and petals.
6. Styloftemum.	- -	on the ftyle.
7. Stigmatoftemum.	- -	on the ftigma.
8. Cryptoftemon.	- -	not vifible.

This method profeffes to be an improvement of that conftructed by Gleditfch. Its author appears to have been as much indebted to Laurence, as his predeceffor was to Bernard Juffieu. We rather wonder at his temerity in offering it to the world, after the "Genera Plantarum fecundum Ordines naturales difpofita" had been fo widely circulated and fo generally admired. He has taken his orders from the difference in the fruit. But as fome of his claffes are very large, he has found it neceffary to make fubdivifions, in which he has had recourfe to other parts of the flower.

Adanfon, in 1763, publifhed what he calls a natural method, in which he has included all parts of a plant, without exception, from the root to the embryo of the future offfpring. It contains 58 orders; but in forming them he has eftablifhed no character fufficiently fimple or precife to render them at all intelligible, without labouring through his tedious verbofe details. His defcription of the 43d or leguminous plants, for inftance, fills eleven pages of his original work, without a poffibility of compreffing it into a narrower compafs; and, after all, the moft attentive ftudent will be in danger of confounding the characters of one order with thofe of another. We fhall, therefore, difmifs it without further notice. It would take up more room than it is worth. A fimilar objection, though not in quite an equal degree, may be made to the recent method of De Necker.

For an account of Gærtner's method founded on the fruit, which was drawn up without an idea of its being applied to any practical purpofe, but merely as an illuftration of his fubject, fee FRUIT.

CLASSIS PROCINCTA, in *Ancient Military Language.* This name or appellation was given by the Romans to either a fleet or an army ranged or drawn up in order of battle and ready to engage.

CLASSITÆ, in *Ancient Geography*, a people of Afia in Affyria, who occupied the borders of the river Lycus, according to Pliny. Hardouin fuppofes that the Cilici were fo called, by way of diftinction, from the Cilici who inhabited the mountains.

CLASSIUS, a river of Gallia Narbonnenfis.

CLASSIDIUM, a town of Italy, in Liguria, according to Polybius, or a village placed by Livy in Gallia Cifalpina; near which Viridomarus, king of the Gauls, was vanquifhed in fingle combat by M. Marcellus.

CLASTON, a town of Spain, in Bœtica, according to Strabo. Cafaubon calls it Caftulo.

CLATERNA, a town of Italy, in Gallia Cifalpina. Pliny gives it the title of a colony. Ptolemy annexes to it the appellation of "Togata," and the Itinerary of Antonine places it 30 miles from "Forum Cornelii," (Imola); M. D'Anville marks it S.E. of Bononia.

CLATHRI, in *Antiquity*, bars of iron, or wood, ufed in fecuring doors and windows.

There was a goddefs that prefided over clathri, called Clathra.

CLATHRUS, in *Botany*, (κλαθροι, *a lattice*, 129.) Linn. Gen. Mich. 93. Bulliard 10. Perfoon. 41. Mart. Lam. Clafs and order, *cryptogamia fungi.*

Gen. Ch. *Fungus* roundifh, confifting of a reticulated, latticed, hollow body; the ramifications connected on every fide. Linn. "*Volva* membranous; *pileus* roundifh, feffile, latticed with anaftomofing branches; *juice* flowing." Perfoon. "Seeds enclofed in the fubftance of the branches." Bulliard.

Sp. 1. C. *cancellatus,* Linn. Sp. Pl. 1. Lam. Pl. 887. Bul.

Bul. Pl. 441. Bolton Pl. 93. fig. 1. Sowerby 50. (C. ruber, Mich. tab. 93. Boletus purpureus & flavefcens, Tourn. 561. Fungus rotundus cancellatus, Bauh. Pin. 375. Barrel. ic. 1263, and 1265. "Branches numerous." W. *Volva*, burfting at its fummit into feveral fegments, and affording a paffage to the latticed pileus. *Branches* very porous, containing a gelatinous fubftance, which diffolves into a very fetid fluid, and thus difcharges the feeds. The plant varies in being either of a purple or yellowifh colour. A native of England and other parts of Europe. 2. C. *carolinianus*, Bofc. Dict. d'Hiftoire Naturelle, Pl. 26, B. "Branches four, anaftomofing only at the top." Bofc. A native of Carolina. Clathrus denudatus, nudus, & recutitus. Linn. See Trichia.

Clathrus is alfo the name of a fpecies of turbo, in the order of *teftacea*, belonging the clafs of worms.

CLATTE', in *Heraldry*, a term borrowed from the French to exprefs irregular lines, found in old paintings and engravings of arms not reducible to any other proper lines of heraldry, as the ingrailed, the indented, or the like.

CLAVA Herculis, in *Botany*, fee Zanthoxylum.

CLAVARIA, from *clava*, a club.) Linn. gen. 1332. Juff. 15. Vent. vol. ii. 18. Clafs and order, *cryptogamia fungi.*

Gen. Ch. "*Fungus*, with an even furface, oblong." "Uniform; upright, club-fhaped; feeds emitted from every part of its furface." Withering.

* *Stem with a head.*

Sp. 1. C. *gyrans*, With. Bolt. 112. 1. Batfch. 164. Willd. 7. 18. "Stem hair-like; head club fhaped, terminating, longifh, tapering at each end." *Stem* about half an inch long, rifing from a fmall bulb, very flender, pellucid, crooked at the bottom, twifting and untwifting as the air is moift or dry. *Head* whitifh. On rotten ftraw and leaves in woods and moift places. Sep. Oct. 2. C. *phacorhiza*, With. A flender, fimple, undulating thread, terminating rather bluntly at the apex. The fubftance at the bafe fomewhat refembles a bean or feed, fplitting to protrude a young plant. Sometimes the head is larger, and refembles a bodkin or knitting needle. 3. C. *gracilis*, Bolt. tab. iii. fig. 1. Sowerb. 232. *Stem* half an inch long, fmooth, flender, pellucid. *Head* enlarging, almoft imperceptibly from the ftem, more than an inch long, dufky white, of a wax-like appearance, terminating more or lefs acutely, differing in colour and texture from the ftem. Found in fhady places in garden ground that has been lately dug. 4. C. *acuta*, Sowerb. 333. (C. piftillaris, Bolt. 110. fig. 2, 3, 4.) Generally growing folitary, and varying much in fize. *Root* compofed of a few fhort fibres. *Stem* cylindrical, partly tranfparent, about the length of the head. *Head* always fharply conical, fomewhat opaque and mealy. 5. C. *phofphorea*, Sowerb. 100. (Rhizomorpha fragilis, Roth. Crypt. minus nota. 7-Himantia umbrina, Perfoon Meth. Fung. 73. Agaricum nigrum reticulatum compreffum, Mich. Gen. 125. tab. 66. fig. 3. Fungus niger compreffus, varie divaricatus et implexus inter lignum & corticem. Rai. Syn. 15 Sometimes parafitic between the wood and bark of trees. The plant figured by Mr. Sowerby was found in a wine-cellar in little St. Helens, London, creeping among faw-duft and bottles, and communicated to him by Mr. B. M. Forfter. When frefh it was remarkably luminous in the dark at the ends of the fhoots, where a very flender head is formed: but Mr. Forfter doubted whether this phofphoric appearance was natural to the plant, or owing to fome vinous moifture imbibed by it. 6. C. *filiformis*, Sowerb. 387. fig. 4. *Stem* branched, hairy. *Heads* terminating the branches, very flender, refembling thofe of the preceding fpecies but fmaller. Not uncommon among dead leaves, when thickly ftrewed on the ground. It is compofed of fibrillæ not unlike Byffus barbata Eng. Bot. tab. 701; but in drying fhrivels up almoft to nothing. 7. C. *tenuis*, Sowerb. 386. fig. 5. Refembling a little black hair, thickening upwards. Found on bits of rotting wood in a coal cellar in damp weather. 8. C. *herbarum*, Sowerb. 353. Perfoon Comment. de Fung. Clavæf. tab. iii. fig. 4? Like C. ophiogloffoides in miniature, but fmoother and of a more uniform colour, very fmall, with a diftinct head, which finally becomes fhriveiled and twifted. Growing on dead ftalks. 9. C. *obtufa*. Very fmall. Parafitic on fern-ftalks in autumn, either on the upright growing plant, or its decaying remains. *Head* larger in proportion to the ftem than in moft of the preceding fpecies; either fmooth or granulated like a fphæria; in the latter cafe, the ftem, when magnified, is a little hairy. In both varieties the head is folid, of a fomewhat friable texture, becoming a little horny in drying. 10. C. *minuta*, Sowerby, 391. Very minute. Head orange-coloured. Found on the bractes of dipfacus pilofus. 10. C. *coccinea*, Sowerb. 294. (Tremella purpurea; Hudf.? Sphæria tremelloides, With.). Seldom without a ftem, though apparently feffile, as may eafily be perceived by a perpendicular fection. *Head* fcarlet. Extremely common on rotten fticks in damp weather in autumn. 12. C. *polymorpha*, Sower. 276. Bafe fomewhat brown, and harder than the reft of the plant, which is of a waxy texture, differing much in fhape, and generally hollow. Often to be feen on decaying elm leaves in Kenfington gardens. 13. C. *parafitica*, With. Willd. Berol. 7. 17. (Sphæria parafitica, Woodw.) "Parafitic, club-fhaped, black, quite fimple; ftem cylindrical; head oblong-cylindrical, obtufe, coated with minute papillæ." Willd. This fingular fungus is always fixed to a lycoperdon. It refembles C. ophiogloffoides, but has a fofter fubftance, and fooner decays. *Root* confifting of many long, wiry, brown fibres, with which it entwines and covers the furface of the tuber, but never penetrates its fubftance. *Stem* flender, about an inch long. *Head* about half an inch long, oval, covered with minute fphæriæ. Found on a heath near Norwich and fent to Mr. Woodward by Mr. Pitchford. 14. C. *cylindrica*, Bull. tab. 463. fig. 1. Sowerb. 90. Whole plant of a wax-like friable texture. *Stem* cylindrical. *Head* elongated, in fome plants pear-fhaped. Found by Mr. Sowerby, in autumn, in a field between Stoke Newington and Hornfey. 15. C. *ephiphylla*, With. Dickf. Fafc. 3. tab. 9. fig. 10. Sowerb. 293. (C. phalloides, Bull. 463. "Club-fhaped, quite entire; head blunt, hollow, red, orange or faffron coloured," two or three inches high. *Stem* cylindrical, whitifh or pale yellow. *Head* roundifh, or oblong-egg-fhaped, fometimes refembling that of an agaric. In bogs and on half rotten dead leaves; in peat holes on Rombalds Moor, Yorkfhire, and in a deep running ftream near Tunbridge Wells. 16. C. *capitata*, With. (Sphæria agaricifolia, Bolt. tab. 130. Flor. Dan. tab. 540.) "Stem yellow, cylindrical; head egg-fhaped, chefnut coloured, dotted." *Root* black, fpongy, furrounded with a thick volva which is of the fame fubftance with the ftem. This volva is inclofed in another, which is dry, hufky, of a brownifh green colour, attached to the inner one by a few radical fibres. *Stem*, while young, folid and fmooth, when old, fiftular, furrowed, a little twifted; in both ftates, foft, pliable, and eafily fplitting into yellow fhining filaments. After being fhut up in a tin box all night, a fmall gelatinous drop was obferved, by Bolton, in every pore on the furface of the head; after an expofure to the warm funfhine for about an hour, the gelatinous particles dried up, and a white powder was copioufly difcharged.

 Found

Found in Ramfden Wood, near Halifax, in Yorkfhire. 17. C. *fpatulata*, With. Schmid. tab. 50. Flor. Dan. 658. (Helvella fpatulata; Sower. 35. H. clavata, Schæf. tab. 149. Dickf. 1. fafc. p. 19. H. feritoria, Bolt. tab. 97.) Battledore clavaria. *Root* a hard fibrous knob, a little thicker than the bottom of the ftem. *Stem*, while young, cylindrical, folid, foft, pliable, filvery white. As it advances in age, it becomes a little wrinkled on the furface, twifted, and fometimes torn, efpecially near the root. *Head* like the large end of a battledore for ftriking a fhuttlecock; at firft confifting of two equal membranes of a pale yellow colour, plain, united by their whole inner furface, refembling a fmall bladder with the two fides preffed together; as it advances in growth, the two fides become wrinkled, and branching veins begin to originate in that part of the ftem which runs into the head; at laft the fides feparate, and the head becomes inflated; when opened, nothing is found in it but a few downy, capillary filaments. In a ftate of perfect maturity, the head, on being touched, throws up its feeds in form of a fmoke, which rife with an elaftic force, and glitter in the funfhine like particles of filver. A very diftinct fpecies, but its genus not eafily determined; it being almoft equally allied to peziza helvella, lycoperdon, and clavaria. Firft difcovered, by the late excellent Mr. Crowe, in the plantations of Coftefy, near Norwich; found, by Bolton, in the plantations about Fixby-Hall, near Halifax. 18. C. *ferruginea*, Sowerb. 84. *Stem* a little rough on the upper part. *Head* refembling that of a fmall agaric, infide fomewhat pithy. Found under the fhade of firs in plantations, near Norwich. 19. C. *militaris*, Linn. Sp. 2. Lam. 2. Lam. Ill. tab. 888. fig. 1. "Club-fhaped, very entire; head either fcaly or granulated. *Var.* 1 Schæff. 290. (Sphæria militans, Bolt. 128.). Head fcaly, about four inches high, near two in diameter at the thicker part, folid, orange-brown. In fhady woods. *Var.* 2. Schmid. 5. fig. 2, 3. Vaill. Paris, tab. 7. fig. 4. Flor. Dan. tab. 657. fig. 1. (Sphæria militaris, Sowerb. 60.) *Head* granulated, orange brown or chocolate-coloured; much more flender than in the preceding fpecies, folid, yellow within, fometimes bifid at the apex. *Var.* 3. Bull. 496. 1. Buxb. 4. 66. 2. "Head granulated, yellow." *Stem* about an inch high, flender, tapering upwards, gradually thickening to form the head. *Head* an inch or an inch and half long, two or three tenths of an inch in diameter, thickeft in the middle, blunt at the end; in moift woods and bogs in autumn. La Marck fuppofes this fpecies to be only a variety of C, piftillaris; but he feems to be acquainted only with the firft variety. 20. C. *ardenia*, Sowerb. 215. Woolly at the bafe. *Stem* tomentous at the bottom, cylindrical, hollow. *Head* dilating upwards. In the younger plants the head is fomewhat pointed and covered with a lightifh mealy powder. In a more advanced ftate it becomes truncated, and covered with a browner powder; fplitting longitudinally in decay. Found by lady Arden, Nov. 29, 1798, in Nook-Park, near Epfom. It grows on rotten hazel fticks, fpringing from the under fide, half an inch or more under the earth, among decaying foliage. Its whole duration feems to be about a week.

** *Stem without a head, nearly undivided.*

21. C. *herculanea*, With. Var. 1. Bull. 244. Sowerb. 277. (C. piftillaris, β. Linn. δ. Hudf.) "Undivided, club-fhaped, folid, not granulated." The largeft of the genus; about three inches high, one or two in diameter towards the top, in the larger fpecimens much refembling the fhape of a pear, dull orange-coloured, beautifully white, and foft within. Found in Windfor foreft. 22. C. *vermiculata*, Lightf. 1057. Sowerb. 253. (C. piftillaris, Hudf. 638.) "Worm-fhaped, ochroleucous." Lightf. About two inches high, generally thickeft in the middl, often longitudinally wrinkled, varying from a ftraw-colour to an orange. 23. C. *tuberofa*, Sowerb. 199. *Root* tuberous. *Stem* tubular, pointed, growing on fticks, forcing its way through the bark. 24. C. *fufiformis*, Sowerb. 234. (C. piftillaris Bolt. 110?) Spindle-fhaped, tapering to a point. Subftance friable when frefh, pithy, moft firm in the external part. 25. C. *rugofa*, Lam. Ill. 888. fig. 2. Sowerb. 235. (C. piftillaris, Lightf.?) Subftance more tender than in the preceding, and moftly hollow, yellow, tipped with orange; young fpecimens fimple, blunt at the end; old ones laciniated in the upper part.

Obf. The laft five fpecies are all included under C. *piftillaris* of Linnæus and Hudfon. Withering has divided them into two, with feveral varieties under each, making a folid ftem the principal character of his herculanea; and a hollow one of his piftillaris; but, as the fame plant appears to vary in this refpect, in different ftages of its growth, it can fcarcely be thought a proper fpecific diftinction. We have followed Sowerby in making five fpecies, which appear to be fufficiently diftinct, and which may include the numerous varieties of different authors.

26. C. *tuberculata*, With. Schæff. 289. "Stemlefs, nearly of equal thicknefs, pale orange, whole furface ftudded with tubercles" About an inch and a quarter high, a quarter of an inch in diameter, rather flatted, fometimes flightly cloven at the top; tubercles deep orange, broadeft at the bafe, pointed, and tranfparent at the tip; interftices filled with a whitifh, cobweb-like fubftance. Grows on the ground, but rare, Aug. 27. C. *elveloides*, With. Dickf. Fafc. i. p 21. Wulfen in Jacq. Mifc. Auft. tab. xii. fig. 3. (Elvela carnea, Schæff. tab. 164.) "Growing in tufts, quite fimple, very thick, united at the bafe, inverfely pyramidal, ftriated." Two inches high, one in diameter; when young flefhy; when older woody, branched, compreffed, fomewhat funnel-fhaped, truncated; margin plaited, curled, brown, with a tinge of purple without, whitifh, or yellowifh within. Woods on the ground, about the trunks of trees, Aug. and Sept. 28. C. *ophioglofsoides*, Linn. Sp. Pl. 3. Lam. 3. Vaill. Paris, tab. 7. fig. 3. Mich. Gen. tab. 87. fig. 4. Schæff. tab. 237. Flor. Dan. tab. 1076. fig. 2. Schmid. 25. Bull. 372. Bolt. 111. fig. 2. Sowerb. 83. (Mufcus clavatus, Pluk. tab. 47. fig. 3.) "Club-fhaped, quite entire, compreffed, blunt." About two inches high, near half an inch in diameter in the broadeft part; always wholly black on the outfide, white within; when young, folid and fmooth; when older, hollow, fhrunk, depreffed, furrowed or wrinkled. In moift paftures, Sept. Oct. 29. C. *lutea*, Lam. 4. Mich. Gen. tab. 87. fig. 5. Hall. Helv. n. 2207. "Horn-fhaped, quite fimple, fmooth." From fix to nine lines long, gold-coloured, flender, hollow, a little pointed at the top, curved, tender. Found by La Marck in the neighbourhood of Rouen. There is a variety a little larger, growing in tufts, figured by Mich. tab. 87. fig. 11. (C. cefpitofa, Jacq. Mifc. ii. tab. 12. fig. 2?) 30. C. *fimbriata*, With. "Undivided, hollow, clofed, and pointed, or open and fringed at the end." Whole plant covered with a greyifh powder. Near half an inch high, about the thicknefs of a pin, greenifh at the bottom, white above, tapering. Found by Dr. Withering among mofs, Oct. 31. C. *cornea*, Withering. Batfch 28. 161. Sowerb. 40. (C. aculeiformis, Bull. 463-4. Sibth.) "Red orange; fimple or cloven, nearly cylindrical, obtufe, gelatinous, folid." Scarcely a quarter of an inch high, often fticking together

from

from their glutinous fubftance, though horny and brittle when dry. With. from Batfch. Sowerby's figure does not perfectly accord with Withering's defcription, though both make the fame reference to Bulliard. In Sowerby's figure, the ftem appears flatter, deeply laciniated, and fometimes cloven almoft to the bafe into three or more fegments.

*** *Stem branched.*

32. C. *elegans*, With. —— Bolt. tab. 115. (C. coralloides, Var. Bull. 496.—Sowerb. 278.) "White, fometimes branched, upright." Four or five inches high. *Root* hard, brown, fibrous. *Stem* fometimes fimple, club-fhaped, wrinkled, longitudinally furrowed; fometimes a little branched; all the divifions obtufe. In both ftates, while frefh and growing, of a pure filvery white, and, if viewed between the eye and the light, refembling the fineft virgin wax. In decay it changes to a pale brown colour, and foon difappears. Sept. Withering thinks Bolton right in keeping it diftinct from C. coralloides, as it connects the unbranched with the branched fpecies. 33. C. *coralloides*, Linn. Sp. Pl. 6. Lam. 7. With. Tourn. 332-6. Barr. 1259, 1260, 1261, 1262. Schœff. 170, 172, 174, 175, 176, 177. 285, 286, 287. Bull. 222, 354, 358, 496. Lam. Ill. 888. fig. 3. Bolt. tab. 113. Sowerb. 278. (Fungoides ramofum maximum, braffícæ cauliflorae facie et magnitudine, Dill. in Rai. Syn. ed. iii. p. 16, communicated by Dr. Richardfon, who, in 1703, found plants which weighed two or three pounds. They grew in a meadow at Bierly-hall near Bradford, Yorkfhire.) "Branches crowded, much divided and fubdivided, unequal." It varies much in colour, being either white, grey, purple, yellow, or olive-coloured; but may always be diftinguifhed from C. piftillaris, by growing from one bafe, and being much branched. It is fometimes as large as a cauliflower. The whole fpecies is efteemed on the continent one of the beft of the fungous tribe for the table, and is eaten by the Germans under the name of *Ziegenbart*. Dr. Withering affures us, from his own experience, that the white and grey varieties may be eaten with fafety. 34. C. *faftigiata*, Linn. Sp. Pl. 7. Lam. 6. Bull. 358, D. E. Bolt. tab. 112. fig. 2. and tab. 113. fig. 6. (Fungoides coralliforme luteum fætidum et minus ramofum, Dill. in Rai. Syn. ed. 3. p. 479. tab. 24. fig. 5.) "Yellow; branches crowded, of equal height." Bulliard is inclined to think it only a variety of coralloides. But, according to Mr. Woodward, it differs from that fpecies in having feveral ftems very flightly connected at the bafe, which are either fimple, or little branched, approaching very near to C. piftillaris, but fpecifically diftinct from both. In the young plants figured by Bolton in tab. 112. fig. 2, the tops of the branches are entire, and truncated; in the older ones, tab. 113, C. pointed teeth fhoot out, which gradually become larger, and fometimes branched. Woods and paftures, Aug. Oct. 35. C. *coriacea*, Willd. Bull. tab. 452. fig. 2. "Branches flattifh, grooved, fringed at the end, grey, changing to black brown;" about two inches high, of a foft but elaftic fubftance. It differs from C. coralloides, and C. faftigiata, in the longitudinal grooves. Found by Dr. Sibthorpe in Shotover plantations, Oxfordfhire, Oct. 36. C. *mufcoides*, Linn. Sp. Pl. 8. Lam. 5. With. Bolt. tab. 114. Sowerb. 157. (C. corniculata, Schœff. tab. 173. Fungus parvus luteus ramofus, Rai. Syn. tab. 24. fig. 7.) "Pale yellow, repeatedly branched, taper-pointed, unequal." From two to five inches high. It agrees with C. faftigiata, in being nearly diftinct at the bafe, and with C. coralloides, in being always much branched, but differs from both in having the extremities of the branches fharp-pointed. Branches feveral times dichotomous; terminating forks fometimes of unequal length; fometimes diverging at their origin, and converging near the point. Luxuriant fpecimens are the fize of a man's fift; the branches much fwelled at the divarications, and much entangled together, but all united at the bafe, Bolt. Heaths and dry woods, Oct. 37. C. *laciniata*, With. Bull. 415. 1. Jacq. Mifc. 14. 1. Schœff. 291. Sowerb. 158. (C. deformis. Var. β. γ. Lam. Encyc. Vaill. tab. 8. fig. 2, 3. La Marck's Var. α of his deformis is C. *cornutus*, Schœff. tab. 289.) "Flat, thin, membranous, jagged, and fringed at the top." From one to two inches high, irregular in fhape, much rooted in the earth, fpreading elegantly in all directions, and feeming to depend on the contiguous herbage for fupport. *Stems* uniting at the bottom, purplifh brown, covered with a fine mealy white, which eafily rubs off; branches often like an expanded hand, whitifh, or yellowifh-brown; the ends jagged, fet with feveral pointed projections, and tipped with reddifh brown, Aug. 38. C. *anthocephala*, With. Sibth. Bull. 452. 1. Sowerb. 156. "Fan-fhaped, lobed, rufty red; ftem fhort, cylindrical, hairy." Of a tough woody texture, nearly two inches high. *Stem* expanding upwards into feveral fegments, which are fcolloped at the end, and paler than the reft of the plant. Oct. 39. C. *hypoxylon*, Linn. Sp. Pl. 5. Lam. 10. With. (C. cornuta Bull. 180. Sphæria hypoxylon, Sowerb. 55. Sphæria digitata, &c. Bolt. tab. 129. *a*, *b*, *c*, *d*. Coralloides ramofa, nigra, compreffa, apicibus albis, Tourn. 565. Lichen agaricus nigricans, Mich. gen. tab. 55. fig. 1.) "Branches refembling horns, compreffed." Very woolly when young, and very black, rather woody, white, and fibrous within, fometimes fingle, or occafionally forked, with the extremities more or lefs acute; fometimes with the fummits compreffed, palmated, or digitated, and covered with a white farinaceous powder, which continues on them from October to March. 40. C. *digitata*, Linn. Sp. Pl. 4. Lam. 11. With. Schœff. tab. 328. Sowerby. 69. (Sphæria digitata, Woodv. Bolt. tab. 129. fig. 2. *f*. Bull. tab. 220. Agaricus digitatus niger, Tourn. 562. Lichen agaricus terreftris, digitatus niger, Mich. gen. tab. 54. fig. 4.) "Branched, woody, black." Linn. "Thick, folid, conical, rough," With. Subftance like cork, tending to a cylindrical figure, from one to two inches high, from a quarter to three quarters of an inch in diameter, fometimes rather branched, white at the top while young. *Seeds* lodged in little cells near the furface, which cells are not vifible till the hairs fall off. Bull. Dr. Waller, in fome curious obfervations communicated to Dr. Withering by the Rev. Mr. Dickenfon, has given it as his opinion, that the plants defcribed by Linnæus under the names of C. hypoxylon, C. digitata, and C. ophiogloffoides, are but one fpecies, which he propofes to call C. villofa. According to him, C. hypoxylon is the moft common appearance of the *male* plant; C. digitata of the *female*; and C. ophiogloffoides is a variety of the *female*. The female plant begins to fpring at the fame time and in the fame place with the male, *i. e.* about the end of September, and generally in fhady woods, but rifes only to half its height. They grow always in clufters together, but never proceed from the fame root. After the male plant has fhed its pollen in November, it begins to decay, and in the fpring entirely difappears: whereas the female plant continues to grow vigoroufly till about the middle of April, when the feeds being ripe, the head burfts in feveral places and falls off. Thefe facts, if fufficiently afcertained, fatisfactorily fhew the diftinction of the fexes. With regard to C. digitata, Dr. Waller obferves, that Linnæus has mifunderftood the term digitatus,

Strahan and Prefton,

digitatus, as applied by Tournefort, Vaillant, and others, to two varieties of the plant, not becaufe they are fingered like the human hand, but becaufe their fingle head, in figure and fize, has fome refemblance to a human finger. In oppofition to this ftatement, it is, however, neceffary to add, that Mr. Sowerby has obferved, that C. digitata commences its growth very early in the fpring, and ripens its feed-veffels annually in autumn. It is alfo worthy of notice, that Mr. Woodward, a very diligent and accurate obferver, could never perceive any appearance of fpherules on C. ophioglof-foides. 41. C. *cupreffiforme*, With. (Sphæria digitata, Bolt. tab. 129. fig. g.) "But little branched; head conical, fupported on a ftem." Mr. Woodward thinks this plant effentially different from the preceding one. *Stem* about half an inch high, fimple, or only once divided. *Head* about the fame length, refembling a cyprefs tree in miniature. On decayed wood. 42. C. *tomentofa*. Lam. 10. "Branched, coriaceous, cloathed with a reddifh brown pubefcence; little branches fomewhat palmated at the top." Growing in expanded tufts; not more than an inch high. Pubefcence fhort, cottony, with the appearance of velvet. Eafily diftinguifhed from every other known fpecies. In habit refembling coralloides ramofum ex rufo carneum platyceron of Micheli, (tab. 88. fig. 3.) which is, perhaps, a variety. Found by La Marck in a mine at Schemnitz, in Hungary, on the wood which fupported the roofs of the galleries. 43. C. *farinofa*, With. Dickf. Fafc. 2. p. 25. Sowerb. 308. (Ramaria farinofa, Holm in nov. act. dan. 1. fig. 6.) "White, mealy; branches fhort, truncated, crenulate." Solitary. *Stem* upright, fomewhat angular, a little compreffed; branches unequal, thicker towards the end. When the white meal is rubbed off, the plant appears yellow. Woods, on the chryfalis of infects. 44. C. *byffoides*, Sowerb. 335. "Small, delicately white." *Stems* branched, forming irregular intricate tufts, refembling a byffus, or rather a minute coral. Found on old ftumps of trees.

Mr. Woodward and other recent botanifts have removed fome of thefe fpecies to fphæria, in confequence of their agreement with that genus in the ftructure of their feed-veffels. But Schmidel has demonftrated a fimilar ftructure in ftill other fpecies of clavaria, and on a more accurate examination of the plants in a ftate of compleat maturity, it may probably be found in all; fo that the two genera muft on this ground be united into one. But the difference in their general habit is fo great, that Withering has thought it beft to keep them diftinct. For a fimilar reafon we have retained C. hypoxylon, &c. in the prefent genus where Linnæus placed them; convinced that, though a new arrangement will hereafter be neceffary, we are not as yet in poffeffion of fufficient knowledge to eftablifh one on a folid foundation. La Marck has retained all the Linnæan fpecies of clavaria, with the addition of three others; but Poiret, his fucceffor in the botanical part of the Encyclopedie Methodique, has removed militaris, hypoxylon, and digitata to fphæria.

Juffieu has given the following character of his clavaria: "Somewhat flefhy, growing either on the ground, or on other plants; either club-fhaped, fimple, oblong, or branched like corals; the little branches fwelling at the tip, with projections refembling nipples." By this definition he has excluded the firft five fpecies of Linnæus, *viz.* piftillaris, militaris, ophiogloffoides, digitata, and hypoxylon. Thefe, under the generic name of hypoxylon, he has removed to the order of algæ, and affociated with the lichens. Ventenat has not adopted this new genus.

CLAVARIUM, in *Ancient Military Language*, an allowance to common Roman foldiers for purchafing fhoes and boots, or harnefs for the legs (called caligæ), and which were fet full of nails. They raifed frequent mutinies, demanding largeffes of the emperors under this pretence.

CLAVATA-VESTIMENTA, in *Antiquity*, habits adorned with purple clavi, which were either broad or narrow. See CLAVUS.

CLAUDE, JOHN, in *Biography*, a highly celebrated French Proteftant divine, was born at Suavetat, in the Agenois, in the year 1618 or 1619. His early education was conducted by his father, who was alfo a minifter, and a man of learning; he was afterwards fent to finifh his ftudies in philofophy and theology at Montauban, where he was ordained in 1645. After having fucceffively ferved two churches of inferior confequence in the country, each for a fhort period, he accepted an invitation from the church of Nifmes, which was efteemed one of the firft in the Proteftant intereft in France. There was a Proteftant college at this city, and Mr. Claude employed his leifure time in delivering a private courfe of theological lectures to the ftudents, who gladly availed themfelves of the affiftance of his great learning and abilities. He had paffed eight years in this fituation, agreeably and ufefully employed, and univerfally refpected by all who had the happinefs of his acquaintance, when a circumftance occurred which obliged him to remove. He had the misfortune to oppofe the efforts of a man who had been gained over by the court, or catholic party, to bring back the Proteftants to the Roman communion; and an order of council was in confequence iffued to forbid him to officiate any longer in Languedoc. On receiving this prohibition he went to Paris, in hopes of being able to get it refcinded; he remained there fix months, but could not fucceed in the object of his journey. During his ftay at Paris, he was prevailed upon by madam De Turenne to write an anfwer to a work which had juft been publifhed by Meffrs. De Port-Royal, "On the Perpetuity of the Roman Catholic Faith refpecting the Eucharift," which was principally defigned to convert her hufband, marfhal Turenne, to the court tenets. Mr. Claude's anfwer led to a controverfy of fome length, in which he appeared with great advantage; but it was not probable he could fucceed in the firft object of his undertaking, the prefervation of marfhal Turenne to the Proteftant intereft, when other inducements, more powerful in the eftimation of a courtier than religious fcruples, weighed on the other fide. From Paris, Mr. Claude went to Montauban, the place of his education, where he accepted the charge of a church. After he had refided here four years, the Port-royalifts difcovered, by the bafeft artifices, that he was preparing an anfwer to their elaborate vindication of the original publication on the "Perpetuity," and made intereft to obtain another order of council to forbid him the exercife of his profeffion at Montauban. This occafioned him another journey to Paris, where he remained nine months, with as little fuccefs as had attended his firft application on a fimilar errand. At this time, 1666, he received a moft flattering invitation from the reformed church of Paris, which affembled at Charenton, and accepted the charge of being one of its paftors. Charenton being the metropolitan church of the French Proteftants, Mr. Claude had an opportunity of exercifing his talents with the greateft advantage to their caufe, and on many occafions rendered them effential fervices by his publications, and by his excellent conduct at fynods and confiftories. His firft publication in his new fituation comprifed two additional tracts againft the work of the Port-royalifts on the Eucharift. After this, Dr. Nicole publifhed an attack upon the Proteftants, in a work entitled, "Well-grounded Prejudices againft the Calvinifts;" which drew from Mr. Claude an anfwer in two

volumes

volumes quarto, entitled, "A Defence of the Reformation," which has been regarded as the ablest work ever published on the subject. He printed also some sermons, under the title of "The Parable of the Wedding Feast." At the request of mademoiselle de Duras, who was a member of his church, he had, in 1678, a long private conference with Bossuet, the bishop of Condom, afterwards of Meaux, which was conducted on both sides with all the talents these able adversaries could call forth. Of this disputation Bossuet first published an account, in which he considered himself as the victor; but Claude afterwards published his replies, claiming, with equal confidence, the honour of the day as his own. In 1682 he published anonymously a small work, entitled, "Considerations on the Circular Letters of the Assembly of the Clergy of France of the Year 1682." The letters to which it was a reply had been written and circulated by the Catholic clergy with the view of bringing back the Protestants to their communion. Shortly after this, Claude published another small piece of a more practical kind, "On Preparation for the Lord's Supper." Thus did he actively employ himself in the cause of the Reformation, until the clergy succeeded in the great measure which they had long laboured to effect, the revocation of the edict of Nantz. This fatal decree was registered in parliament, and received the sanction of law, on the 22d of December 1685. The longest period which was granted to the Protestant clergy to quit France was fifteen days; but so eager were the exulting bishops to get fairly rid of their old adversary, that an exception was made to the case of Claude, who received special orders to depart the kingdom in twenty-four hours! On the 23d of December, therefore, in compliance with this injunction, he set out for the Hague, where his son was minister of the Walloon church. He was received on his arrival with the greatest kindness by persons of the highest distinction; particularly by the prince of Orange, who granted him a pension for his maintenance. He enjoyed the bounty of his benefactor, however, only for a short period; as he died, after a short illness, in January 1687. During his residence at the Hague, he published a work, entitled, "The Complaints of the Protestants of France;" which was designed to expose the conduct of the bishops of France in their persecution of his party. It was well received by the friends of the reformation on the continent; but was, of course, execrated in France, and in England was ordered by James II. to be burnt by the common hangman. After his death, his son, Mr. Isaac Claude, published his posthumous works in five volumes 8vo.

Mr. Claude did not possess many requisites for a public speaker. His person was bad, and his voice deficient in those qualities which are calculated to impart the charms of melody and persuasive fascination to the eloquence of public discourse. His style and language, although not distinguished by elegance, were, nevertheless, correct, vigorous, and animated; and if they were not adapted to amuse the fancy and captivate the feelings, seldom failed to convince the understanding and improve the heart. His writings prove him to have possessed a large share of learning, and justly claim for him the highest reputation as a controversialist. To this it must be added, that his private life was truly excellent; he had imbibed the genuine spirit of the religion he taught; and manifested, in the whole of his conduct, a piety and devotion, a charity and benevolence, an integrity and uprightness of character, which reflect the highest lustre on his name and memory. Bayle. Nouveau Dict. Historique, Paris 1804. Robinson's Life of Claude.

CLAUDE, Le Jeune, or Claudin, in *Biography*, the most renowned French musician of his time, was a native of Valenciennes. He was an early follower of Calvin; but flourished somewhat later than Goudimel, with whom he is often confounded; both having the name of Claude, both being Hugonots, both great musicians, and both in high favour with the Calvinists for setting Clement Marot's musical translation of the Psalms to music for their temple worship, which rendered both so obnoxious to the Catholics that one of them was massacred on St. Bartholomew's day, 1572, and the other narrowly escaped.

Concerning the mistaken identity of these musicians, Bayle has cleared up that point with his usual accuracy; and proved from indisputable authority, that Le Jeune was living and in the highest public favour, even at court, though a Hugonot, many years after the fatal feast of St. Bartholomew, particularly in 1581, when the wonders which he is said to have performed by his musical art at the wedding of the duke de Joyeuse are recorded. The works of Claude le Jeune consisted chiefly of miscellaneous songs, and psalms; *de melanges, des chansons, des pseaumes*, of which he published many books. His "Melanges" consist of songs and motets, in French, Italian, and Latin. His songs are chiefly French, and in many parts like the madrigals of Italy. Of his psalms in simple counterparts of three and four parts, we have examined three several editions, printed in different forms and in different countries; and as far as counterpart is concerned we find them admirable. Few of the melodies, we believe, were of his invention, but were the productions of the first German reformers; they however went through more editions perhaps than any musical work since the invention of printing.

Claude, Clauda, or Claudius, in *Ancient Geography*, an island of the Cretan sea, mentioned by Ptolemy, and in the Acts of the Apostles, (ch. xxvii. 16.) and lying S. of Crete. In Pliny's time it had a city called Gaulos. This island is supposed to be the modern isle of Gozo

Claude, St., in *Geography*, a town of France, and principal place of a district in the department of Jura; the place contains 3579, and the canton 14,722 inhabitants; the territory comprehends 382½ kiliometres and 32 communes.

Claude, St., a town of France in the department of Charente, and chief place of a canton in the district of Confolens; the place contains 2008 and the canton 12,289 inhabitants; the territory includes 295 kiliometres and 17 communes.

CLAUDENDA *curia*. See Curia.

CLAUDENS *palpebras*, in *Anatomy*, a name given by Spigelius, and some others, to one of the muscles of the face, called by Albinus and Winslow, *musculus orbicularis palpebrarum*, and by others *sphincter palpebrarum*.

CLAUDER, Gabriel, in *Biography*, physician to the elector of Saxony and member of the Imperial Academy at Vienna, was born at Altenbourg, in the year 1633. After being instructed in the Greek and Latin languages, in which he is said to have made great proficiency, he was sent, at the age of eighteen, to Jena, to be initiated in the different branches of medicine, which he studied under the professors Rolfinck, Moebius, and Schenck. He then went to Leipsic, Holland, and England, conversing, in each place, with the most eminent of the professors. Returning by Leipsic, he took his degree of doctor in medicine in 1662. He was a frequent correspondent of the Acad. Nat. Curios. and furnished them with a great variety of observations, which appear in their collections. In a man who died after almost incessant vomiting, the stomach, omentum, and part of the duodenum, were found in the cavity of the thorax. One patient took thirty, and at length

 fifty

fifty grains of solid opium each day, and continued the practice eighteen months, without suffering any inconvenience. He gave the hyoscyamus in dysentery with success. For the titles and accounts of the remaining dissertations, see Haller's Bib. Med. His separate publications are "Dissertatio de Tinctura Universali, vulgo Lapis Philosophorum dicta," Altemb. 1678, 4to. "Methodus balsamandi Corpora humana, aliaque majora, sine Evisceratione et Sectione, hucusque solita." Altem. 1679, 4to. The preparation used by him was supposed to be similar to that employed by De Bils, of which he had heard (see the article BILS, DE, in Vol. iv. of the Cyclopædia,); it proved equally insufficient. "Dissertatio de Cinnabari nativa Hungarica, in majorem efficaciam fixata et exaltata." Jena, 1684, 4to. The cinnabar was exposed to the flame of a lamp for the space of eight or nine months; it was then exposed to other degrees of heat for about four months longer; at the end of this process it was supposed to have acquired a specific power over the lues venerea. In this also he was unsuccessful, and we only learn from it that he had an active mind, and was desirous of doing something beneficial to humanity, and which might transmit his name, with credit, to posterity. He also left "Praxeos Medicæ Monumenta generalia," which was published at Chemnitz, 1729, 8vo. He died Jan. 9, 1691. His nephew, Frederic William Clauder, succeeded him in his post of physician to the elector of Saxony. He was also elected member of the Imperial Academy, and, like his uncle, sent some observations which were published in the "Collectanea." Haller, Bib. Eloy. Dict. Hist.

CLAUDIA, in *Ancient Geography*, a town of Norica, according to Pliny; named Claudivium by Ptolemy. Cluverius supposes it to be Clausen in Bavaria, and Hardouin refers it to Clagenfurt in Carinthia.

CLAUDIA *Regio*, a country of Asia Minor, in the vicinity of the town of Miletus. Diod. Sic.

CLAUDIA *Via*, a Roman road, in Italy; commencing at the bridge Milvius and joining the Flaminian high-way.

CLAUDIÆ *Aquæ*, two fountains of Italy, in the neighbourhood of Rome. Suetonius.

CLAUDIAN, CLAUDIUS CLAUDIANUS, in *Biography*, an eminent Latin poet, flourished in the fourth century under the emperors Theodosius, and his sons Arcadius and Honorius. Like the epic bard of Greece, various cities have contended for the honour of having given him birth. It has been maintained by some that he was a native of Florence, by others, of Gaul, while a third party have supposed him to have been a Spaniard; but the most probable and best authenticated accounts, among which may perhaps be placed his own testimony, assert that he was born at or near Alexandria in Egypt. He was greatly in favour with the celebrated general Stilicho; and enjoyed all the benefit of the extensive patronage of that commander while he retained his influence and authority in the government of the empire. He was made a tribune and notary, and had, at one time, so highly ingratiated himself into public esteem, that the senate ordered a statue to be erected in honour of him, in the forum of Trajan, with an inscription expressive of their high opinion of his accomplishments and practical merit. Serena, the wife of Stilicho, procured for him, by her extensive interest, a most advantageous marriage with a wealthy lady of Africa. When his patron was put to death, Claudian considering that the favourites of a disgraced minister are generally objects of enmity or suspicion to his successful and triumphant adversaries, hastily quitted the court. Little is known of his subsequent history; but it has been supposed that he passed the remainder of his days in retirement; it does not appear, however, that he was deprived of any of his dignities. From some pieces which have been inserted by ignorant editors among his poems, it has been thought by some that he was a convert to Christianity; but there are the strongest reasons to prove that he was a polytheist and idolater to the last. Orosius, particularly, calls him "an obstinate pagan;" and his own works abound with passages which imply that he was a votary of the popular superstitions of Pagan Rome. Lardner, nevertheless, quotes him as bearing a remarkable testimony to the victory of the Christian emperor Theodosius in Gaul, and which was decided in his favour by a storm so extraordinary in its effects upon the army of his adversaries as to have been regarded even by Claudian himself as a proof of divine interposition.

Claudian justly holds a distinguished rank as a poet. During the decline of Roman literature, he alone has left to posterity, specimens of composition which may be regarded as worthy of the Augustan age, for the purity and classic elegance of their style and language. He is by many esteemed the poet who approached nearest to Virgil in the dignity and harmonious flow of his versification. Fabricius styles him "poeta floridus et amoenissimi ingenii." His poems, however, display great inequalities of genius; for although he sometimes astonishes by the boldest flights of imagination, and bears away his readers by the fire and animation of his language, he often flags in the midst of his finest passages, and, in his longer poems especially, generally falls off before he reaches the conclusion. His writings are numerous; the principal of his pieces are, a severe satire which he wrote against Ruffinus and Eutropius, who were the rivals of his patron Stilicho; his poems in honour of Honorius and of Stilicho; his "Rape of Proserpine," the commencement of an epic poem which he never finished; his "Idylliums and Epigrams." The most valuable editions of his works are those of Barthius and Heinsius; Delphin, Gesner, 1759; and Burman, 1760. Suidas, Fabricius, Tiraboschi, Tillemont.

CLAUDIANA, in *Ancient Geography*, a town of Asia, in Syria, near the Euphrates.

CLAUDIAS, a town of Asia, in Armenia Minor; supposed to be the same with Claudias, *Ara-Cloudieh*, in Comagene, on the right bank of the Euphrates, N.E. of Juliopolis, and S.S.E. of the place where the Euphrates crosses the Taurus.

CLAUDICATION, in *Surgery*. See LAMENESS.

CLAUDIO, LORRENESE, or CLAUDE LORRAINE, in *Biography*. See GALLIE.

CLAUDIOMERIUM, in *Ancient Geography*, a town of Spain, placed by Ptolemy in the country of the Artabri.

CLAUDIOPOLIS, a town of Asia Minor in Bithynia, called also Bithynium by Dion Cassius and Ptolemy; it is placed on the river Sangar and named Bithynia by Pausanias.—Also, a town of Asia in Isauria, according to Ammianus Marcellinus, who says that the emperor Claudius sent thither a colony. It had been episcopal.—Also, an ancient town of Asia in the Honoriade, according to the book of the Authentics. It had been episcopal according to Hierocles, who distinguishes it from that of Isauria.—Also, an ancient town of Asia, in Cataonia, a country of Armenia Minor, according to Ptolemy. Pliny places it in Cappadocia. It was probably the same with the Claudiopolis of Isauria. These towns derived their names from Claudius Cæsar, son of Drusus, who established colonies in various parts of the empire.—Also, a town of Galatia, at a small distance from the river Halys. It was formerly called Adrapta. Ptolemy calls it the new Clodiopolis, or Neo-Clodiopolis.

Clodiopolis.—Alſo, a town of Armenia Minor, near the Euphrates, ſuppoſed to be the ſame with *Claudias*.

CLAUDIUS, Tiberius Claudius Drusus Cæsar, in *Biography*, the fifth of the emperors of Rome, was born at Lyons in Gaul, about ten years before the birth of Chriſt. He was the ſon of Nero Claudius Druſus, and Antonia; deſcended on his father's ſide from Livia, the wife of Auguſtus, and on that of his mother, from M. Antony and Octavia, the ſiſter of Auguſtus: he was alſo the nephew of Tiberius, the brother of Germanicus, and the uncle of his predeceſſor in the empire, Caligula. Having loſt his father while he was in his infancy, the care of his education was committed to a preceptor, of whoſe cruel treatment he afterwards loudly complained. Under the tuition of this pedagogue he made conſiderable proficiency in ſeveral branches of learning, and acquired a competent knowledge of the Greek language ſo as to be able to write and ſpeak it with facility; but being all his life time ſubjected to a great variety of bodily diſorders, his judgment and mental powers were ſo greatly impaired and enfeebled, that he was not deemed capable of undertaking any public truſt in the government of the empire. His relations in general rated his abilities very low; even his mother and ſiſter, from whom ſome tenderneſs at leaſt was due to his weakneſſes; and they were not ſparing of their ridicule and declarations of contempt whenever his name happened to become the ſubject of converſation. During the reigns of Auguſtus and Tiberius he was ſuffered to remain in the condition of a private citizen; but when his nephew Caligula obtained the imperial purple, he was dignified with the rank of ſenator, and made the colleague of the emperor in his firſt conſulſhip. During this period he occaſionally preſided inſtead of Caligula at the public games, and was frequently greeted by the acclamations of the aſſembly as the brother of their favourite Germanicus. He was, however, much more commonly the object of contempt than of public eſteem; the domeſtics whoſe duty it was to attend upon him as their maſter, treating him at their pleaſure with the groſſeſt indignities. After ſuffering ſuch various mortifications, in which his life was not unfrequently expoſed to imminent danger, a circumſtance, which to the thoughtleſs mind may bear the appearance of accident, diverted the courſe of events, and raiſed him to the throne of the Cæſars. At the time Caligula was aſſaſſinated, Claudius was in the palace, but was ſo terrified and alarmed at the event, that he retreated to an adjoining balcony, and concealed himſelf in the hangings of a doorway. A ſoldier, who was roaming for ſpoil, obſerving his feet, dragged him from his retreat, but had no ſooner recognized his perſon, than he fell on his knees, ſolicited his pardon, and addreſſed him under the title of emperor. This man, whoſe name was Gratus, was ſoon joined by other ſoldiers, equally diſpoſed, from their attachment to the memory of Germanicus, to ſerve his brother; they placed the terrified emperor in a chair, conveyed him to the camp full of conſternation and fears for his life, and lodged him within the ramparts for the night. On the following morning (January 25th, A.D 41. A.U. 794.), the ſoldiers formally eſtabliſhed him at the head of the empire, by ſwearing allegiance to him as their lawful ſovereign; for which, it is ſaid, he promiſed to reward them liberally at a future period. The ſenate, when they found themſelves delivered from the ſanguinary deſpotiſm of Caligula, made ſome attempts to reſtore the ancient conſtitution of the commonwealth; but not being ſufficiently prompt in their deciſions, nor cordial in their co-operation, they were obliged to abandon their ſcheme, and ſubmit to the governor whom the military had been pleaſed to inveſt with the inſignia of power. Claudius began his reign with ſeveral acts of lenity, moderation, and juſtice. He publiſhed a proclamation of pardon to all who had in any manner oppoſed his elevation to the throne, or who had been concerned in the late conſpiracy againſt Caligula, ſuch perſons only excepted as had been actually engaged in his aſſaſſination; and it has been thought that he was urged to the condemnation and puniſhment even of thoſe by apprehenſions that his own life was not ſecure againſt their daggers. The laws which were at that time in force concerning treaſon, he aboliſhed, as too tyrannical and ſevere, and releaſed ſuch perſons as had been impriſoned on account of them by Caligula and Tiberius; he aboliſhed ſeveral oppreſſive impoſts which had been extorted by thoſe emperors from the people; and whatever property they had unlawfully taken from their ſubjects, he reſtored to the parties themſelves, if alive, or elſe to their deſcendants. In all theſe proceedings he conducted himſelf with ſingular modeſty and propriety. He did not appear at all elated by the popularity which they acquired him, nor would he conſent to accept the honours which the ſenate had decreed him as a teſtimony of their attachment and gratitude. Theſe were, however, but the tranſient efforts of a character radically feeble and debaſed, too deficient in firmneſs and energy to preſerve an uniformity of virtue, or maintain a ſolid popularity, in a turbulent and licentious age. His natural imbecility of intellect, while it rendered his perſonal conduct in the government feeble and contradictory, made him an eaſy dupe and obſequious ſlave to the bolder ſpirit of his wife, Meſſalina, of infamous notoriety, and of his ambitious and daring freed-men and favourites, Pallas, Caliſtus, and Narciſſus. Their policy was to keep his mind in a ſtate of conſtant alarm, to inſpire him with diſtruſt and ſuſpicion of all who were obnoxious to themſelves, and whoſe rank or influence in the ſtate might render them formidable opponents to their ſchemes of aggrandiſement and blood; and, under feigned pretences of diſaffection and treaſonable deſigns, to obtain from him the imperial ſanction for their unbluſhing enormities of proſcription, baniſhment, and murder. It may be ſaid, that while he wore the purple, the ſceptre was in other hands; and of the many acts of his reign, ſmall indeed is the proportion of thoſe which can with hiſtorical propriety be attributed to the uncontrouled dictates of his own mind. At the inſtigation of the licentious and ſanguinary Meſſalina, Julia, the niece of the emperor, and other women of diſtinction, who were falſely accuſed, were put to death; and Seneca, among other of her victims, baniſhed to Corſica. To the ſame influence, ſupported by the power of her willing miniſters, Narciſſus and his fellow freed-men, we may alſo ſafely refer the frequent execution of Roman ſenators, and of Roman knights, to the almoſt incredible number of three hundred and upwards, who became the unfortunate objects of her ſuſpicion and vengeance. At length, however, ſhe fell a ſacrifice to the unreſtrained impulſes of her licentious paſſions. She became enamoured of Caius Silius, a young Roman of noble birth and remarkable beauty. In order the more ſecurely to carry on her adulterous connections, ſhe cauſed him to be divorced from his wife, whom Tacitus calls "a lady of elevated rank," and inveigled him into her toils by the flattering promiſes of royal favour, and by holding out no very equivocal hopes of future elevation to imperial honours.

It is, perhaps, ſcarcely poſſible to find, even in the annals of declining Rome, a greater monſter of depravity than this woman, or one whoſe character is blackened with darker ſhades of criminality. Inflamed by her guilty paſſion, ſhe broke through every reſtraint of decency; frequented the houſe of her paramour in the moſt open and undiſguiſed manner, loaded

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-ed him with the richest presents, and publicly treated him in every respect as if he had been her husband and the emperor of Rome. The historical student almost doubts the evidence of facts, when it is added respecting her, that, daring beyond all example in iniquity, she had the shameless effrontery to marry this object of her brutal lust. She availed herself of the absence of Claudius at Ostia, to put this final seal to her wickedness, and to stamp her character with indelible infamy. Claudius remained long a stranger to her practices and to his own disgrace, and would probably have become the victim of the adulterous parties, had not Narcissus, rather fearing their power than abhorring their guilt, taken measures to apprize him of his danger, and eventually to effect their downfall and punishment. So insensible was the dishonoured emperor of the stain which had been inflicted upon his character, that it is doubtful whether he would have punished the defilers of his bed, had he not been urged, and repeatedly impelled to it by Narcissus, who, availing himself of an involuntary consent extorted from him with great difficulty, dispatched a tribune to the gardens of Lucullus, where Messalina had retired in despair, to put her to death. Nothing can give a more degrading idea of the character of Claudius than the account which Tacitus gives of this transaction. He was enjoying the luxuries of his table when the intelligence was communicated to him of the death of the empress; he received it without emotion, and did not suffer her fate, interesting as it was in many important points of view, to interrupt his pleasures. He was alike insensible to the feelings which such an event might naturally have been supposed to awake in the breast of a husband, and to the lamentations of his children at the loss of their mother. After the downfall and death of Messalina, Agrippina, the niece of Claudius, artfully availed herself of the advantages of access to his person which her near relationship gave her, to ingratiate herself into favour with him, and ultimately so completely succeeded in her plan, as to induce him to take her for his wife. A vote to recommend, to legalize and justify this incestuous union, so contrary to the Roman customs, as well as revolting to human nature, was previously obtained from the senate, who pleaded for the marriage as an event which promised to be of the greatest benefit to the state. As Messalina had rendered herself unpopular by her various acts of tyranny, Agrippina thought it adviseable to reverse, as the first act of her power, one of the proceedings which had given most offence to reflecting men, by recalling Seneca, whom her predecessor had caused to be banished; but perhaps her real motive in this affair was to give Domitius, her son by a former marriage, the advantage of his instruction, in order to raise him to the empire, as she afterwards did, to the prejudice of Britannicus, the son and legitimate heir of Claudius. From the proceedings of the government, it soon appeared that Claudius had only exchanged one mistress for another. As he had formerly been the dupe and the slave of Messalina, so was he now the tool and the vassal of Agrippina. Her whole ambition was to obtain the future sovereignty for her own son, and to this all the efforts of her craft and power were directed. Whoever was considered as hostile to her views, was soon removed from the situation where he might have the means to embarrass her proceedings, and none were admitted to offices of trust and honour but such as were subservient to her will and devoted to her cause. As some of her measures, resulting from extreme anxiety, were prosecuted with too little disguise and precaution, Claudius was privately apprised of their dangerous and threatening nature. In the paroxysm of terror, which never failed to alarm him, when he had reason to suspect treasonable designs against his life, he gave vent to his feelings in expressions of threatening import, which soon reached the ears of Agrippina. She no sooner learned his sentiments than she fully apprehended her danger. She saw that strong measures must be pursued before her object could be secured, and that the utmost promptness was necessary in the execution of them. To rid herself therefore of every cause of alarm, and of every chance of opposition, she took an early opportunity of administering poison to him in a favourite luxury of his taste. This had the intended effect, and proved fatal to him, A. D. 54, in the 64th year of his age, after having worn the imperial purple 14 years.

When the imbecility of his character is considered, no personal military achievements of importance can be expected to have added glory to his reign. But though the throne of the Cæsars was occupied by a being scarcely human in respect to mental capacity, the empire was not without military commanders to support the dignity of the Roman name. In Germany, Corbulo and Galba led the Roman legions to victory and conquest; while Plautius carried the Roman eagle triumphantly through many of the fertile provinces of Britain. At the time this general was pursuing his conquests, Claudius himself, desirous of obtaing the nominal honours of a triumph, passed over into Britain, and after witnessing some of the successes of his troops returned to Rome, to decorate his brow with the honours which had been hardly earned by the valour of his generals and their brave followers. Plautius was succeeded by Ostorius, who prosecuted the successes of his predecessor, and vanquished the brave and noble Caractacus. Claudius, however, though he could hardly flatter himself with the hope of high distinctions as a military man, was ambitious of literary reputation. Several compositions of his in the Greek and Latin languages are mentioned by Roman writers; but he signalized himself principally by his attempt to improve the Roman alphabet. He added three letters to those already in use, which were adopted pretty generally during his reign; but his successors do not appear to have been convinced of their utility, as they were not used after his death. His reign did not, however, pass without some public works of national importance. The better to provide the city of Rome with grain from foreign markets in years of scarcity, he formed a port at Ostia, at the mouth of the Tiber. He cut a grand canal with the view of draining the water of the Fucine lake, and recovering the land which it inundated for the purposes of agriculture. This was an undertaking of astonishing difficulty, which employed for eleven years nearly thirty thousand labourers; it did not, however, fully succeed, nor produce a benefit at all adequate to the immense expence bestowed upon it. But perhaps Rome was most indebted to this emperor for completing an aqueduct of stupendous magnitude, which had been begun by Caius, by which the city was supplied with the delightful waters which issued from the springs of the neighbouring hills. The character of Claudius was a strange mixture of good and bad qualities. The former, however, lost their effect in his conduct from the want of energy and firmness of mind to act in conformity to their dictates; and the latter, operating with equal blindness and indiscrimination, led him, in the administration of the empire, to the most wanton acts of cruelty, and the most barbarous measures of tyranny and oppression. His puerile attempts to administer justice in person, seemed only to defeat the very end he aimed to secure, and to render him ridiculous in the eyes of an indignant public; and his impotent endeavours to crush the immediate objects of his suspicion and hatred, instead of effecting their destruction, most commonly recoiled with accumulated force against himself, and rendered him the object of vengeance

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rather than the dispenser of destruction and death. But it is useless to dwell upon a character which has nothing in it worthy of the notice of posterity. He died lamented by none,—despised by all; and was succeeded by Domitius, the son of Agrippina, who is better known under the name of Nero. Suetonius. Tacitus. Tillemont.

Claudius, M. Aurelius, (sometimes called Claudius II.) was a native of Illyricum, and most probably a person of mean and obscure parentage. He was early distinguished for his military talents, and, after having gained the approbation and confidence of the emperor, the senate and the people of Rome, was promoted by Decius to the chief command of the Illyrian frontier, and of the troops which were stationed in Thrace and the neighbouring provinces. At this period the barbarians of the north were frequent in their incursions into the Roman territories, and afforded the Roman legions full employment to repel their attacks. On the side of Illyricum Claudius had to contend with the Goths; and by his skill and bravery obtained a victory over them, for which the senate decreed him the honour of a statue. The emperor Gallienus viewed his success and popularity with a different eye; but, dreading a rupture with a man who, by his great services in supporting the tottering fabric of the state against those powerful enemies who were assailing its foundations, and who ultimately effected its ruin, was regarded with just esteem by all ranks of citizens, he thought it best to temporize, and to disguise his real feelings by rich and munificent presents, which were intended to lure the mind of Claudius to a belief that it was the sincere wish of the emperor to cultivate his friendship. Gallienus, during the siege of Milan, where Aureolus, an impostor, and his desperate followers, had shut themselves up, was treacherously killed by some of his own officers; and Claudius, though at the time absent on duty at another post, has not escaped suspicion of being privy to the conspiracy. Perhaps, however, his subsequent elevation is the only circumstance which can be said to give a colour of probability to so foul an imputation. It is said, that when Gallienus found that his wound was likely to prove mortal, he nominated Claudius his successor, and strongly recommended him to the choice of the soldiers and the senate. The consent of the latter was easily obtained, for he was already their favourite; and the concurrence of the former was secured without much difficulty by large promises of reward. Claudius was, therefore, invested with the imperial purple, A. D. 268, and as nearly as can be judged in the fifty-fourth year of his age. He prosecuted the siege of Milan with redoubled vigour, and soon compelled Aureolus to surrender at discretion, and submit to the fatal doom which the army adjudged to be his due. His unfortunate adversary was, however, executed contrary to his wishes. Claudius, on coming to the throne, found himself placed in a situation crowded with difficulties, and with dangers of the most threatening kind. The emperors whom he was called to succeed, abandoned to the debilitating luxuries and pleasures of the age, had neglected the discipline of the troops, and relaxed in the maintenance of that regular subordination which had in former times trained them up to be the conquerors and the masters of the world; and had by this means weakened the barriers of the empire, which were now every where assailed by the most formidable and determined enemies. The first care of Claudius was to correct, as far as circumstances would admit, the error of his predecessors; to controul the licentiousness of the military, and to impart to them the energy and bravery as well as the name of Roman soldiers. Having, in some measure, succeeded in his undertaking by the judicious use of his influence over them, he prepared to put their valour to the severest test. The Gothic nations on the shores of the Euxine had assembled a formidable armament near the Niester, where, from two to four thousand transports were prepared to convey them towards the Grecian provinces. After various vicissitudes, in which, from want of nautical skill, and from the unpropitiousness of the weather, they suffered very extensive losses, a body of them, said to amount to the almost incredible number of three hundred and twenty thousand, landed near mount Athos, and laid siege to the city of Thessalonica. Claudius, on the first intelligence of their invasion, marched with all possible expedition to check their progress, and avert the desolation with which they threatened the empire. While on his way, he addressed a letter to the senate, which is still extant, expressive of the great disadvantages under which he would have to combat his formidable adversaries, from his want of arms of almost every description, and, more than all, from the imbecile and pusillanimous spirit with which the depravity of the times had infected the legions which attended him. It displays, however, a brave, determined, and dignified courage in himself, by which he appeared prepared to contend for victory with unbending resolution, and to enjoy the honour of conquest, or to submit to defeat without despondency. He first engaged the Goths at Naissus, in Dardania. His troops, overpowered by numbers, began to give way; but a detachment, which had been purposely stationed in some of the defiles of the mountains, issued forth in the critical moment, attacked the enemy in the rear, inspired their countrymen with new courage, and ultimately caused the barbarian hordes to fly in disorder, and to leave behind them fifty thousand of their number dead upon the field of battle.

Claudius delayed not to prosecute the advantages he had almost unexpectedly obtained; but his progress was, nevertheless, an arduous struggle against the desperate efforts of a determined foe. The Goths rallied their troops; and, while they retreated towards Macedonia, resolutely contended for every inch of ground over which they had to pass. Their army was, however, at length destroyed, through the superior skill of Claudius, and his intimate acquaintance with the country; and his soldiers obtained a rich booty of cattle and slaves as the reward of their toils. The few that escaped the sword of the vast multitude which, but a short time before, had spread like locusts over the shores of Greece, took refuge in the precipitous retreats of mount Hæmus, where want, and the inclemency of winter, soon lessened their number, and completed their wretchedness. By this signal and splendid victory Claudius merited the highest reward from his countrymen. It was, indeed, scarcely possible to over-rate his services, since he contributed most essentially to support the falling greatness of the empire, and to save it from sinking at once beneath the power of enemies, who, like a mighty torrent, were rolling towards it, and threatening it with instant and complete desolation and ruin. He did not live, however, to enjoy the glories of the triumph, nor to receive the plaudit he had so well deserved. He fell a victim at Sirmium to the pestilence which had broken out among the Gothic fugitives, after a reign of two years, which, for its length, may vie in splendour with any that are recorded in the page of history. He was succeeded by Aurelian, one of his generals, who afterwards proved himself worthy of the partiality to which he owed his elevation. Crevier. Gibbon.

Claudius, Appius, a Sabine by birth, whose original name

name was Atta, or Aetius Claufus. He was a man of fome confequence in his own country, but conceiving himfelf to be ill ufed by a factious party who were endeavouring to ftir up a war againft the Romans, he removed (about A.U. 254, B.C. 500.) with a large body of his partizans to Rome, where he was well received, and admitted into the patrician order. On this occafion he changed his name to Appius Claudius, and became the founder of one of the moft illuftrious of the Roman families. He was elected conful with Publius Servilius A.U. 259. B.C. 495., and became the refolute opponent of the common people in their turbulent demands to be relieved from the operation of the laws then in force againft debtors. He withftood them with firmnefs and with fome feverity, and by that means gained the efteem and confidence of the fenate; while his colleague, who wanted his energy and decifion of character, by purfuing half meafures with them, forfeited the refpect of both parties. He afterwards fhewed the fame fpirit of hoftility to the plebeians, in his oppofition to the Agrarian law; and on all public occafions ftood forward the moft determined fupporter of the power and authority of the patricians. The imperfection of the hiftorical documents of this early age prevent our being able to ftate the time of his death. Livii Hift. lib. ii.

Claudius, Appius, was the fon of the preceding, and equally diftinguifhed for his fupercilious contempt of the plebeians, and his refolute hoftility to all the public meafures which originated with them. Volero, one of the tribunes of the people, propofed a new law for determining the election of their magiftrates, which went very much to reftrict the power which the patricians had before poffeffed on fuch occafions. The fenate, therefore, to maintain their former influence, obtained the confulfhip for Claudius (A.U. 283. B.C. 471), who they knew would not be wanting in exertions to fupport their caufe; and gave him for a colleague, Titus Quintius, a man of milder temper and more conciliatory difpofitions. Notwithftanding, however, all that Claudius could do, the law of Volero paffed, and he had the mortification to find himfelf defeated by men whom he defpifed. He vented his fpleen in invectives againft the fenate, and attributed his failure to their cowardice in withholding from him the affiftance and fupport it was in their power to have rendered him. While thefe diffentions were embroiling the citizens of Rome in fevere contefts againft each other, their attention was called to the hoftile menaces of external foes. The Æquans and Volfcians had availed themfelves of thefe divifions to take the field, and had invaded the Roman territories. Quintius was difpatched againft the Æquans, and Claudius againft the Volfcians. He was no fooner invefted with the command, than he gave full vent to the ill-will and hatred which burned in his breaft, by treating the foldiers with the moft unjuftifiable harfhnefs and feverity; and his conduct had the natural effect of rendering more inveterate the averfion in which he was before held by them. This he foon had a painful opportunity of knowing; for when his troops had drawn near the enemy, and it became neceffary for him to lead them to battle, they threw down their arms in difguft, and fled with the utmoft precipitation towards the city, difgracefully abandoning their ftandards to an enemy whom they might eafily have vanquifhed. For this defertion of duty, and flagrant violation of difcipline and fubordination, they were however afterwards punifhed by their incenfed general; fome he beheaded, others he caufed to be beaten with rods, and the remainder he punifhed by decimating them, and inflicting the penalty on every tenth man, who was felected by lot. In the year following frefh contefts arofe between Claudius and the people. Having been particularly active in his oppofition to the Agrarian law, a profecution was inftituted againft him by the tribunes, and he was compelled to appear before the tribunal of his determined foes. He held their perfecution of him however in fovereign contempt. He refufed to put on the humiliating drefs which it was ufual for an accufed perfon to wear during his trial, and unawed by the dangers which threatened him, he pleaded his caufe with the fame boldnefs of demeanour, the fame unbending ftubbornnefs of fpirit, and the fame bitternefs and violence of expreffion, which characterized his proceedings and harangues when he was armed with the confular authority; and it is faid by his hiftorian, Livy, "that the people confeffed themfelves more awed by the culprit than they had been by the conful." The impreffion which his firmnefs made on his accufers and judges caufed the trial to be adjourned to a future day; but before that day arrived, he was feized by a diforder which foon terminated in his death. He was buried with honours fuitable to his rank and character; and in liftening to the encomiums pronounced over his grave, the multitudes who attended, and who but a fhort time before were bent upon his deftruction, convinced of their juftnefs, forgot their enmity in the admiration of his virtues. Livii Hift. lib. ii.

Claudius, Appius, the *Decemvir*, has been thought to be the fon of the laft-mentioned of the fame name, and was the firft perfon elected to that office (A.U. 303. B.C. 451.) on the change of the conftitution of the commonwealth. He inherited from his anceftors all that averfion to the common people, for which they had been remarkable; but being ambitious of popular honours, he changed his tone, and became, before his election to the decemvirate, their warm advocate and friend. His favour with the common people enabled him to procure the office a fecond time, and to choofe, as his colleagues, men of the moft worthlefs characters, who were not likely to thwart him in any of his fchemes, whatever might be their iniquity. With the concurrence of this faction, he ruled the commonwealth with a rod of iron, and contrived, under various pretences, to extend the period of his office beyond the year, the regular term of its duration; and from the numerous partizans which he had acquired among the plebeians, and the young and diffipated part of the nobility, would probably have refifted with fuccefs every attempt to effect his downfall, or to control his power, had not a circumftance happened which at once laid bare the bafe iniquity of his character, and roufed the generous indignation of an infulted people. During the abfence of the other decemvirs in the army, and when, according to the laws, he poffeffed fupreme power, he became enamoured of a young and beautiful woman, of the name of Virginia, whofe father, Virginius, was a centurion in the army. Having in vain practifed every infidious art, and tried every vile expedient to fubdue her virtue, he determined upon a device as daring as it was abominable to gratify his luft. He inftructed one of his creatures, Marcus Claudius, to claim her as his flave, who had been clandeftinely taken from him, and at all events to obtain poffeffion of her perfon, and detain her in cuftody until he, as fupreme judge, fhould think proper to decide the fuit. The abfence of her father on duty with the army, left him no room to doubt but by this means his purpofe might be fecured. According to this fcheme, Marcus embraced an early opportunity, and feized the devoted girl in the public forum; but his conduct exciting the indignation of the populace, who were not inclined to credit his tale, or acknowledge his claim, he found it moft prudent not to ufe violence, but to fummon her before the tribunal of Claudius, where he well knew what fentence to anticipate. Claudius, that his defigns might be in fome meafure difguifed, confented to put off his decision on the case till the morrow, to give time for her father to attend in her behalf; but, at the same time, to accomplish his purpose, he ordered that she should in the interim remain under the care of Marcus. On passing this decree, Icilius, a young man to whom she had been betrothed, alarmed at the danger which threatened the object of his affection, addressed Claudius in the bitterest terms of reproach, exposed his evil intentions, and so wrought upon the feelings of the populace, that the decemvir found himself reluctantly obliged to put off the execution of his design one day longer. To this, however, he submitted the more readily, because he did not think Virginius would be able to reach the city time enough to prevent the decree he meant to pass. But Icilius was too deeply interested in the event, to lose his cause through procrastination. He dispatched messengers to the camp even before Appius had quitted the judgment seat, and early on the morrow the anxious father was in the city. He proceeded to the forum, attended by his daughter, and several matrons, all clothed in mourning, to denote their distress; and on his way interested all men in his behalf, by the greatness of his affliction, and the danger which threatened his child. Claudius was already in waiting, and the claimant no sooner began to plead, than he interrupted him, and peremptorily decreed, that Virginia should be held in slavery, until he should finally decide her case. At this dreadful sentence every heart was petrified with horror; but Claudius, who alone beheld unmoved the agonizing spectacle, commanded the armed men with whom he had crowded the forum, to disperse the populace, who had closed round Virginius to support him. They retired, however, of their own accord; and the distressed father beheld himself deserted and forsaken, hopeless of assistance to protect his daughter from violence and from shame. Suppressing for a moment the tumultuous feelings of indignation which burned within him, he addressed Claudius in supplicating tones, praying permission to withdraw a little to make some inquiries of Virginia's nurse on the subject in dispute. He accordingly retired a short way towards the butchers' sheds, and, bursting with grief and despair, seized a knife and plunged it into his daughter's heart. "Thus, my Virginia," said he, "the only way in my power, do I secure thy freedom!" Then, turning to Claudius, "Appius," he exclaimed, "with this blood I devote thine head to destruction!" He then rushed from the crowd in desperation, clearing his way with the knife, which he still held in his hand. Icilius caught up the body of his espoused bride, and held it up to the view of the astonished multitude, and, by his pathetic expostulation, fired them with honest indignation and abhorrence of the monster who had been the real cause of the dreadful deed. Virginius had now reached the camp, and interested the great body of his brethren in arms in his distress. They unanimously agreed to avenge his wrongs, and instantly marched in a body to Rome. They demanded that the power of the decemviri, which they had so grossly abused, should be abolished; and the senate, dreading farther mischief, thought proper to comply. The old constitution being established, Virginius instituted a prosecution against Claudius for malversation, and caused him to be committed to prison, where, unable to bear the mortifications of his situation, and the disgrace which had overtaken him, he put a period to his existence. Livii Hist. lib. iii.

Claudius, Appius, commonly called *Cæcus*, or the Blind, was a descendant of the preceding, and much esteemed for his abilities, and for the public works completed under his care and direction. He is mentioned as being censor, A.U. 442. B.C. 312. with Caius Plautius for his colleague. Caius, disgusted with some proceedings regarding the choice of senators, resigned his office, and Claudius undertook its duties alone. He has perpetuated his memory by the great road which he caused to be made from Rome to Capua, a distance of 140 miles; and also by an aqueduct which was finished in his censorship, and which brought a plentiful supply of water 7 miles to Rome. (See Appian Aquæduct, and Appian Way.) He introduced an innovation into the order of the priests employed at the altar of Hercules, which gave great offence, by taking it from the Potitian family, who claimed it as their hereditary right, and consigning it to persons of meaner birth, and even to emancipated slaves. The abhorrence in which this transaction was viewed by the Romans, may be estimated by the language in which it is spoken of by Livy, who gravely states, that it was followed by very fatal consequences to the descendants of the Potitian family, and attributes to the wrath of the gods on the occasion the blindness with which Claudius was afflicted in his old age. In the year of Rome 446, B.C. 308, he was created consul, with Lucius Volumnius for his colleague, and was elected to that office a second time, with the same assistant, A.U. 456, B.C. 298. Soon after this election he was sent towards Etruria, to meet the combined armies of the Samnites and Etruscans, who threatened the Roman frontier. His engagements with them were a series of successive disasters, in which he lost his credit with his troops for military skill. Claudius was so greatly mortified at his defeats, that it was with the greatest reluctance he would seem to admit his inadequacy to combat the enemy, by admitting his colleague to bring in his forces to his assistance. When, however, he had submitted to this, and the armies were again engaged, he is said to have displayed the highest degree of personal bravery, and to have contributed very greatly to the successful issue of the engagement. The time of his death is not mentioned. Livii Hist. lib. ix. x.

Claudius is a name common to several other persons who are occasionally mentioned in the Roman history; but none of them are of sufficient importance to demand particular biographical notice in a work of this nature.

Claudius, in *Ancient Geography*. See Claude.

Claudius *Mons*, a range of mountains in Pannonia, which separated the territory of the Taurisci from that of the Scordisii. Pliny.

CLAVE, in *Block-Making*, a stool 14 inches high, made of elm, and supported by 4 legs; the top 6 feet long, 2 or 3 feet wide, and 8 inches thick at each end, and only 4 inches thick in the middle, in which the shells are set up with wedges for making the sheave-holes.

CLAVECIN, Fr. in *Music*, a harpsichord.

Clavecin *oculaire*, an ocular harpsichord. Father Castel, an ingenious and whimsical Jesuit, who was a geometrician and a great mechanic, passionately fond of music, finding in sir Isaac Newton's "Optics," that he compared the seven prismatic colours to the septenary or seven notes that lead to the octave in music, imagined it possible to excite the same sensations of pleasure to the eye by the melody and harmony of colours, as the common harpsichord produces to the ear by a series or combination of sounds.

He supposed that there was in nature a primitive and fundamental sound, and called that sound C; and that there was likewise in nature a principal and original colour, or key-note, among colours, which was the base and fundamental of all other colours, and that this was the primitive colour *blue*. And further, as there are in music three tones or essential sounds dependent on the primitive sound C, which compose the perfect or common chord C E G, or 8th, 10th, and

and 12th of the fundamental C; there are likewise three original colours dependent on *blue*, that are not compounded of any other colours, but are distinct and original: these are *blue*, *yellow*, and *red*. Blue is the key-note, red the 5th, and yellow the 3d or 10th.

There are in music five tones, and two semi-tones, C D E G A, and F B. There are likewise five primitive whole colours, *blue*, *green*, *yellow*, *red*, and *violet*, and two semitonic colours, *orange* and *purple*. The scale of music is therefore C D E F G A B, and the scale of colours, *blue*, *green*, *yellow*, *orange*, *red*, *indigo*, and *violet*; and as the whole tones in music are divided into half notes by flats and sharps, so the colours may be shaded off by the neighbouring colours, and rendered *demi blue*, *demi-yellow*, &c. going through the whole musical system, and composing colours upon the original septenary to suit all kinds of modulation.

It was so early as the year 1725, that Pere Castel announced his idea of an ocular harpsichord, and wrote an ingenious paper or memoire on the subject, in the "Journal des Savans," to which he long contributed; Diderot likewise drew up a description of the new instrument, and the celebrated German musician, Tilemann of Hamburgh, undertook to compose for it. A pamphlet on the subject was published in London about the year 1750, preparatory to an exhibition, and great expectations were raised in the credulous all over Europe.

Pere Castel in his youth chiefly attached himself to geometry, and published many tracts that were esteemed for their originality. His style was lively, free, natural, simple, and sentimentally energetic; but without method, and so visionary and whimsical, that he often touched and affected his readers at the same time that he made them laugh; and it was by this means that he amused and persuaded. His project of a *clavecin oculaire*, upon trial, was found ridiculous and impracticable, and was soon forgotten. He died in the year 1757, at the age of 68; and in 1763 there was published a collection of the bons mots, sallies, and singularities of Pere Castel.

CLAVELLATI CINERES. See CINERES.

CLAVENNA, in *Ancient Geography*, a town which belonged to the Helvetians, placed by the Itinerary of Antonine 10 miles from Larius lacus, or the lake of Como.

CLAVERACK, in *Geography*, a post town of America, in the state of New York and county of Columbia, pleasantly situated on a large plain, about 2½ miles east of Hudson city, near a creek of the same name. It contains about 60 houses, a Dutch church, a court-house, and a gaol. By the census of 1791, the township contained 3262 inhabitants, including 320 slaves. By the state census of 1796, it had 512 electors. It is distant 231 miles from Philadelphia.

CLAVES *insulæ*, a term used in the Isle of Man, where all ambiguous and weighty cases are referred to twelve persons, whom they call *claves insulæ*, i. e. *the keys of the island*.

CLAVICHORD, in *Music*, a keyed instrument, long known, and still much used in Germany. Its form is that of a small piano forte; it has no quills, jacks, or hammers. The strings are all muffled with slips of red cloth, and the tone is produced by little brass wedges, placed at the ends of the keys, which, when put down, press against the middle of the strings, acting as a bridge to each. When this instrument is touched by a great master, it is capable of great expression, though of a melancholy kind, something like the effect of the old close-shake on the violin. We had in 1772, the extreme pleasure of hearing the incomparable Emanuel Bach touch his favourite clavichord at Hamburgh; when he threw away such thoughts and execution in his *toccate* or preludes, as alone would have set up a young professor, and have established the character of a great musician.

In pathetic and slow passages on this instrument, whenever he had a long note to colour, he absolutely produced the effect of a cry of sorrow and complaint, such as could only be effected on the clavichord, and perhaps by himself.

The antiquity of this keyed instrument in Germany is very great among modern musical inventions; as there is a description and a representation of it cut in wood, in the Latin "Musurgia" of Ottomarus Luscinius, printed at Strasburg in 1536. But we find mention made of it, as a common instrument, in England, under the name of *clarichord*, by Taverner, still more early.

CLAVICITHERIUM. See CITOLE.

CLAVICLE, *Clavicula*, in *Anatomy*, one of the bones of the shoulder, connecting the acromion process of the scapula with the first bone of the sternum. See SKELETON.

CLAVICLE, *Fracture and Dislocation of*. See FRACTURE and DISLOCATION.

CLAVICULUS, in *Botany*, an old term for a tendril. See CIRRUS. Linnæus has still retained it in the name of *fumaria claviculata*, a plant whose leaf-stalks end in branched cirri; while he has called a neighbouring species, *capreolata*, the leaf-stalks of which themselves perform the same office, without any such branching terminations. This is an essential difference between the two species, which their names do not indicate.

CLAVICYMBALUM, in *Antiquity*, a musical instrument with thirty strings, in a perpendicular situation.

Modern writers apply the name to our harpsichords.

CLAVIER, *French*, implies, in *Music*, what we mean by the complete set of keys on the organ, harpsichord, pianoforte, virginal, clavichord, and spinet. When it is said of a performer on any of these instruments, *qu'il sait bien son clavier*, it implies that he has a good method of fingering, understands modulation, and has a neat and clean execution: as we say in England of a great player on the violin, that he knows the finger-board well.

CLAVIJA, in *Botany*, Bosc. Nouv. Dict. Flor. Peruv. Pl. 30. Class and order, *polygamia diœcia*.

Gen. Ch. *Cal.* five-leaved; leaves nearly round. *Cor.* wheel-shaped; mouth closed with five oblong projections; border five-cleft; segments almost round. In the male flower, tube membranous, ten-toothed, covering the abortive germ. *Stam.* five. In the female, tube none. *Stam.* five, barren. *Pist.* Germ superior, egg-shaped; stigma sessile, umbilicated. *Peric.* Berry globular, one-celled. *Seed* solitary, uniform, very hard, enveloped in the pulp, and seated on a fleshy receptacle. The hermaphrodite and male flowers are on different plants. Four species, all shrubs, are found in Peru. Bosc.

CLAVIOL, a musical instrument, said in the *True Briton*, August 9 1802, to be constructed by a Mr. Hawkins of New York. By the description in this paper, it seems much to resemble the lyrichord of Plinius, that was exhibited for two or three years in the middle of the last century; the tones of which were produced by wheels resined, which in their revolution acted as so many fiddle bows; the strings being brought into contact with the wheel by the pressure of the fingers on the key. One peculiarity in the lyrichord was, that the strings were tuned by weights. The bases were very fine, but the treble screamed intolerably. Plinius was a German, and the first who attempted to make large pianofortes in England.

The instrument called a *claviol* by Mr. Hawkins, "produces its effects from bowel strings, by a refined horse-hair bow, and is played with finger keys, like the harpsichord. The tones of this instrument are stated to possess the sweetness of the armonica, the richness of the violin, and the

grandeur

grandeur of the organ." We have never heard or feen this inftrument, and have not difcovered that any one has been fent to England; and only give this account of it as an advertifement. If its perfections are not exaggerated its invention would be a valuable difcovery.

CLAVIS, a Latin word, fometimes ufed in Englifh writers for a key.

CLAVIUS, Christopher, in *Biography*, a German Jefuit, was born at Bamberg, in Germany, in 1537, and became a very ftudious mathematician, and a voluminous writer. His works containing a complete courfe of mathematics, and confifting chiefly of elementary treatifes and commentaries on Euclid and others, without any original inventions, amount to five large folio volumes. Pope Gregory fent for him to Rome for the purpofe of affifting other learned perfons in the reformation of the calendar; and he afterwards engaged in the defence of it againft Scaliger, Vieta, and others, by whom it was attacked. He died at Rome, Feb. 6th, 1612, at the age of 75 years.

CLAVO, in *Geography*, a town of Corfica; 8 miles E.S.E. of Ajaccio.

CLAUS, a town of Germany, in the county of Bregentz; one mile N.N.E. of Bregentz.

CLAUSE, an article, or particular ftipulation in a contract; a charge or condition in a teftament, &c.

We fay, a *derogatory claufe*, *penal claufe*, *faving claufe*, *codicillary claufe*, &c.

CLAUSEN, in *Geography*, a town of Germany, in the Tyrolefe; 6 miles S.W. of Brixen.—Alfo, a town of Germany, in the circle of the Lower Rhine, and electorate of Treves; 5 miles S. of Wittick.

CLAUSENA, in *Botany*, Lam. Encyc. Juff. 430. Burm. Fl. Ind. 87. Clafs and order, *octandria monogynia*. Nat. ord. *Uncertain*, Juff.

Gen. Ch. *Cal.* one-leafed, fhort, rather flat, four-toothed. *Cor.* Petals four, round, feffile. *Stam.* Filaments eight, fhorter than the corolla, awl-fhaped, thickened, and hollow at the bafe; anthers round, verfatile. *Pift.* Germ fuperior, roundifh; ftyle cylindrical, fhorter than the ftamens; ftigma fimple.

Sp. C. *excavata*, Lam. Ill. Pl. 310. A fhrub. Leaves alternate, winged; leaflets numerous, petioled, oval-oblong, flightly crenulate, pubefcent. *Flowers* in a panicled raceme. *Fruit* unknown. A native of the ifland of Java.

CLAUSENBURG. See Colosoar.

CLAUSENTUM, in *Ancient Geography*, a town of Albion or England, marked in the Itinerary of Antonine, on the route from Regnum to Londinium, between Regnum and Venta Belgarum, 20 miles from the former, and 10 from the latter. It is fuppofed to have been Old Southampton. Dion Caffius fays, that this town had been celebrated before the reign of Claudius, and that it had been the refidence of Dunobelin.

CLAUSIT *extremum diem*. See Diem.

CLAUSTHAL, in *Geography*, a town of Germany, in the circle of Lower Saxony, and principality of Grubenhagen, containing 800 houfes, 2 churches, an houfe of orphans, a public fchool, a fmall garrifon, and a mint for coining money, and having near it filver mines; 15 miles S. of Goflar.

CLAUSTRAL *Prior*. See Prior.

CLAUSULA, in *Ancient Geography*, a river of Illyria, according to Livy, who fays that it watered the town of Scodra, on the eaftern fide.

CLAUSUM *fregit*, in *Law*, an action of trefpafs; thus called, becaufe the writ demands the perfon fummoned to anfwer to *quare claufum fregit*, of the plaintiff, why he committed fuch a trefpafs? See Capias.

CLAUSZ, in *Geography*, a town of Germany, in the archduchy of Auftria, 177 miles S.S.W. of Steyr.

CLAUSZNITZ, a town of Germany, in the circle of Upper Saxony, and territory of Erzgebirg; 14 miles S.S.E. of Freyberg.

CLAUTINATII, in *Ancient Geography*, one of the moft turbulent people of Vindelicia, according to Strabo. They are fuppofed to have occupied both banks of the Inn, near its junction with the Danube.

CLAVUM *Veneris*, in *Botany*, a name given by fome authors to the *water-lily*, or *nymphæa*.

CLAVUS, in *Antiquity*, a band, or fillet of purple, worn on the breaft by the Roman fenators and knights, more or lefs broad, according to the dignity of the perfon; from the proportions of which arofe the difference of *tunica anguftíclavia*, and *laticlavia*. See Tunica. This ornament, according to fome, was called *clavus*, *nail*, as being ftudded with little round plates of gold, or filver, like the heads of nails. Cantelius maintains, that the clavus confifted of a kind of purple flowers, fewed upon the ftuff; or interwoven with it. Others will have them to be the buttons or clafps by which the tunic was held together. Some again fuppofe that the latus clavus was nothing but a tunic bordered with purple. Scaliger is of opinion, that the clavi did not belong to the veft, but hung down from the neck, like chains and ornaments of that nature. Rubenius maintains, that the clavi were merely purple lines or ftreaks in the middle of the garment; and that they did not receive the name of clavi in allufion to the heads of nails, to which, as he thinks, they bore no refemblance, but that they were fo called from their being of a different colour from the reft of the garment; for the Romans, he fays, ufed to inlay their cups, and other precious utenfils, with ftuds of gold, or other ornamental materials. Thefe, from their likenefs to nail-heads, they called in general clavi. Hence it was natural to ufe the fame word for denoting thefe lines of purple, or other colours, which were different from the reft of the garment, as thofe clavi were of a different colour and figure from the veffels which they adorned. M. Dacier (in Horat. l. ii. fat. 5) fays, that the clavi were purple galoons, with which they bordered the fore-part of the tunic, on both fides, in a place where it came together. The broad galoons, he fays, made the laticlavium, and the narrow the anguiticlavium. As to the name of clavi, he thinks the ancients gave it to any thing that was made with a defign to be put upon another.

Clavus *annalis*. So rude and illiterate were the Romans towards the rife of their ftate, that the driving or fixing of a nail was the only method they had of keeping a regifter of time; for which reafon it was called *clavus annalis*. There was an ancient law, ordaining the chief prætor to fix a nail every year on the ides of September; it was driven into the right fide of the temple of Jupiter Opt. Max. towards Minerva's temple.

This cuftom of keeping an account of time, by means of fixing nails, was not peculiar to the Romans, for the Etrurians likewife ufed to drive nails into the temple of their goddefs Nortia, with the fame view; and from them it is faid to have paffed to Rome. Liv. lib. vii. cap. 3. We learn alfo from Livy (l. viii. c. 18.) that the Romans recurred to the ceremony of driving a nail into the temple in order to ftop the progrefs of a plague that raged at Rome A.U.C. 389. B.C. 365. The fame ceremony was again employed about thirty years after, by way of remedy againft a ftrange alienation of mind, which was confidered as the caufe of the multiplication of crimes in the city.

Clavus, in *Medicine*, See Cephalalgia.

Clavus *hyftericus*, a term introduced by Sydenham to denote a fevere pain of the head, which is peculiar to

 hyfterical

hysterical women. The pain is circumscribed, and is said to resemble the sensation, which a nail driven into the head might be supposed to occasion; hence the term *clavus*, a *nail*, was adopted. The cure of this species of head-ache, must depend upon the removal or palliation of the original disease, *hysteria*, of which it is a symptom. See HYSTERIA. See also CEPHALALGIA.

CLAVUS, in *Surgery*, See CORN.

CLAWEDOK, in *Geography*, a river of North Wales in the county of Denbigh, which runs into the Clwyd, four miles N. of Ruthyn.

CLAWING, or CLAWING-*off*, in *Sea language*, signifies the act of *beating* or turning to windward from a lee-shore, so as to escape the danger of shipwreck.

CLAWS, among *Zoologists*, denote the sharp pointed nails, with which the feet of certain quadrupeds and birds are furnished.

CLAWS, *Elks'*. See ELK.

CLAWS is also used for a close or small measure of land.

CLAY. In common language, any earth which possesses sufficient ductility when kneaded up with water to be fashioned like paste by the hand, or the potter's lathe, is called a *clay*. In *Mineralogy*, however, the term has a somewhat more extended application, comprehending not only the proper ductile clays, but certain other mineral substances which bear a strong analogy to them. They may be conveniently arranged under the five following sub-species.

1. Subsp. *Pure clay.—Reinethon Erde*, Germ.—*Lac Lunæ* of some authors.

Its colour is snow-white or yellowish-white. It occurs in small kidney-shaped pieces. It is without lustre; its fracture is fine earthy; it is opake; stains the fingers slightly; adheres feebly to the tongue; is fine but meagre to the touch; is very light, soft, and easily frangible. Its component parts, according to a recent analysis by Fourcroy, are,

45	alumine
24	sulphated lime
27	water
4	lime and silex.
100	

It has hitherto been found only at Halle in Saxony, where it occurs very near the surface, and accompanied by gypsum.

2. Subsp. *Porcelain clay.—Porzellauerde*, Germ.

Its colour is reddish-white, passing to yellowish and greyish-white. It occurs in mass and disseminated. It stains the fingers; is for the most part slightly coherent, passing into dusty; is fine but meagre to the touch; slightly adheres to the tongue, and is but of little specific gravity.

A specimen, analysed by Vauquelin, afforded the following result:

55	silex
27	alumine
0.5	oxyd of iron
2	lime
14	water
98.5	

When perfectly pure, it is nearly, if not entirely, fusible in the greatest heat of a porcelain furnace.

It forms beds in geiss, and not unfrequently occurs in granite, occupying the place of the felspar: indeed, it may readily be traced through various states of induration into true felspar; hence it has been considered by some as decomposed felspar, and by others as unformed or imperfect felspar.

The clay employed in the manufacture of the Berlin porcelain, is procured from the district of Magdeburg: the best French porcelain clay (the subject of the above analysis) is dug near Limoges; and the best English porcelain clay is procured from Cornwall: this latter is naturally mixed with quartz and mica, forming a granite, from both of which it is separated by washing.

3. Subsp. *Common clay.—Potter's clay.—Pipe clay.*

Its colour is very various; when greyish-white it is called *pipe clay*; it also occurs greenish-grey, passing into verdegris-green; smoke-grey, passing into yellowish-brown; reddish-brown and brownish-red; or, lastly, bluish-grey, passing into blackish-blue. It occurs massive, or fine slaty, forming veins or beds; these latter, often of great extent and thickness. Its fracture is earthy, passing into uneven or imperfectly conchoidal. It is generally smooth, and somewhat unctuous to the touch; adheres pretty strongly to the tongue, is soft and easily frangible.

When in veins, it generally occurs in primitive mountains, accompanying metallic ores; when in beds, it is usually found in alluvial land, covered by or resting on gravel.

It consists essentially of alumine and silex, but generally contains, besides, a variable proportion of oxyd of iron. Carbonated lime, too, is by no means an unfrequent ingredient, and when this abounds, the clay passes into marl. See MARL.

4. Subsp. *Indurated clay.—Clay-stone.*

Its colours are greenish-grey, bluish, ash, smoke, and pearl-grey, or brownish-red. It occurs in mass; is opake and without lustre. Its fracture is fine grained earthy, passing into slaty, splintering, and imperfectly conchoidal. It adheres but slightly to the tongue; is soft and easily frangible.

When put into water, it falls to pieces by degrees, but even then possesses very little ductility. It occurs in rock masses, in veins and beds, and forms the basis of clay porphyry. It passes, on the one hand, into potter's clay, and, on the other, into jasper.

5. Subsp. *Shale.*

Its colour is smoke-grey, yellowish, ash, or bluish-grey, or greyish black. It occurs in mass. It is dull, but when mixed with mica is glimmering. Its fracture is slaty, approaching sometimes to earthy. It is opake, soft, and easily frangible; it is meagre to the touch, adheres slightly to the tongue. Sp. gr. about 2.6.

It occurs in the independent coal formation, also in the most recent floetz trap and alluvial formations.

It generally breaks down when put into water, and by exposure to the weather it decomposes into a very unctuous and tenacious clay.

Of the above sub-species, the first, on account of its rarity, is made no use of. The second is the basis of the European porcelains, for which it is well adapted, on account of its difficult fusibility, and its hardness and compactness of texture when baked; it is even less fusible than felspar, from the decomposition of which, in particular cases, it certainly originates: but felspar contains a very notable proportion of pot-ash, which disappears during its decomposition, being probably washed away; and to this, no doubt, is owing the greater infusibility of the clay.

The method of ascertaining the goodness of porcelain clay is to knead it into a mass with water, and after having dried it very gradually and thoroughly, to expose it to a full white heat in a muffle; if, after being thus baked, its colour is a pure white, if its texture is compact and porcellanous, and it exhibits no signs of fusion, it may be considered as of the very best quality: but as it generally contains a variable proportion of iron, so its colour will exhibit more or less of a reddish-yellow tinge; and as this prevails, so the value of the clay will be materially impaired. A slight ashery tinge may

may be got rid of in the manufacture, by the addition of a little smalt; but the ware thus acquires a bluish tinge, which, though not very perceptible alone, is sufficiently obvious when compared with porcelain made of pure unsophisticated clay.

The common clays, or those that belong to the third subspecies, may be divided, with regard to their utility, into the three classes of unctuous, meagre, and calcareous.

The unctuous contains, in general, more alumine than the meagre, and the siliceous ingredient is in finer grains: when burnt, it adheres strongly to the tongue, but its texture is not visibly porous. When containing little or no oxyd of iron, it burns to a very good white colour, and is very infusible; pipes are made of it, and it forms the basis of the white Staffordshire ware. If it contains oxyd of iron, or pyrites, sufficient to colour it red when baked (as is usually the case), it becomes much more fusible, and can only be employed in manufacturing the coarser kinds of pottery.

Meagre clay is such as when dry does not take a polish from rubbing it with the nail: it feels gritty between the teeth, and the sand which it contains is in visible grains. When burnt without addition, it has a coarse granular texture, and is employed in the manufacture of bricks and tiles.

Calcareous clay effervesces with acids, is unctuous to the touch, and always contains iron enough to give it a red colour when baked. It is much more fusible than any of the preceding, and is only employed in brick-making: by judicious burning it may be made to assume a semi-vitreous texture, and bricks thus made are very durable.

Any of the unctuous or meagre clays, that are very infusible and contain but little iron, may be employed in making crucibles, and other similar chemical vessels, that are required to stand a powerful heat.

Clay, in *Agriculture*, a soft, earthy substance, of an unctuous and tenacious quality, and which is found in a native state in different situations. It has been remarked by Dr. Fordyce, to form a tenacious mass when mixed with water, which hardens upon drying, and does not diffuse so readily in water again as sand; and that if a mass of it be heated red hot, it becomes hard, and burns to a brick, resembling crystalline earth in its properties. It is also found that soap-earth agrees in its properties with clay, of which it is a species, only it is much more diffusible in water, separates from it with greater difficulty, is of a smoother texture, and has finer particles. It is a substance that by culture becomes more diffusible in water. The earth or soil consists chiefly of strata of substances, in which the clay and crystalline earth are sometimes found pure, but more commonly there is a mixture of the two; and it is seldomer that pure clay is found than pure sand. It has been remarked by Lord Dundonald, that this kind of matter forms not only a large portion of the surface-soil of most countries, but it is also found in the mineral strata to an immense depth; that argillaceous matter, or clay, is no where found pure, but is more or less adulterated with other earths, and with different materials, such as mineral, vegetable, and animal substances. And that the purest clay contains upwards of sixty per cent. of siliceous matter, or sand.

It is the earth most retentive of moisture, by which it becomes ductile and tenacious, and loses these properties by the action of fire, or by being burnt. According to Mr. Kirwan, it is of various colours, as white, grey, brownish red, brownish black, yellow, or bluish; it feels smooth, and somewhat unctuous; if moist, it adheres to the fingers, and if sufficiently so, it becomes tough and ductile. If dry, it adheres more or less to the tongue; if thrown into water, it gradually diffuses itself through it, and slowly separates from it. It does not usually effervesce with acids, unless a strong heat be applied, or that it contains a few calcareous particles, or magnesia. It consists of argill and fine sand usually of the siliceous kind, in various proportions, and more or less ferruginous matter. The argill, according to him, forms generally from 20 to 75 per cent. of the whole mass; the sand and calx of iron the remainder. These are perfectly separable by boiling in strong vitriolic acid.

It is remarked by Dr. Darwin, in his "Philosophy of Agriculture and Gardening," that the too great adhesion of the particles of argillaceous earth, or clay, renders it, in its pure state, unfit for vegetation; as the tender fibrils of roots can with difficulty penetrate it; whence it becomes much improved for the purposes of agriculture, when it is mixed with calcareous earth and with siliceous sand, as in marl. It is commonly believed, he also says, that lumps of clay become meliorated by being exposed to frost in its moist state, which, by expanding the water which it contains, by converting it into ice, is supposed to leave the particles of the clay further from each other. This, however, he says, seems in general to be a mistaken idea, since, if the act of freezing seems to occur, as noticed by Mr. Kirwan in his "Mineralogy," vol. i. p. 9, who observes, that clay, in its usual state of dryness, can absorb two and a half times its weight of water without suffering any to drop out, and retains it in the open air more pertinaciously than other earths, squeezing out its water, and thus parting with more of it than other earths. This curious circumstance, that water as it crystallizes detrudes the clay which is diffused in it, corresponds, he remarks, with other facts of congelation. Thus when wine, or vinegar, or common salt and water are thus exposed to frosty air, the alcohol, the acetous acid, the marine salt, and the calx of copper, are all of them detruded from the aqueous crystals, and retreat to the central part of the fluid, or to that last frozen, or into numerous cells surrounded with partitions of ice, as he has frequently observed; whence it appears, that wet clay is in general rendered more solid and tenacious by being frozen, as well as when it is dried, and its moisture exhaled by too warm a sun, and by both those circumstances becomes less adapted to the purposes of agriculture. In most clays a kind of effervescence occurs, after they are turned over and thrown on heaps, and thus acquire air into their interstices, which renders them much fitter for the purposes of vitrification, and thus forwards the processes of the brick-kiln and pottery. This greater facility to vitrify, is probably effected by the union of oxygen with the iron, which most clays contain; as oxydes of lead and manganese are used in the more perfect vitrifications. When the clay abounds with vitriolic acid, so as to be converted into alum, it becomes very unfriendly to vegetation.

It has been found in practice, that vast improvement in many of the lighter sorts of soil may be effected by the use or application of clay upon them. And Mr. Rodwell has experienced great improvement from it on the poorer sorts of sandy soils, which are very loose, and even on black sands. See Claying *of Land*.

It has also been remarked by Mr. Young, in speaking of marl, that when that substance "is not to be had, clay in many places is to be found at a moderate depth. This manure has," he says, "few of the properties by which marl is to be known, but yet it works wonderful improvements on many soils. In some light lands it has been preferred by many good farmers to indifferent sorts of marl; and this preference has been the result of attentive experience. But," continues he, "the great point concerning clay, is not so much the comparison with marl, as the use of it where no marl is to be had. On all light sandy soils it should be used with a confidence of success; for the precedents of its good effects are so numerous, that we cannot have a doubt of its excellence. About sixty or seventy loads an acre, at the same

expence

expence as of marl, will work an improvement great enough to shew how much mistaken those men are who think nothing but the finest marls worthy of attention; and upon heavier soils, as wet loams, brick earths, upon clay, and loose hollow soils, that want a firmer texture, clay is an excellent manure; but there are vast tracts of such land that cover very fine veins of clay, and yet farmers know nothing of the use of it. It is much to be regretted," he thinks, "that their landlords do not give them a juster idea, by being at the expence of claying some small fields until the benefit of the improvement becomes conspicuous."

Clay-*Balls*, in *Mineralogy*, are the name by which, in some places, the stony nodulous fossils called *Ludus Helmontii* are known. These are usually reckoned among the extraneous fossils, and are found of various sizes from four or five inches to almost as many feet in diameter; they are usually flattened irregularly, and appear externally, like masses of soft matter kneaded or moulded imperfectly together; their internal substance is cracked, apparently by the shrinking of their substance in drying or hardening, and the joints or septa are more or less coated or filled with spar, often of a waxen colour, whence this fossil is sometimes called *Septariæ*, or *Waxen-vein*. Clay-balls are found in many of the British clay strata, and are usually lodged therein with the utmost regularity, like pavement, often touching each other, as is the case with two remarkable layers of this fossil near the top of the clay on which London stands. In the cutting of the Grand-Junction canal from Paddington towards Uxbridge, and the Croydon canal from Deptford towards Croydon, these layers were cut through and exposed in a very complete manner for examination, for great distances together; they are sunk through in all the wells near London, where the clay stratum is complete, or where none of its upper part is abraded or washed away. Sometimes a small spring of water ouzes out of these layers of clay-balls, and the same is found to possess mineral qualities, and they are, we believe, the source of most or all of the mineral springs in the immediate vicinity of the metropolis. When exposed to the air, rain, &c. clay-balls soon split, and fall into an ochry powder, and at length mix with the soil; but the spar occupying the septa is sometimes very durable, and remains entire after the substance of the ball is mouldered away. An important use was a few years ago discovered for these curious nodules, in the manufacture of a cement for water-works and stuccoing of buildings, for which Messrs. Parker and Co. of Bankside, London, have a patent; they call it Roman cement, and the same is now largely used in the construction of the walls of docks, reservoirs, &c. and for imitating stone-work in buildings; the new door-cases to the Treasury-Chambers, in Whitehall, are a specimen of the valuable qualities of this cement, the same having been applied, in very thick layers at once, during an intense frost a few winters ago, and yet it set immediately, and stands the weather as perfectly as the best stone. The front of the House of Lords, and many other buildings in Westminster, are now covering with this cement, under the direction of Mr. James Wyatt, who has applied it with effect on the new palace at Kew, and in some additions and repairs at Windsor Castle. It is not certain that all the clay-balls, lodged in the different clay strata, are exactly similar in their composition, or adapted to the manufacture of cement; where, however, they can be had in plenty, it may be worth the while of the owners of the soil to procure their analysis and trial. See Ludus Helmontii.

Clay *Castle*, in *Geography*, is situate about a mile S.W. from Youghal, in the county of Cork, Ireland, where the pieces of the bank that break off and are washed down by the sea, are by degrees petrified into a hard firm grit. This is composed of a mixture of fine sand, and a yellow clay tempered by the sea water which beats against the hill. Wood and several other things daubed over with this clay are petrified on the spot. Smith says, there is a similar petrification at Harwich in England. Smith's Cork.

Clay-*Farms*, in *Agriculture*, such as have the lands either wholly or in a great part of a clayey quality. There are many extensive tracts in different parts of the kingdom where this sort of land prevails, and which have been often cultivated to much disadvantage from the want of a due mode of cropping, and their not having of course a sufficient proportion of green winter food for the support of the requisite number of live stock, and the raising of the necessary quantity of manure. It has been suggested that these inconveniences may be fully obviated by having recourse to the cabbage husbandry. See Cabbage and Farm.

Clay *Hill*, or Copt-Heap, in *Geography*, a remarkable eminence on the south west branch of the grand ridge of England, about two miles W. of Warminster, and near the edge of the Chalk strata. The situation of the barrow or tumulus on the top of this hill was determined in the government trigonometrical survey in 1794, by an observation from Beacon-Hill station, distant 117,216 feet, and bearing 85° 54″ 8″ S.E. from the parallel to the meridian of Dunnose; and another from Wingreen station distant 84,554 feet; whence is deduced its latitude 51° 12′ 13″, and its longitude from Greenwich 2° 13′ 25″.8 W. or 8ᵐ 53ˢ.7 in time.

Clay-*Mill*, a machine used by the brick-makers near London for tempering their clay. In *Plate* XII. *Mechanics*, are represented two of these machines. In *fig.* 10, which is the most common, A B is an upright shaft turning on a pivot at the lower end, which works in a brass socket let into a piece of wood lying on the ground; the upper end has a similar pivot, the brass is fixed in the intersection of two beams, C D, of the frame; these beams are supported by four uprights at their ends, which are firmly fixed in the ground; the whole is braced together so as to form a very steady frame for the shaft A B to turn round in. E, F, G, H, are four arms mortised in the shaft somewhat below the middle, supported by braces from the upper part of the shaft, and connected together by four braces in the form of a square; the two arms, E, F, are longer than the other two, and have hooks, by which the horses draw, fastened to them. They have also each two irons, *ab*, *ab*, attached to them, whose lower ends work at the sides of a circular trough or ditch, KK, which is concentric with the shaft A B, and walled with bricks. The ends of the levers, G, H, carry harrows, L, M, (*fig.* 11.) working in the same trough; these harrows are sometimes fixed to the arms, as at G, by three struts, and sometimes they are connected with the levers by four chains, and loaded with heavy weights, as at H, and better explained in the following figure.

When the machine is in use, a quantity of clay is thrown into the circular trough, K K, which is about one-fourth filled with water by a pump, the trough from which is laid under the horse-walk. The horses are then put to the ends of the levers, E, F, and set in motion; as they turn the machine round, the harrows, L, M, drag the clay round, in the trough, and by agitating it in the water, soon dissolve part of the clay, forming it into the consistence of thick mud; as the horses continue to work and more water is added, the whole mass is thoroughly incorporated; a sluice, N, is then opened which allows the clay to run out into shallow pits, which are dug in the ground at some distance round the mill, and a little below its level; in these pits the clay is suffered to remain until the greater part of the water is evaporated; it is then dug out and carried to the brick-maker. The pump for

for supplying the mill, is in general worked by a man, but in the machine before us, it is worked by the mill; at the upper end of the shaft, AB, *fig.* 10. a wheel, P, is fixed, which has wooden projections nailed to it; these take the end of a lever, Q, moving on an iron bar, *d*, as a center; the weight of the lever is supported by a friction-wheel running on an horizontal bar R, fixed to the frame-work above; the lever, Q, has a rod, S, jointed to it near its end, which is supported by a frame, T, fastened to one of the upright posts, the end of this rod is jointed to one arm of a bent lever, the other arm of which has the pump-rod of the pump, O, hooked to it. As the horses turn the wheel its teeth move the end of the lever Q with it and raise the pump-rod; when the tooth quits the end of the lever the weight of the pump-rod pulls back the lever to its original position, ready for the next stroke; by this contrivance a constant supply of water is easily procured, and, by preventing the descent of the pump-rod, the pump-work is stopped when there is water enough. The iron bars, *a b*, *a b*, are intended to remove the clay which may get to the sides of the trough KK, and by that means escape the harrows.

The machine represented by *fig.* 11, though not so common, is much more simple in its construction. A is a stout post firmly fixed in the ground; it is hooped at top, and has a brass socket in the centre to receive the point of an iron pin, *a*, which goes through the intersection of two levers, EF, GH; this pin has a cast-iron plate, *b*, fastened to it, that is bolted to the lever, so as to connect them together. I, I, I, I, are four braces to strengthen the cross. O, O, O, O, are four other braces which carry a circular ring, R, and the whole is strengthened by four long screw bolts *d, d, d, d*; this ring fits the post loosely, and when the horse turns the machine it moves as steadily as the former machine; the harrows and the circular trough are the same. The two preceding machines are used, in those places where the clay used by the brick-makers is not very clean, but has many stones and other extraneous matter among it, as they sink to the bottom of the circular trough, and remain there when the clay is drawn off. Where the clay is naturally sufficiently pure, and requires only to be tempered, a different machine is used; it consists of a cylindric tub about three feet diameter and four feet high, in the centre of which is a vertical spindle, the lower end working in a brass socket at the bottom of the tub, the upper end turns in a collar supported by two iron bars nailed to the sides of the tub; at the top of the spindle, above this collar, a long lever is fixed for the horse to turn the spindle by; the upright spindle has six or eight arms fixed perpendicularly to it in different planes, working within the tub; these arms have spikes projecting from their upper and under sides, the tub has a small trap door in the side, near the bottom, which can be kept closed by a hasp; the clay is thrown in at the top of the tub, and the horse made to turn the spindle, the arms and the spikes fixed to it, cut the clay in every direction and mix it thoroughly, water being added in the proper quantity. When it is sufficiently ground the door at the bottom of the tub is opened, and, as the horse turns, the clay is thrown out, and carried to the brick-maker.

Clay-*Stone*. See Clay *indurated*.

Clay *Strata*, in *Mineralogy*. The recurrence of clayey strata, in the sinking of deep wells, and shafts for mines, in England, is more common than those of any other matter; and since the discoveries, and meritorious labour of Mr. William Smith, on the stratification of these islands, have been known among the circle of his friends, opportunities have offered, of ascertaining the peculiarities of the organic remains most commonly lodged in these strata. In the south-eastern part of England, or uppermost parts of the series of British strata, these are, cornua ammonii, belemnites, corallines, or coralloids, entrochi, gryphites, bituminous wood, &c.; at the same time that ludus helmontii, iron-ore, or ochre, pyrites, selenite, or gypsum, mica, &c. are not unfrequently found lodged in these clay strata.

The uppermost, or first clay stratum (or rather assemblage of clay strata) in the British series, is that on which the metropolis of the British empire and its environs stand; its upper part is red, and very tenacious when wet, forming perhaps one of the worst strata for cultivation, in England; which, but for the great population thereon, and consequent opportunities of obtaining manure, for a series of ages back, would probably, to the present day, have been in a similar state to the wastes or commons, with which the vicinity of London has been so often reproached. Near the top of this stratum, there are two remarkable layers of clay-balls, or ludus helmontii, as observed under the article Clay-*Ball*, and lower down, pyrites, and other fossils; a layer or stratum of sand, containing black particles, occurs near the bottom of the London clay strata, which, in the sinking of wells, is sometimes found nearly dry, and at others produces a spring of unpalatable water. Beneath the London clay strata, a thick sand stratum is found, resting upon the chalk strata, and, by means of the numerous and large cracks and fissures in the *chalk*, the sand is supplied with a most powerfully pent or confined spring, which often rises near 250 feet, on the sinking of a well, through the clay strata above mentioned, and runs over the surface, as in Mr. Vulliaumy's well, near Kensington Gravel-pits, described in the "Philosophical Transactions" for 1797, and many others in and near London, which have been sunk within a few years past. Near the bottom of the London clay strata, there are layers, or strata, of smooth, flat, and round chert pebbles, of uniform sizes, which do not appear to be worn or rounded fragments of a chert rock, but nodules, many of them consisting of concentric layers, originally formed, of the particular sizes in which we now find them.

The next clayey stratum in the British series, is found beneath the chalk strata; from its white colour, it is denominated chalk-marl in many places; when overflowed, and kept wet, by springs from the edge of the chalk strata, as at the foot of the chalk hills N. of Dunstable, this chalk-marl is very tenacious and barren; but where its out-crop is dry, as on the south side of the North Downs, near Ryegate, Godstone, &c. or the north side of the South Downs, as at Clayton, Plumpton, &c. its surface forms very good land, particularly for wheat; while the inner parts of it are, in such situations, disposed to harden into a substance almost like stone, in thin laminæ. Cornua-ammonii, shark's teeth, and a curious variety of extraneous fossils, are found in this chalk marl, of which we hope that the publication of Mr. Smith's intended work, will enable us to give a more detailed account, under the head of each fossil, as we arrive at the same in the progress of our work.

The next considerable assemblage of clay strata which we meet with in the British series, has a remarkable stratum of red potter's-clay on its surface, on which there is a variety of tile and pottery kilns in Sussex, beneath which a whitish tenacious clay is found, and therein a thin stratum of lime-stone, called Sussex marble, in many places where it is used, particularly in the slender grouped pillars of Gothic buildings, like Westminster Abbey; this thin and curious stratum of lime-stone, consists almost entirely of a congeries of turbinated, or perriwinkle-like shells, of very uniform sizes; in some specimens these are all smaller than pease, and in others they are of the ordinary size of perriwinkles; whether these are the produce of different beds in the same stratum, or whether a thickness of clay separates them, we have not yet been able to to ascertain. This subject we must, for the reason above stated, resume on future occasions.

The most usual vegetable productions found upon clay strata, are of the following genera; *viz.* in wet situations, carex, juncus, schœnus, aira, orchis, carduus, poterium, salix, &c. while, in dry situations, the following prevail, *viz.* primula, arum, rhinanthus, orchis, poa, rosa, rubus, prunus, acer, quercus, &c.

CLAYE, in *Geography*, a town of France, in the department of the Seine and Marne, and chief place of a canton in the district of Meaux, 2½ leagues W. of it. The place contains 1007, and the canton 10,725 inhabitants; the territory includes 195 kiliometres, and 25 communes

CLAYES, in *Fortification*, are wattles made with stakes, interwoven with oziers, &c. to cover lodgments.

CLAYETTE, La, in *Geography*, a town of France, in the department of the Saone and Loire, and chief place of a canton, in the district of Charolles, 3½ leagues E.N.E. of Marcigny. The place contains 1089, and the canton 10,887 inhabitants; the territory comprehends 202½ kiliometres and 17 communes.

CLAYEY Land, in *Agriculture*, that sort of lands in which the clayey ingredient is more or less abundant, and which differs very materially in proportion to the nature and qualities of the clay, as well as the quantity in which it enters into their composition; some being extremely sterile and unproductive, while others are capable of affording an abundant produce of different kinds of vegetable crops.

According to the observations of the very intelligent and able author of the "Treatise on the Connection of Agriculture with Chemistry," there is no clayey land or soil that is pure and free from sand; and there are but few clays that are free from a mixture of calcareous matter, magnesia, vegetable and animal matters, mineral oil, and other mineral or metallic substances; some clays are of a much more unctuous, and, as it were, greasy nature than others. They do not differ more in this respect, than they do in the appearance they assume, when submitted to a moderate degree of heat. Those clays which are the most unctuous and greasy to the touch, are, by calcination, changed to a black colour. This must be owing, either to their containing animal or vegetable matter, although, previous to calcination, it escapes observation; or, the inflammable matter in the clay may exist in the state of a colourless mineral oil, adhering obstinately to the clay, and not capable of being separated from it by water, with which oil can hold no union; yet capable of being changed into a black carbonaceous matter by the action of fire. A due mixture of clay, serves the important purposes of retaining in the soil the attenuated vegetable and animal substances, as also the mineral oil. Of this description are those clays, or clayey loams, which have been deposited by the sea, or muddy streams, containing a considerable proportion of the exuviæ, or remains of animal and vegetable bodies, in an extreme degree of attenuation. Such lands as these are the most permanently fertile, and, where the climate is favourable, produce the heaviest and best filled grain. He further states, that soils, formed by depositure, for the most part contain a sufficient quantity of calcareous matter. Adding lime to such lands may prove injurious, by its expending, taking up, or otherwise altering the arrangement and combination of the animal and vegetable matters, which should carefully be preserved for succeeding crops. Under any circumstances, lime should, he thinks, be given to such soils but sparingly. But there are clayey soils containing little or no animal, vegetable, or bituminous matter, and which are equally deficient of calcareous matter, consisting only of clay, sand, and the earth of iron. To improve and render fertile a soil of this description, is truly an Herculean task, and will seldom repay the industry of the cultivator, unless situated in the neighbourhood of a town, where more dung may be procured than can be spared from the farm in its contiguity. A soil of this nature can receive little or no benefit by the application of lime, as it contains nothing for the lime to act upon or combine with. When under such circumstances, that dung, or such like manure, cannot be procured, a preparation of peat, with a very moderate proportion of lime, seems to be the next best application. A soil of poor lean clay, such as above described, will, he says, require 8 tons of lime, and 48 tons of peat, for one dressing. Doing things partially can never answer; this quantity is the least that ought to be applied; a much greater may be given, if the articles can be cheaply and easily procured. In this the farmer must be regulated, in a great measure, by his ability in doing, or extent of his capital. His primary object, in this case, should be to promote the growth of pasture grasses, because the land or soil at first will be in no heart to produce crops of grain; and, secondly, because the promoting of the growth of such grasses, and judiciously depasturing and folding, is the surest way of improving such lands. After the grass has taken hold of the ground, and is beginning to carry a tolerably thick sward, its thickness and quality may be greatly improved, by some one or more of the top-dressings, or preparations, recommended under that head. See Top-Dressings.

It is evident that clayey lands are therefore as different in their natures as in their colours. Some of them are so obstinate that it is scarcely possible to subdue them. Others are so soft and unctuous, as to be easily reduced to a proper state for nourishing plants; while others, again, are so hungry, as to absorb in a short time whatever kind of manure is applied, without either materially altering the nature of the land or soil, or improving the crops. Clay being, as has been seen, a solid compact body, and its particles adhering firmly together, it does not easily admit water, although capable of receiving a large quantity, nor does it part with it but by slow degrees. When dry it is hard and dense; and the more rapidly water is drained off or exhaled, the harder it becomes, frequently opening into small chasms or rents, when suddenly dried. As clay, from its tenacious quality, retains water longer than any other soil, the roots of the plants, in a rainy season, are frequently soaked in water for a considerable time, and the plants themselves, if not entirely destroyed, are so chilled and weakened as to produce very indifferent crops. On the other hand, from the natural closeness of its texture, added to the circumstance of its hardening very quickly and to a great degree when the moisture is suddenly extracted, the plants in a dry season are prevented from extending their roots in search of nutriment; while the dews and light summer showers, so essential to the growth of all vegetables, and which easily penetrate the more friable soils, are repelled by the clay, and again exhaled by the influence of the sun. From this account of the nature and properties of all clayey lands or soils, it is scarcely necessary to mention the great importance of keeping them as dry as possible at all seasons, especially during winter. When that is properly attended to, the farmer has it in his power to plough and sow on the first return of favourable weather in the spring, as thereby, in a great measure, he avoids the risk of his crops suffering either from heavy falls of rain, or a long continued season of dry weather, particularly the latter, for when a clayey soil is reduced to a proper state by the harrows and rollers, after the seed is sown, it very seldom happens that the crop sustains any material injury from the want of rain during the remainder of the season. But although the nature and properties of clayey lands be such as above described, yet, by industry,

industry, and the application of such manures as are best calculated for correcting their bad qualities, and for bringing those most favourable to vegetation into action, this sort of land is often made to produce abundant crops, of many different kinds.

But clayey lands, of whatever kind they may be, the author of the "Synopsis of Husbandry" thinks "require a more laborious exertion to reduce them to a fineness necessary for the purpose of husbandry than any other soils, and are distinguished under various names, arising from the colour; but the intrinsic good or ill quality of this soil depends not on these vague distinctions, but on the proportion of sand intermixed with it; and where this ingredient is happily blended with the clay, and where the soil is of a reasonable depth, and the springs do not rise too near the surface; when these several good qualities are united, there are few soils more kindly for the several purposes of husbandry; and though in their cultivation the clays may require a greater strength both of horses and tackle than any other, yet, on many accounts, they deservedly claim the preference either to a chalk, gravel, or sand." Of this kind, he observes, are the lands in the wealds of Kent and Sussex; and he knows of no part of the kingdom where the several purposes of husbandry are more effectually answered than in these counties: the size and fatness of the beasts evince the fertility of their pasture, whilst the luxuriancy of its several growths of hops and corn proclaim the superior goodness of the arable land; and the large spreading oaks are a demonstrable proof that it is kindly to the growth of timber. But there are other kinds of clayey soils which, being by nature so stiff and tenacious as not to be meliorated either by tillage or manure, bid defiance to the most skilful plan of husbandry, and can never be brought to yield a sufficient quantity of earth to heat the seed, unless in a season the most propitious; and even with every advantage that can attend it, this ground will fail to produce a crop by any means adequate to the pains and expence required in working it; so that it demands some judgment to discriminate the various kinds of clays, which, though they all rank under the same general denomination, do yet differ most essentially in their properties. Those of the more sterile kind are rarely of any considerable depth, having a bed of gravel for the under stratum, and are generally within a near proximity to the springs; for this kind of land being always overcharged with wet, or parched with drought, and therefore subject to accidents which it is seldom in the power of the husbandman to foresee or prevent, is, on these accounts, inferior to most others: whilst clays of the first denomination are deservedly ranked, as has been observed, among the most fertile soils. To determine the goodness of a clayey soil, one should have recourse, he says, to the appearance of the trees, corn, and other vegetables: the prosperous growth of the trees and hedges, the flourishing state of the corn, and the verdure of the meadow-land, are favourable omens; whilst the stunted appearance of the trees, thin crops of corn, and short grass, are plain indications of the poverty of the soil.

"In the business of tilling this kind of land, the renter will act wisely," he says, "in providing himself with stout and able horses, strong ploughs, and other instruments of husbandry; and his hinds, likewise, ought to be those of the most hardy breeds. Of the many different kinds of ploughs now in use, there are none better adapted for working these stubborn grounds than those commonly distinguished by the name of swing-ploughs: these are constructed without wheels, and the horses draw singly, following each other in the furrow, in both which respects this plough claims the preference to wheel-ploughs, where the horses, by going a-breast, tread the ground much more than in the former instance; though in Kent the farmers usually work their stiff land with the common turn-rest, or, as it is vulgarly called, turn-rise plough, which is made far more weighty than the Hertfordshire or any other wheel-plough; and, from the circumstance of turning the rest at the end of every furrow, is not chargeable with the defect before mentioned, of subjecting the fresh ploughed ground to be trodden by the horses. In some counties they till their stiff lands with a foot-plough, which, by means of the iron that is let into the beam, and rests in the furrow, works with more steadiness than the swing-plough, but in the other parts of its construction nearly resembles the last-mentioned instrument. As most of the ill qualities attending the soil originate in its adhesive nature, every art should be made use of to meliorate and pulverise the stubborn clods, so as to reduce them to that degree of fineness necessary for the purpose of vegetation."

"And in the practice of winter-fallowing a clayey soil, let," says he, "the ground that is proposed to be sown with oats or beans in the spring, be fallowed up as soon as possible after the wheat season is finished, and be careful that the lands may not be made over-large; perhaps five bouts or wents may be a proper size, so that each land may measure about half a rod over; but this is to be determined by the nature of the soil and the locality of the situation. It has been shewn already, that clays differ essentially from each other, and hence it seems of consequence, at the fallowing of those which are of the wet, spewy kind, to lay the ridges in such manner that they may be least incommoded by the winter rains; whereas, in those of a moderate texture, and which are less inclined to moisture, this caution is not necessary, but to guard against the contingency of moisture during the winter, by laying the land as dry as possible, is a point to be attempted by all possible means on every different description of this soil. The ground having been thus fallowed at an early season, and having partaken of the benefit of the winter frosts, will generally work kindly towards the middle of February, which is the proper time for planting beans on clays. For oats, perhaps, three ploughings may be required, provided the season be favourable for performing them; for, in a very wet spring, it may be more prudent to dispense with one ploughing, and to sow after the first stirring in April; but if the weather be kindly, it will be advisable, when the bean season is finished, to stir such ground as is intended for oats; and this fallow, having enjoyed the benefit of the March winds, will work well at the second stirring in April, the proper time for sowing oats on stiff lands. The ground having been thus managed, will come in for beans the next year, or be in a state of tillage proper to sow with clover, which generally suceeds well when cultivated on these soils; and fields which were put in with beans, if the ground be in good heart, will come in for a wheat season at the following autumn. And this shews how necessary it is for a farmer to look forward, in order that his land may not only be well prepared for the growth of the present crop, but be in readiness for the reception of a different grain in the following years."

In fallowing for wheat in clayey lands, it has been already observed, he adds, that "wheat might very properly succeed a crop of beans on these soils, a method which is generally pursued in Kent and Sussex; but where the land is of a very stiff nature, it is absolutely necessary to give it a summer fallow once in four or five years or oftner, according to its goodness, by which method its adhesion is destroyed and the pores are opened for the admission of the sun, air, rains and dew, all of which abound with such principles as may

may contribute, in a high degree, towards the melioration and fertility of the soil. The proper time to fallow for wheat, on a clay, is in the month of April, as soon as the lent season is finished; and if the weather will permit, the stirring should be effected in May, and this is sometimes all that can be done to the field till after the rains in August; for, should a dry time happen in June, it will be impracticable to work the land, it having been rendered so hard as to preclude the entrance of the plough, or if this can be effected, the surface will, in this case, break up in such large clods, and withal so shallow, as to render the tillage of little worth; but should the weather permit, it will be proper to give the ground a second stirring in June, and to lay the fields in ridges; for in such form the soil will more conveniently imbibe the various influences of the atmosphere, than in broader lands. The number of ploughings throughout the summer depends so much upon contingencies, that no stated rule can be laid down upon that head; for if the weather be either too wet, or tending to the contrary extreme, this work of the more obstinate kind of clays will be wholly impracticable, and on this account, the farmer is frequently disappointed of a wheat season; but on clays which are less adhesive, and where the land has been conducted in a husbandlike manner for a series of years, there is not so much hazard of being thrown out at the wheat season; and a time generally offers for sowing the corn between the latter end of August and the beginning of October, which is the latest term to which the sowing of this grain ought to be protracted on these heavy lands. If the weather shall have been kindly throughout the summer, the land will have been stirred at least twice during that period: and thus with the fallowing, and the last ploughing at seed time, the ground will have been four times ploughed, which will most probably have reduced it to a degree of fineness proper for the reception of the wheat, after which the field should be sufficiently harrowed, so as to cover the corn to a proper depth."

And it is observed, by the practical author of the "Present State of Husbandry," that "the manures most proper to be applied to these lands, are lime, chalk, sea-sand, and ashes. It appears, he says, from the accounts given by those chemists who have analized these substances, that they are admirably calculated to correct the stubborn density of clay, so as to render it more easily reducible by the plough; to open its pores, so that it may more readily imbibe and transmit water; and that they operate as a powerful stimulus, and some way or other dispose whatever principles in clayey soils are friendly to vegetation, to exert themselves. Long and established practice confirms this observation: lime, for instance, has been applied to these soils for many years in the counties of Durham, Gloucester, Hereford, Montgomery, Berwick, Stirling, Perth, and many other districts where such soils prevail. Chalk is used both in its natural and calcined states, in Hertford, Middlesex, Essex, Kent, Wilts, and other southern counties. Sea-sand is employed as a manure in Cornwall, Devon, Pembroke, Anglesey, Caernarvon, and also in several districts in Scotland. Coal-ashes, in the neighbourhood of London, are laid with astonishing success on clayey-soils, whence brick earth has been taken. Peat ashes have produced wonderful effects in Berkshire; and ashes of both kinds are used to great advantage, as a top-dressing on the strong soils, in all those counties where that practice is established. Besides these manures, composts, especially when formed chiefly of light sandy, or gravelly earths, with lime and chalk, are also applied to clay soils with success in many parts o fEngland. Few composts being made on the better cultivated clayey soils in Scotland, the common method is to lay on farm yard dung, the same season in which a field is limed; by adopting this practice the lime is found to operate more rapidly, and at the same time more powerfully."

It has been remarked by lord Dundonald, that "there is a great extent of poor clayey land or soil, similar to that which has been mentioned, in many parts of the north of England and in Scotland for the most part lying at a considerable height above the level of the sea; and frequently in the vicinity of peat mosses in the county of Lanark, or Clydesdale, he says, there are computed to be 40,000 acres of peat-moss totally unimproved, producing nothing itself nor contributing in any way to the fertility of the adjacent poor lands, which are as destitute of vegetable matter, as the moss contains a superabundance. It requires a much longer time, and a much greater application of dung and vegetable matters, than would be generally believed, before poor lands of this description can be rendered highly fertile, and made in all respects, similar to land that has been long, or for ages under cultivation. Ten times the quantity of peat, or vegetable matter, recommended to be given at once, or 480 tons would scarcely bring poor barren land to the colour of rich black mould, known in Scotland by the name of infield-land, and to which, for ages, the dung of the farm has been exclusively applied. Experiments made with an intimate mixture of poor lean clay and peat warrant this assertion; here purposely stated, he says, that the over sanguine cultivator or improver of ground may not imagine, that with a summer fallow, and a dunging or dressing or two, he may be enabled to complete so arduous a task. Land is always requiring a supply of manure, and repays, in general, more abundantly for the last expence when brought to an advanced state of cultivation, than for that which at first is incurred. Both seed and labour are thereby saved, and good crops, with much more certainty, are to be depended upon."

"Paring and burning the sward of some clayey soils, he thinks, may be practised with advantage, as the burnt clay will diminish the stiffness of the soil, and render it more pervious to water. This may be still more economically effected, and in other respects, with less injury to the soil, by half burning the clay, in clamps or in kilns: a preference which can however only be given in situations where fuel can at a cheap rate be procured for this purpose." See Burnt *Clay*.

Mr. Donaldson says, that, "while it may be admitted, that, by the application of such manures and proper cultivation, clayey lands are made to produce, occasionally, luxuriant crops; to every person acquainted with these soils, it must be obvious, that the crops are, upon the whole, more precarious and uncertain than those on deep fertile loams, and other similar soils or sorts of land. And the natural produce of clay-lands, with regard to weeds, is rushes, goose-grass, or wild tansey, large daisies, thistles, docks, May-weed, poppies, and other coarse herbage of a similar kind."

The following is the method of improvement that was employed in the bringing of a tract of ninety-three acres of clayey-land which had remained long in an uncultivated state into a proper condition, in order to lay it to grass, as practised by Mr. Best, and stated in the fourth volume of "Communications to the Board of Agriculture." "These lands," says he, "since the memory of man, were let at 18 *l.* per annum: from this sum they increased, owing to the advance of the times, to 22 *l.* 5 *s.* which is the most they were ever let for." In the year 1788, he began on a field of eight acres, by employing some men to take up brambles, furze, and other natural incumbrances, with which

which two parts in three of that field were covered; in the winter he had it under-ground drained. This, he thinks, is the first step which a farmer ought to take, before he converts his land to tillage. He laid the top turf on two shoulders, about sixteen inches deep, leaving a channel open under, which got the land very dry, and so it continues. The expence of draining, when he first began, was about 30 *s.* an acre, but now it is near 40 *s.* In December, 1790, he ploughed the whole of this field, and in the February following, spread about ten tons of well-mixed dung and earth over every acre. In April he sowed it with flax; this is a crop that requires, (particularly in strong land, which this is, being on a strong clay, with some spots of flinty gravel), in its early part, at least twelve hours rain in every week. Unfortunately for him, he had not half rain enough; consequently, that crop failed. He then made as good a fallow, as the nature of the land and the season would permit. At Michaelmas, 1791, he sowed it with wheat, which produced about eighteen bushels (single Winchester) per acre. As soon as the ground was cleared of the wheat, it was ploughed and sown to vetches, of which he had a great crop; he fed these off with sheep in the spring, 1793, and the ground which they cleared by day they lay on at night. After the vetches were all eaten, he made a very good fallow, and, in September, dressed it over with ten hogsheads of lime (which cost 1 *s.* 6 *d.* per hogshead), per acre, which he had, in the month of May, mixed with the head-lands well together. About Michaelmas, he sowed it with wheat again, and had too great a burden; for, in the month of May, 1794, he was obliged to have a man with a keen reap-hook, to cut off all the luxuriant blades, the ear not having made its appearance. This precaution, however, did not fully answer his purpose, for a great part of the crop was thrown; notwithstanding, he had full twenty-five bushels per acre. He then made a fallow, and, in the spring 1795, sowed the field with white oats and grass-seeds of different sorts, *viz.* rye-grass, cow-grass, Dutch clover and hop. The oats were very thick and long; in consequence of which, the grass-plants in some places did not thrive; for, in spots of five or six feet square, there was no appearance of any. He had eight quarters of oats per acre. He fed the grass with sheep the years 1796, 1797, and till August, 1798, when he again ploughed it, and dragged in some vetches. He had a great crop, and, in the spring 1799, fed it off with sheep, folding them on the ground as they eat the vetches. When this was done, he made a fallow, as good as a wet summer would admit of, and sowed it to wheat again, at the usual season, without any additional manure, and had about twelve bushels per acre, a good crop for this year, some lands in the neighbourhood not producing more than six or seven. The acre in this county is customary measure, not statute.

It is added, that, from finding this land drained so well, he has, every winter, drained a little, as fast as he could get the land cleansed; and last winter he completed the whole ninety-three acres. He has drained a great many acres of land besides these, and has had it done in the same manner, which answers extremely well. Twenty acres of the above, ninety-three he has kept in pasture, having, in the space of five or six years, dressed it over twice with about fifteen tons per acre each time. His manure consists of dung, earth, soap-ashes, and the scrapings of turnpike roads: this latter article answers remarkably well on a strong clay soil. The whole of these ninety-three acres are on such a soil, with some gravel. During the summer, it is necessary to turn it twice, in order that it may be well mixed; and, by doing this, it is brought to a fine mould; when spread on the lands, once brushing over with some thorns makes it soon disappear. The above twenty acres are at this time worth 25 *s.* per acre. In November, 1795, he began ploughing another piece of ground of fourteen acres. From the manner in which this piece of ground lay, his servant could not throw it plain, (it being left, the last time it was ploughed, in six-furrowed ridges), so as to bring it with any advantage to a crop in the spring. In April, 1796, he ploughed it across; after this, worked it well with drags and barrows. Finding this would not do (owing to the turf not being sufficiently rotten, which he accounts for, by lying in a rough open state all the winter), he set some men to hack it over: and, harrowing it well with four horses abreast, it became tolerably fine, with the exception only of the rush and sedge, of which there was a great abundance. The weather being dry, he employed twelve or fifteen women and boys beating over these rush and sedge roots, in order to get them out of the earth, some men going after them with three-pronged forks, throwing them in heaps and burning them. By doing this, he raised a great quantity of ashes, which he spread over the land, and, as soon as sufficiently cold, he harrowed in some turnip seed, which came up very well: but the land being of a close stiff nature, they did not get larger than about the size of a cricket-ball; he had them hoed, otherwise they would not, in his opinion, have grown to that size. He kept 450 sheep upon them, with a little hay, a month and a few days. In the month of May, previous to this, he put on the head-lands 140 hogsheads of lime, which he caused to be well-turned and mixed, and, as the sheep ate the turnips, this was carried and spread on the land. The latter end of October it was sown with wheat, and produced a good crop, averaging better than twenty bushels per acre. As soon as the wheat was carried off, it was ploughed and sown to vetches (a greater burden than lands of the value of 40 *s.* an acre could produce;) and in the spring 1798, he fed them off with sheep, folding them by night, where they fed by day. He always makes it a point, as soon as the sheep have cleared a day's work for the plough, to plough the land; by doing this, he preserves the manure of the sheep from the sun, and turns in what vetches were left, which, in his opinion, are equal, if not superior, to the droppings of the sheep. He has observed, that where the greatest quantity has been left and ploughed in, that part of the ground generally works much lighter at seed-time; and that, at harvest, the wheat is superior. This may not do so well on a light sandy loam. He finished sowing this field to wheat (the second time) by Michaelmas, 1798. He was obliged in May to cut off all the tops of it (as he did in the other field), in order to keep it standing. When harvest came, he had sixty tithing per acre, which produced no more than 300 bushels, and about two pecks in the whole field. If the kern had been such as it was the year before, he should, he believes, have had thirty bushels per acre. Last year it was sown to barley and grass-seeds. As the barley is not threshed, he cannot exactly state the quantity grown, but, from appearance, it was judged to be about twenty bushels per acre: a good crop for this country last season; the grass plants look remarkably well, and consist of the following sorts:—rye-grass one peck, cow-grass 6 lbs., Dutch clover 2 lbs.; this he allowed for every acre. It is customary, he says, for the tenant to be at the expence of the grass-seeds. The hop-grass did not answer in the other field; it is his opinion that the soil is too heavy and close for it. He very much disapproves of mowing the first year after laying down, particularly on strong lands.

 He

He further states, that, in November, 1795, he ploughed another field, of eleven acres, and threw it very plain. As soon as it was finished ploughing, he had it rolled with a heavy roller, that it might be as close as possible all the winter, in order to rot the spine or turf the better. In the early part of April he dragged in some black oats; shortly after they were up, an easterly wind (to which the field lay quite exposed) struck them very yellow, exactly like straw, and the ground being so very poor, they never recovered it. The ground lay in this state till September, when it was ploughed across, and so it remained till the March following. The frost having opened it, and by dragging and harrowing it well, he brought it to be tolerably fine. In May he dressed it over with 20 hogsheads of lime per acre, (which was well mixed with the head-lands in April), then ploughed it as thin as possible, and sowed some turnip-seed, which came up very well, but did not flourish, owing, in his opinion, as he has before observed, to the soil being too stiff and heavy for turnips. At Michaelmas, 1798, it was sown to wheat without any other manure. The crop produced him nineteen bushels per acre. As soon as the wheat was carried off the land, he sowed it to vetches (which he is convinced is the best artificial sowing on strong lands), and he had a very good crop, which he fed off with sheep in the same manner as before described; and last Michaelmas it was sown the second time to wheat without any additional manure; at present it is impossible for plants to look better. He intends taking three crops from this field, as he did from the last, and then to lay it down for three years. He thinks no land should have more than three crops of corn without rest; at the same time sowing between those crops, some sorts of artificials, for sheep-feed, which will keep the land clean and in good condition. The soil will dictate to the farmer what sort of artificials to sow for his advantage. He has, at this time, another field of ten acres in fallow, which has been ploughed these twelve months. He intends pursuing exactly the same method with this and the remaining thirty acres, as he has done with the former, and when finished, he has no donbt but that the ninety-three acres will be worth one hundred pounds per annum.

The great advantage of adopting proper modes, in bringing lands of this nature into the state of good grass, or *sward*, is here shown in a very striking manner; and it is rendered still more evident in the practice detailed below.

In respect to the breaking up and re-laying clayey land to the state of sward, Mr. Amos has observed in the same volume of "Communications," that it is the most obdurate and unmanageable soil which the farmer has to encounter, the too great adhesion of its particles rendering it unfit for vegetation, but which may be in some degree corrected by lime, sand, ashes, long dung, marle; by frequently exposing fresh surfaces of it to the influence of the sun and atmosphere; by planting on it succulent plants, as beans, red clover, &c.; which having top roots not only render the mass less cohesive thereby, but also add to it much carbon. And that as the lower leaves of the dense foliage of these vigorous vegetables also give out much carbonic acid by their respiration in the shade: which, perpetually sinking down upon the surface of the soil, supplies it with carbon, which renders it more nutritive to other vegetables, which may afterwards grow upon it. The mode displayed at fig. 1. in Plate X. on *Agriculture*, answers the purpose in the most effectual manner, as shown by the section of a 12 feet ridge.

But in breaking up grass land of this kind of soil, great attention should be paid to ploughing the furrows, so as to expose the greatest surface possible to the influence of the sun and atmosphere, and to furnish the greatest quantity of mould for covering the seed.

It is supposed that furrows nine inches broad and three inches and a half thick are the best proportioned size. He is however truly sensible that no certain standard can be fixed for the breadth and width of the furrows; that must entirely depend upon the depth of the soil. By limiting the breadth and thickness of the furrow as above, he only means that those proportions should neither be much exceeded nor abated where the staple of the soil will permit.

"In regard to the first crop, as the size of the ridges is already formed upon all grass lands, nothing can be done, but to plough the ridges in the manner described, early in February. As soon as the weather permits, in the last week of February, or on the first or second week in March, to sow five bushels of good oats upon every acre; then to harrow the land only just enough to cover the seed; afterwards to let the whole be water furrowed, and the drains opened, so that no water may stand upon the land. Nothing more is wanted to be done till the latter end of May or beginning of June, when the crop should be well weeded.

And for the second crop, the land should be gone over "early in November to see that no water stands upon it, and that the water furrows and cross grips or drains are kept clear and open. And as soon in February, as the weather and condition of the soil will permit, to drill ten pecks of beans upon every acre, twenty-seven inches between each row and three inches deep; then to harrow the ridges twice or thrice with *swinging trees* as long as the ridges are broad, to which as many harrows should be tied as will cover them, and the horses walk in the open furrows. But as soon as the beans are fairly above ground, they should be rolled and harrowed; some time in May be horse-hoed, by ploughing a furrow off from the beans on each side, making a ridge in the intervals between the rows. The beans will then stand upon a ridge of about six or eight inches wide, which must be well hand-hoed. In about a week after, the earth must be returned again to the beans in the rows. In about two weeks more the double mould-board plough should be used to scour up the middle of the intervals, and to lay the earth closer to the beans. If any more weeds appear they must be pulled up by the hand. And as soon as the ground is cleared of the beans, the land should be scuffled the cross way of the ridges, then harrowed once or twice, and the weeds collected in heaps and burnt.

"And early sowing should be practised, as the mildew is more injurious to late crops than forward ones, owing to the great dampness of the ground in autumn.

"For the third crop, after having scuffled, and cleansed the ground well, it must then be ploughed up in the manner denoted above, four inches deep if the staple will permit. And when the seed is to be drilled the ridges should be harrowed twice or thrice in a place, then ten pecks of wheat drilled upon every acre, and finished by harrowing the land once; the less harrowing the better, provided there is depth of mould for permitting the seed to be drilled two inches and a half deep. But when the seed is to be sown broad cast, it should be sown after the land is ploughed, at the rate of twelve pecks to the acre; harrowing the land just enough to cover the seed; then water furrow it, and afterwards grip or drain it completely in both cases."

Where "the stems and foliage of the wheat are too vigorous, it may be advantageous to eat it down with sheep the latter end of March, or beginning of April, and afterwards to harrow it the length way and to roll it the cross way

way of the ridges. And about the latter end of May the wheat should be breast or horse-hoed if drilled; if sown broad cast, the weeding must be done by hand; the same operations should be performed a second time in the month of June."

For the "fourth, or fallow crop, the land should be ploughed across into ridges four inches and a half deep, early in November, and afterwards well water-furrowed, and gripped or drained completely. The field will then lie in deep open furrows and high narrow ridges, and consequently be exposed to the largest extent of superficies that is possible, which is the *sine qua non* of ploughing such land. Sometimes in February, as soon as the season and weather will permit, the ridges must be split down the middle and reversed, so that the whole surface-soil may be equally exposed to the influence of the sun and atmosphere. And about the beginning of April, the ridges should be drawn down by the break or drag-harrow going across them once or twice; after lying in this state some time, the land should get a clean ploughing four inches deep the latter end of the same month. About the middle of May is the last time to lay on the auxiliary earths, *viz.* four chaldrons of lime, or six chaldrons of chalk, or fifty tons of calcareous marl, or four chaldrons of ashes, or twenty cubic yards of tanners' bark, or fifty tons of sand, or fifty tons of peat-earth, &c. upon every acre; then drag-harrow the land both length and crossways to incorporate the whole intimately together. If the land is very rough, it may be reduced a little either by the spike-roller, or a heavyish plain one, to a roundish clod; but it should not by any means be made too fine. When long dung is the intended manure, it should not be laid on till after the second clean ploughing has been given, which should be done the later end of May in both cases: after the middle of June, the dung may be laid on after the rate of ten or twelve tons to the acre; the land in either case must then be ploughed into ridges of from nine to twelve feet wide, and gathered up in the manner described above; then sow half a peck of cole-seed upon every acre, if sown broad cast, or a quarter of a peck, if drilled; and then harrow the whole once. If any weeds spring up, they must be hand-hoed, whether the seed has been drilled or sown broad-cast.

"The cole should be eaten off in the month of September; then plough the land immediately after the cole has been eaten off three inches and a half deep, reserving the furrows, which must be left clear and open for the sake of draining the land in winter; open also all the cross grips or drains completely, so that no water may be suffered to stand upon the land; for to all improvements draining is the first step. As soon as the weather permits, in April, the land must be ploughed, for the last time, into three inches deep furrows, which must be reserved again; reduce the surface to a very fine tilth, by harrowing and rolling it completely for the reception of the seeds. Then upon every acre he advises the sowing the following seeds:"

"*Of artificial Grass-seeds.*

Cow clover, - - - - -	8 pounds.
White ditto, - - - - -	10 ditto.
Trefoil, - - - - -	4 ditto.

"*Of natural Grass-seeds.*

Sweet scented vernal grass, - -	½ peck.
Meadow foxtail grass, - - -	1 ditto.
Rough-stalked meadow grass, - -	1 ditto.
Meadow fescue grass, - - -	½ ditto.
Rye grass, - - - - - -	2 ditto."

This "composition and proportion of seeds are the most suitable for clayey or moist soils, and will form in two or three years a most excellent meadow, as all the plants sown are strong and hardy perennials. After the seeds have been all sown, the land should be bush-harrowed once, the length way of the ridges, and then rolled across."

And "the next thing to be done," he says, "is carefully to open all the water-furrows with a double mould-board plough, four inches deep, no width at bottom, but eight inches wide at top. Then open all the cross grips or main drains in the manner expressed" at *fig.* 2. in the same plate. "Afterwards roll the whole down the cross way of the lands."

It is added, that "no stock should be suffered to graze on the seeds till they have got proper hold of the ground; when that happens, ewes, and lambs, and yearly beasts are the most proper stock for them the first year. And as the act of [illegible] the quantity of leaves round the root of young grass, [illegible] the central stems by them and [illegible] in the [illegible], whence new [illegible] produced [illegible] the first [illegible] of the stem [illegible] it [illegible] way [illegible], which are [illegible] grazed, are so much thicker or closer covered with grass roots, than those which are annually mowed. Hence the impropriety of mowing the grass the first, or even the second, third, or fourth year; especially upon this soil, which produces them very tardily." By the above management, the land will, he thinks, keep one-third more stock than it did for several years. But, after a certain period of time, the grasses degenerate, and the pasture returns to its original state, which, he says, shews the necessity of converting grass land into tillage, and of laying down such lands with grass-seed alternately."

CLAYEY *Loam*, that sort of loam which contains a large proportion of clay in its composition. It is a sort of land that is of the more stiff kind, but which is highly productive when properly cultivated. It abounds much in many districts. See LOAM and SOIL.

CLAYEY *Marl*, that sort of marle which has much of the clayey ingredient in its composition. See MARL.

CLAYEY *Soil*, that sort which is principally constituted of clayey materials. Extensive districts are met with in which the soil is chiefly of this sort. See SOIL.

CLAYING OF LAND, the process of applying this sort of material on land, which, in many cases, is found extremely beneficial in affording a better texture and consistence. In the county of Norfolk the term claying is often improperly applied to the practice of marling.

In many situations, where marl is not to be had, clay may often be found at no great depth below the surface, and may be had recourse to with the greatest benefit on the more light poor sorts of land. See SOIL.

The application of it is a business that may proceed during most of the summer as well as the autumnal months, and often in the winter, with much propriety and convenience; but it is constantly the most advantageously laid on before the commencement of the winter frosts, as in that way it is more perfectly reduced and incorporated with the land. The manner of performing the work is similar to that made use of for marl. See MARLING.

CLAYING *of Sugar.* See SUGAR.

CLAYONAGE, *in the Military Art*, hurdles for covering the wooden work of a gallery for the passage of the ditch, and for securing the people employed in carrying on the saps against the fire of the besieged when it is dangerous.

CLAYTON, THOMAS, in *Biography*, took his degree of doctor in medicine at Oxford towards the end of the seventeenth

teenth century, and soon after went to Virginia, from whence he corresponded with the Royal Society. Several of his communications, treating of the culture and different species of the nicotiana (tobacco), are published in numbers 201, 4, 5, and 6, of the "Philosophical Transactions," and in number 454 is an ample account of medicinal plants which he had discovered growing in that country. Haller supposes that the "Flora Virginica exhibens plantas quas T. Clayton in Virginia observavit et collegit," was composed from papers left by him. It was published by Gronovius, at Leyden, in 1743, 8vo., and again in 4to. in 1762. Haller. Bib. Bot.

CLAYTON, ROBERT, a learned prelate of the church of Ireland, was born in the capital of that kingdom, in 1695. He was the son of Dr. Clayton, minister of St. Michael in that city, and dean of Kildare. He received his classical education at Westminster school; whence he removed to Trinity college, Dublin, of which he was some time after elected a fellow. The date of his first degrees, and of his ordination, are not known, but he became doctor in divinity in 1729. On his father's death, coming into possession of a handsome fortune, he conscientiously resigned his fellowship without any prospect of compensation by church preferment; a measure, it must be confessed, not very usual among members of Universities. But this scrupulous generosity of disposition appears to have been a prominent feature of Dr. Clayton's character; for on his marriage in 1728, he presented the fortune which he received with his wife to her sister; and made a better provision for his own sisters than had been done by his father, by doubling the legacies which he had left them. It was this beneficent temper that led principally to his advancement in his profession. During a temporary residence in London, shortly after his marriage, a person applied to him for pecuniary relief, whose case was recommended by Dr. Samuel Clarke. Dr. Clayton, entering fully into the situation of the petitioner, presented him with a donation of three hundred pounds. This munificent act procured him the acquaintance and the friendship of Dr. Clarke; and it is thought that this intimacy contributed to the heterodoxy which Dr. Clayton afterwards manifested with regard to many of the doctrines of his church. Dr. Clarke took an early opportunity to introduce his friend to queen Caroline, who had already, from the report of his beneficence, entertained a favourable opinion of his character, which was greatly strengthened and confirmed by the kind offices of lady Sundon, a relation of Dr. Clayton by marriage, and at that time a great favourite at court. Under these very favourable auspices, which Dr. Clayton's personal merit gradually secured for him, he obtained the queen's recommendation to the lord lieutenant for the first vacant bishopric in Ireland, and in consequence was presented to the see of Killala in January 1729—30. In November 1735 he was translated to Cork, and to Clogher in 1745. Thus far Clayton had been distinguished rather as the polite gentleman than the erudite scholar and divine; and from his long silence in the literary world, even after his elevation in the church, and his unassuming diffidence upon topics of learned disquisition, so low was the common opinion of his abilities, that the first publication which appeared under his name, "An Introduction to the History of the Jews," was generally attributed to some other hand. This ungrounded prejudice was, however, soon removed by unquestionable evidence that he possessed talents of a superior kind. In 1747 he published in 4to. an elaborate work, entitled, "The Chronology of the Hebrew Bible vindicated, with some Conjectures in Relation to Egypt," &c. In 1749, he pursued his biblical disquisitions, by publishing "A Dissertation on Prophecy," which was followed in 1751 by "An impartial Enquiry into the Time of the Coming of the Messiah, in two Letters to an eminent Jew." In the course of this year was published, in octavo, "An Essay on Spirit, wherein the Doctrine of the Trinity is considered in the Light of Reason and Nature, as well as in the Light in which it was held by the ancient Hebrews, &c." This work, as may naturally be supposed from its title, excited much attention. In consequence of the bishop of Clogher having prefixed a dedication to it, addressed to the primate of Ireland, and subscribed with his name, he was universally considered as the author, and all the odium which it excited by the supposed heresy of its tenets, was thrown upon him, so as to place an inseparable bar in his way to farther ecclesiastical promotion. In fact, however, the bishop was only its foster father, the work having been written, as afterwards appeared, by a young clergyman of his diocese, who was too strongly apprehensive of the consequences to bring it forward under his own name. The alarm spread by this publication among the clergy may be estimated by the number of pamphlets to which it gave occasion. The controversy to which it prompted was not, however, marked by any display of superior talent and erudition. Dr. Clayton next appeared before the public in a work universally allowed to be his legitimate production; it was entitled, "A Vindication of the Histories of the Old and New Testament, in Answer to the Objections of the late lord Bolingbroke, in two Letters to a young Nobleman." It was published in octavo, 1752. This was only the first part of an extensive design, which Dr. Clayton afterwards prosecuted; for in 1754, he published "A second Part, wherein the Mosaical History of the Creation and Deluge is philosophically explained, the Errors of the present Theory of the Tides detected and rectified, &c." There is much ingenuity and learning displayed in these works; but many of the remarks discover a deficiency of judgment, and a mind too much swayed by hypothetical fancies. In the interval between the publication of these two pieces, Dr. Clayton published a translation of "A Journal from Grand Cairo to Mount Sinai and back again; from a Manuscript written by the Prefetto of Egypt, in Company with the Missionaries *de propaganda Fide* at Grand Cairo. To which are added, some Remarks on the Origin of Hieroglyphics and the Mythology of the ancient Heathens." The principal object of the bishop in the translation and publication of this work, was to recommend to the attention of the Society of Antiquaries certain ancient inscriptions which are mentioned in it, as existing in a part of the wilderness of Sinai, known by the name of the *Written Mountains*, and from which his lordship conceived that it might be possible to recover the ancient Hebrew character. The society did not, however, second his views, notwithstanding his munificent offer of assistance to defray the expences which might attend the experiment. Nor do his lordship's conjectures appear to have been well founded, for when Mr. Edward Wortley Montague afterwards visited the very spot where such important discoveries were expected to be made, he was grievously disappointed by finding the inscriptions intermixed every where with representations of human figures, which clearly demonstrated that they were not the work of any of the descendants of Jacob. The bishop published, in 1755, a correspondence which had passed between him and Mr. William Penn on the subject of baptism. The next year was marked by a bold attempt on the part of his lordship to introduce some material innovation into the liturgy of the established church. He had in his writings expressed his disapprobation of the Athanasian and Nicene creeds; and, prompted by his wish to have them expunged, he determined ed to bring the matter to a fair difcuffion, by introducing the fubject in the form of a motion to the Irifh Houfe of Lords, which he did on the 2d of Fe&ruary, 1756, by moving, That thofe creeds fhould, for the future, be left out of the liturgy of the Church of Ireland. The fpeech which he delivered on this occafion was afterwards publifhed, and paffed through feveral editions. Dr. Clayton's conduct and fentiments on this occafion gave very general offence to his ecclefiaftical brethren, and created him a holt of powerful enemies. Great, however, as was the outcry raifed againft him, no fteps of a public nature were taken to arraign his conduct, until the appearance of the third part of the "Vindication of the Hiftory of the Old and New Teftament" in 1757, in which, unappalled by the formidable afpect of his adverfaries, he purfued his fpeculations even farther than he had before done. But his prefent attack was deemed by his more orthodox ecclefiaftical fuperiors and brethren to be of fo hoftile a complexion, that they came to a refolution to make his proceedings the fubject of legal inquiry. Under their influence, his majefty, George the Second, directed the duke of Bedford, then lord lieutenant of Ireland, to inftitute a profecution againft the bifhop of Clogher. Agreeably to this, a day was fixed for a general meeting of the Irifh prelates at the houfe of the primate, and Dr. Clayton was fummoned to attend. Before, however, the time arrived, an end was put to their malicious proceedings, by the death of the venerable object of their enmity and perfecution. The thought that he was abandoned by the king, from whom, as placed above the influence of the paltry animofities by which his fubjects may often be divided, he had hoped for fhelter and protection in the gathering ftorm, joined to his repugnance, to have paffed againft him a verdict of cenfure or deprivation, is thought to have affected his fpirits fo deeply, as to bring on an obftinate nervous fever, of which he died, February 26th, 1758, in the 64th year of his age. Biog. Brit.

Clayton, Thomas, an Englifh mufician, and one of the royal band in the reign of king William and queen Mary, who having been in Italy, had not only perfuaded himfelf, but had the addrefs to perfuade others, that he was equal to the tafk of reforming our tafte in mufic, and eftablifhing operas in our own language, not inferior to thofe which were then fo much admired on the Continent. And the firft mufical drama that was wholly performed after the Italian manner, in recitative for the dialogue or narrative parts, and meafured melody for the airs, was "Arfinoe Queen of Cyprus," tranflated from an Italian opera of the fame name, written by Stanzani of Bologna, for that theatre, in 1677, and revived at Venice 1678. And the Englifh verfion of this opera, fet by Clayton, was our firft attempt at a mufical drama after the manner of the Italians, with recitative in the dialogue, inftead of declamation. In the compofer's preface to the printed copy of the words, he fays, that "the defign of this entertainment being to introduce the Italian manner of mufic on the Englifh ftage, which has not been before attempted, I was obliged to have an Italian opera tranflated: in which the words, however mean in feveral places, fuited much better with that manner of mufic, than others more poetical would do. The ftyle of this mufic is to exprefs the paffions, which is the foul of mufic; and though the voices are not equal to the Italian, yet I have engaged the beft that were to be found in England; and I have not been wanting, to the utmoft of my diligence, in the inftructing of them. The mufic being recitative, may not, at firft, meet with that general acception, as is to be hoped for, from the audience's being better acquainted with it: but if this attempt fhall be a means of bringing this manner of mufic to be ufed in my native country, I fhall think my ftudy and pains very well employed."

The fingers were all Englifh, confifting of Meffrs. Hughes, Leveridge, and Cook; with Mrs. Tofts, Mrs. Crofs, and Mr. Lyndfey. This opera was firft performed at Drury-lane, January 16th, by fubfcription; the pit and boxes were referved for fubfcribers, the reft of the theatre was open as ufual, at the fubfcription mufic. In the Daily Courant, Arfinoe is called "a new opera, after the Italian manner, all fung, being fet by mafter Clayton, with dancing and finging before and after the opera, by fignora F. Margarita de l'Epine." This finging was probably in Italian.

Clayton is fuppofed to have brought from Italy a collection of the favourite opera airs of the time, from which he pillaged paffages and adapted them to Englifh words; but this is doing the mufic of Arfinoe too much honour. In the title-page of the mufic, printed by Walfh, we are affured that it was wholly compofed by Mr. Thomas Clayton; and in juftice to the mafters of Italy at that time, it may be allowed to be his own, as nothing fo mean in melody and incorrect in counterpoint was likely to have been produced by any of the reigning compofers of that time. For not only the common rules of mufical compofition are violated in every fong, but the profody and accents of our language. The tranflation is wretched; but it is rendered much more abfurd by the manner in which it is fet to mufic. Indeed, the Englifh muft have hungered and thirfted extremely after dramatic mufic at this time, to be attracted and amufed by fuch trafh. It is fcarcely credible, that in the courfe of the firft year this miferable performance, which neither deferved the name of a *drama* by its poetry, nor an *opera* by its mufic, fhould fuftain twenty-four reprefentations, and the fecond year eleven.

But fuch was now the paffion for this exotic fpecies of amufement, even in its lifping infant ftate, that the perfpicacious critic and zealous patriot, Mr. Addifon, condefcended to write an opera for the fame Englifh fingers as had been employed in Arfinoe. Mr. Addifon, though he had vifited Italy, and was always ambitious of being thought a judge of mufic, difcovers, whenever he mentions the fubject, a total want of fenfibility as well as knowledge in the art. But this admirable writer and refpectable critic in topics within his competence, never manifefted a greater want of tafte and intelligence in mufic than when he employed Clayton to fet his opera of Rofamond. Indeed, it feems as if nothing but the groffeft ignorance, or defect of ear, could be impofed upon by the pretenfions of fo fhallow and contemptible a compofer. But, to judges of mufic, nothing more need be faid of Mr. Addifon's abilities to decide concerning the comparative degrees of national excellence in the art, and the merit of particular mafters, than his predilection for the productions of Clayton, and infenfibility to the force and originality of Handel's compofitions in Rinaldo, with which every real judge and lover of mufic feem to have been captivated.

This opera, in fpite of all its poetical merit, and the partiality of a confiderable part of the nation for Englifh mufic and Englifh finging, as well as fervent wifh to eftablifh this elegant fpecies of mufic in our own country without the affiftance of foreigners, after fupporting with great difficulty only three reprefentations, was laid afide and never again performed to the fame mufic.

In the year 1733, this Englifh drama was fet, as a *coup d'effai*, by Mr. Thomas Aug. Arne, afterwards Dr. Arne, and performed at the little theatre in the Haymarket; in which his fifter Mifs Arne, afterwards Mrs. Cibber, performed

formed the part of Rosamond; that admirable actress appearing first on the stage in this character as a singer. The three following airs were admirably set, and remained long in favour: "No, no, 'tis decreed,"—"Was ever nymph like Rosamond," and "Rise glory, rise." See OPERA and ADDISON.

CLAYTONIA, in *Botany*, (named from John Clayton, who collected plants, chiefly in Virginia, for Gronovius, which were published by him in his "Flora Virginica.) Linn. Gen. 287. Schreb. 402. Gært. 745. Juss. 314. Vent. 3. 260. Lam. Ill. 394. Class and Order, *pentandria monogynia*. Nat. Ord. *Succulentæ*, Linn. *Portulaceæ*, Juss. Vent.

Gen. Ch. *Cal.* two-leaved, persisting; leaves egg-shaped, rather acute, opposite. *Cor.* Petals five, egg-shaped or oblong, obtuse, narrowed at the base, longer than the calyx. *Stam.* Filaments five, awl-shaped, a little shorter than the corolla, affixed to the claws of the petals; anthers oblong, incumbent. *Pist.* Germ superior, roundish; style simple, the length of the stamens; stigma trifid. *Peric.* Capsule egg-shaped, one-celled, three-valved, included in the calyx. *Seeds* three, roundish.

Eff. Ch. Calyx two-celled. Petals five. Stigma three-cleft. Capsule one-celled, three-valved, three-seeded.

Sp. 1. C. *virginica*, Linn. Sp. 1. Mart. 1. Lam. 2. Pl. 144. fig. 1. Willd. 1. Gron. Virg. 25. Bot. Mag. 941. (Ornithogalo affinis virginiana; Pluk. Alm. tab. 102. fig. 3. Rudb. Elys. 2. p. 139. fig. 6.) "Leaves linear-lanceolate, petals entire." *Root* small, tuberous. *Stems* about three inches high, slender. *Root leaves* narrow-linear, almost gramineous. *Stem-leaves* generally two, opposite, linear, green, smooth, a little fleshy. *Flowers* white, spotted or streaked with red on the inside, in a loose terminal raceme. A native of Virginia, flowering in April. There is a variety with lanceolate leaves, and acutish calyxes. 2. C. *sibirica*, Linn. Sp. 2. Mart. 2. Lam. 2. Willd. 2. Gmel. Sib. 4. p. 89. Gært. tab. 129. fig. 3. (Limnia, Linn. Act. Ups. 1746. tab. 5. Act. Holm. 1746. tab. 5.) "Leaves nerved, root and stem ones egg-shaped; petioles trifid," Willd. *Root* tuberous. *Stem* declining. *Root-leaves* petioled, quite smooth. *Stem leaves* two, opposite, sessile. *Flowers* red, racemes two, unilateral, one of them two-leaved. A native of Siberia. 3. C. *perfoliata*, Willd. 3. Donn. Hort. Cant. p. 25. "Leaves without nerves, root ones rhomb-egg-shaped, stem ones somewhat connate; flowers umbel-verticillate; petals entire," Willd. *Root* annual. *Stem* four or five inches high, erect. *Root-leaves* petioled, somewhat fleshy. *Stem* ones two, opposite; either rhomb-egg-shaped, attenuated, cohering; or egg-shaped, connate on one side, emarginate on the other. *Flowers* white, two or three about the middle of the stem, peduncled, each of them supported by a small oblong bracte; six or eight in a terminal umbel, peduncled, without bractes. A native of North America.

C. *portulacaria*. See PORTULACARIA.

CLAZOMENÆ, in *Ancient Geography*, a town of Asia Minor, and one of the 12 Ionian cities situated in Lydia. Herodotus, who mentions it, assigns it in one place to Ionia, and in another to Lydia. The ancient city stood on the continent, and was fortified by the Ionians at a great expence, in order to put a stop to the Persian conquests. But, after the defeat of Crœsus, and the surrender of Sardis, the inhabitants were so terrified, that they abandoned the city, and withdrew, with all their effects, to one of the neighbouring islands, where they built the city of Clazomenæ, so often mentioned in the Roman history. Pausanias (Achaic. c. 3.) informs us, that Alexander joined it to the continent by a causeway 250 paces long; whence Strabo, Pliny, Ptolemy, and most of the ancient geographers, count it among the cities on the continent. The Romans, according to Livy, (lib. xxxviii. c. 39.) always treated the inhabitants with great kindness, apprized of the importance of this city to their conquests in Asia; for they not only declared them a free people, but put them in possession of the island of Drymusa, and often quarrelled with the princes of Asia on their account. Augustus repaired and embellished their city with many magnificent buildings; whence, on some medals, he is styled the founder of Clazomenæ, though this city was undoubtedly founded by the Ionians, and from the beginning was one of the Ionian confederacy. Some antiquarians take Clazomenæ for the ancient city of Grynium, which gave the epithet of Grynæus to Apollo; for, in ancient times, Apollo had a famous temple in the vicinity of Clazomenæ. Cybele was likewise one of their chief deities, and also Diana, as we learn from several ancient medals and inscriptions. The Clazomenians held out against the Lydians, after most of the other cities of Ionia were reduced by Alyattes, who besieged, but could not master Clazomenæ. The Persians gained possession of it in the time of Darius Hystaspis, and such was its importance in their estimation, that they would not part with it at the famous peace of Antalcides. Alexander reinstated them in their ancient liberty and privileges; which were enlarged by the Romans, whom they assisted on all occasions with great fidelity. Clazomenæ anciently derived great profit from its oils. On one occasion its inhabitants had recourse to a singular contrivance for restoring their finances. After a war that had exhausted the public treasury, they found themselves indebted to the disbanded soldiers to the amount of 20 talents (4,500 *l*); which, being unable to raise, they paid them, during some years, interest, which they fixed at 5 *per cent.* They afterwards struck copper money, to which they affixed the same value as if it were silver. The rich consented to take it: the debt was liquidated, and the revenues of the state administered with economy, enabled them gradually to call in the adulterated coin circulated in commerce. The ancient Clazomenæ was the native place of Anaxagoras. On or near the ruins of this illustrious city, was built the present *Dourlak*, or *Vourla*, a small town, situated on the south coast of the gulf of Smyrna.

CLEAN *Lough*, in *Geography*, a small lake of the county of Leitrim, Ireland, which is considered as the fountain of the noble river Shannon. This lake is not four miles distant from the river Bonnet, which carries boats into Lough Gilly, and thence into Sligo bay. Perhaps, says Dr. Beaufort, the day may come, when the spirit of enterprize and commerce will open itself a passage by this channel.—Beaufort.

CLEANDRIA, in *Ancient Geography*, a place of Asia Minor, in the Troade, where Strabo places the source of the Rhodius.

CLEANTHES, in *Biography*, a stoic philosopher, and a disciple of Zeno, was born in the year 339 B. C. and died in 240 B. C. He wrote many pieces, none of which are come down to us, except his "Hymn to Jupiter," and a few fragments; the several editions of which have been enumerated, with the various readings, and critical remarks, by the learned reviewer of Butler's edition of "Marcus Musurus," &c. containing this hymn, and other fragments, (Monthly Review, enlarged, vol. xxv, p. 18, &c.) It was first published by Fulvius Ursinus, in 1568; then by Henry Stephens, in his "Poesis Philosophica," in 1573; afterwards by Cudworth, in his "Intellectual system," fol. 1678; again in Mosheim's Latin translation of Cudworth, in 1733; a fifth time in the third dissertation added to Daniel Secundum Septuaginta, Rom. fol. 1773; a sixth

time

time in the 2d edition of Mosheim's translation of Cudworth, published after his death, Leyd. Bat. fol. 1773; again in Brunck's "Analecta," in 1776, and afterwards by Brunck, in his edition of the "Gnomici Poetæ;" a ninth time in the "Eclogæ Physicæ" of John Stobæus, published at Gottingen, 8vo. 1792, by A. H. Heeren. It has also been translated into German, Latin, and English. For the English translation by Mr. West, at the desire of a friend, who was pleased to find such just sentiments of the deity in a Heathen, and so much poetry in a philosopher; see "Odes of Pindar," &c. vol. ii.

CLEANTHES, one of the first inventors of painting in Corinth. He is said to have learned the art from Ardices, his countryman, and was one of those painters who were styled monochromatists, because their art extended no farther than to draw the simple outline of the figure, and fill it up with one colour only. Strabo, however, describes some large compositions of this master. Winkelman. Orlandi. Della Valle, Vite d'Pitt. Ant.

CLEAR, in *Building*, is sometimes used among the workmen for the inside work of a house, &c.

CLEAR, in *Sea Language*, is applied to the weather, when it is fair and open; to the coast, when the navigation is not interrupted by rocks, &c. to the cordage, cables, &c. when they are disentangled so as to be ready for immediate service. In these senses it is opposed to foul.

CLEAR, *Cape*, in *Geography*, in the island of Clare south of the county of Cork, the most southern point of land in Ireland. N. lat. 51° 19'. W. long. 9° 24'.

CLEAR *lake*, a lake in the N.W. part of North America, connected with the Athabasca lake by the river Hay, and with the Peace river by the river Pine. See ATHABASCA.

CLEARE, St. a village in Cornwall, being a vicarage in the West Hundred; the situation of the steeple of its church was determined in the government trigonometrical survey in 1796, by an observation from Bindown station, distant 35,256 feet; and another from Kitt Hill station distant 42,931 feet, and bearing 74° 42' 9" N.E. from the parallel to the meridian of Butterton station; whence is deduced its latitude 50° 29' 16" N. and its longitude from Greenwich 4° 27' 20".6 W. or 17^m 49^s.4 in time. In 1777 the Liskeard canal was in contemplation to terminate at Bark-Mill bridge in this parish, for bringing up lime and sea sand for manures, coals, &c. and exporting corn, &c.; but the same has not been carried into effect. See CANAL.

CLEARER, a tool used in *Rope-making*, similar to the hatchell, but with finer teeth, as the hemp is always finished on it for linen and twines for sail-makers, &c.

CLEARING, in *Agriculture*, a term sometimes applied, in threshing corn, to signify a heap large enough to be winnowed.

CLEARING *the Anchor* and *the Hawse*. See ANCHOR and HAWSE.

CLEARING *of Land*, in *Agriculture*, the removing of such obstacles and impediments as retard or prevent its cultivation and improvement. See *Removing Obstructions to* TILLAGE.

CLEARING of *Liquors*. See CLARIFICATION.

CLEAS, in *Agriculture*, a provincial word, signifying the hoofs or claws of cattle, sheep, hogs, &c.

CLEATS, in *Ship building*, are pieces of wood of different shapes, used for various purposes in mast-making, block-making, and rigging. Those used for stopping of shores are commonly made of elm, similar to wedges, but only taper from one side; those for stopping of rigging are haunched on the back with a hollow, from one-third of the length, the thin end being shaped with a duck's bill; these are made of oak; but, for mast-heads, of elm. Cleats used in block-making are made of oak plank or board, and when sawed to different shapes for the purposes to which they are to be applied, they are made smooth, and finished with gouges, chissels, and rasps. In rigging they are used for stops, and ropes are fastened to them. *Arm* or *sling cleats* are nailed on each side of the slings of the lower yard, and have an arm at one end, which lies over the straps of the jeer-blocks, to prevent their being chaffed; these are made of elm-plank, in length one and a quarter of the diameter of the yard, in breadth one-fourth of the length, and in thickness two-thirds of the breadth; the shoulder is one-third of the length of the cleat, and hollowed on the back from the shoulder to the end. *Belaying-cleats* are shaped like range-cleats, but smaller; they have two arms or horns, and are nailed through the middle to the masts, or elsewhere, and to them ropes are belayed. *Comb-cleats* are made of ash, or elm, board; they are semicircular, with their backs rounded so as to resemble a cock's comb, and they have one or more hollow cavities gouged in the middle for the purpose of confining a rope to one place. *Range-cleats* to which are belayed tacks and sheets, are from three to seven inches thick, and in length seven times the thickness. The arms are each one third of the length, and made round; the middle, between the two arms, is left square, twice the thickness in breadth, through which it is bolted or fastened; the back is curved in the length, that the arms may rise from the inside straight. *Shroud cleats* are similar to belaying-cleats, with the addition of an inside piece, out of the same solid, long enough to have a score on each side of the middle part of the cleat, to contain the seizings which fasten it to the shroud; the inside is hollowed to fit the shroud, and another score cut across the middle of the cleat for the middle seizing; the scores are rounded on the outside edges, and cut deep enough to bury the seizing, in order to prevent its being worn when the rope is belayed. *Sling-cleats* are made of elm-plank, in length one and a quarter of the diameter of the yard, in breadth one-fourth of the length, and in thickness two-thirds of the breadth. The shoulder is to be one-third of the length of the cleat, and hollowed on the back from the shoulder to the end; these are used as stops to the straps of jeer-blocks, &c. to the lower yards. *Stop-cleats* are made of oak plank or board, of all lengths under twelve inches; the largest are commonly for gammoning bowsprits and as stops to stay collars. The breadth is one-fourth of the length, the thickness two-thirds of the breadth, and they are hollowed on the back. Those for lashings on the mast-heads are made of elm, three times the thickness in breadth, and one and a half of the breadth in length. Stop cleats are nailed to the yard-arms, to prevent the slipping of the rigging and the gammoning, &c. *Thumb-cleats* are similar in shape to arm-cleats, but are much smaller; they are nailed up vertically to hang any thing on; or horizontally, as stop-cleats. Cleats are nailed wherever they are wanted with more or fewer nails, according to the strain they resist.

CLEAVERS, or CLIVERS, in *Botany*. See GALIUM *Aparine*.

CLEBUCZ, in *Geography*, a town of European Turkey, in Dalmatia; 11 miles S.S.E. of Moster.

CLEBURG, a town of Germany with a castle, in the circle of the Upper Rhine, and duchy of Deux Ponts, which gives name to a branch of the Palatine family; 28 miles S.S.W. of Deux Ponts.

CLEBURY. See CLEOBURY.

CLECHE', or CLECHY, a French term in *Heraldry*, signifying any ordinary or bearing that is pierced throughout, *i. e.* when the whole figure is so much perforated that the chief which substance is taken from it, and nothing remains visible but the edges.

CLECY, in *Geography*, a town of France in the department of Calvados, and district of Falaise; containing about 1700 inhabitants; 3½ leagues W. of Falaise.

CLEDAGH, the name of several rivers in Wales; one runs into the Usk in Monmouthshire; another runs into the river of Neath, 5 miles N. of Neath in Glamorganshire; a third runs into the Muthvey, 2 miles E. of Langadock in Caermarthenshire; and a fourth runs into the Clethy in Pembrokeshire.

CLEDAGNVAGH, a river of Wales, which runs into the Usk, about a mile W. of Abergavenny.

CLEDEN, a town of France, in the department of Finisterre, and district of Quimper; 2 leagues W. of Pontcroix.—Also, a town in the same department, and district of Morlaix; 1½ league W. of St. Pol-de Leon.—Also, a town in the same department and district of Chateaulun; 5 miles S.W. of Carhaix.

CLEDGE, a name given by miners to the upper part of the stratum of fuller's earth.

CLEDGY, in *Agriculture*, a term applied to such kinds of land as are stiff, stubborn, and of a hard tenacious quality, from the mixture of clay in them.

CLEDHEWEN, a river of Wales, which runs into the Dungledy, in Pembrokeshire.

CLEDONISM, CLEDONISMUS, a kind of divination in use among the ancients.

The word is formed from κληδων, which signifies two things, *rumor*, a report, and *avis*, a bird: in the first sense *kledonism* should denote a kind of divination drawn from words occasionally uttered. Cicero observes, that the Pythagoreans made observation not only of the words of the gods, but of those of men; and accordingly, believed the pronouncing of certain words, *v. g. incendium*, at a meal, very unhappy. Thus, instead of prison, they used the word *domicilium*; and to avoid *erinnyes*, furies, said *eumenides*.

In the second sense, cledonism should seem to be a divination drawn from birds: the same with ornithomantia.

CLEEF, JOAS, or JOOST VAN, in *Biography*, a painter, native of Antwerp, who enjoyed the reputation of being one of the best colourists of his time. The period of his birth is not known, but it appears that he entered into the company of painters at Antwerp, in the year 1511.

Soon after the marriage of Philip of Spain to Mary queen of England, he came to London; but seeing some pictures of Titian preferred to his own, he became frantic with rage and disappointment, and from that time was nick-named Joost the Madman. There was an altar picture by him at the church of Notre Dame at Antwerp, which is said to have possessed much of the purity of the Roman school of painting: the subject was S. Cosmo and Damiano. The period when this artist died is unknown. Descamps. Heinecken. Pilkington.

CLEEF, HENDRICK, HENRY, MARTIN, and WILLEM VAN, three brothers, painters of Antwerp; the first, HENDRICK, excelled in landscape, and having spent many years in studying at Rome, published upon his return many views of the ruins of ancient temples existing in that city. He was received into the company of painters at Antwerp in 1533, and died in 1589. MARTIN, the second brother, was the disciple of Francis Floris, and was admired for his history pieces with small figures. Many landscape painters, and amongst others Gillis Coninxloo employed him to paint the figures in their landscapes. He became one of the company of painters at Antwerp in 1551, and died aged 50. WILLEM, the other brother, excelled in large figure painting, but died young. Martin had four sons, all painters, Gillis, Martin, George, and Nicolas. The first painted well in small, but died young; the second lived a long time in Spain, and afterwards went to the Indies: Nicolas was still living at Antwerp in the time of Van Mander, in the year 1604. According to Strutt and Heinecken, Henry and Martin Van Cleef engraved a few pieces. Descamps. Heinecken.

CLEEF, JOHN VAN, a Flemish painter of considerable note, was born at Venloo, in 1646, and having discovered, when young, a strong inclination for the art, was placed under the tuition of Gentile, an historical painter at Brussels, with whom, however, he remained but a short time: he then became a disciple of Gaspar de Crayer, to whom he was so much attached, that he continued with him until his death; when he was judged capable to put the last hand to some designs left unfinished by Gaspar, particularly the cartoons for the tapestry intended for Lewis XIV.

He had a manner peculiar to himself, and in composition and design far surpassed his master, though he fell short of him in colouring. His pencil was bold and flowing: his pictures, though full of figures, are free from confusion; and he thoroughly understood the introduction of architectural decoration.

He painted the principal altar-pieces of Ghent, many of which are described by his historian, Descamps. Amongst the most celebrated is a large picture at the church of St. James, representing Christ delivering the Souls out of Prison; and another in the church of a convent, where the Nuns are relieving those afflicted with the Plague; the Virgin and Child, S. Austin, S. Catherine, and other saints, are seen in the sky. This artist died in the year 1716, aged 70. Descamps.

CLEENISH, in *Geography*, a small island in Lough Erne, county of Fermanagh, Ireland, about three miles from Enniskillen.

CLEES, LES, or LES ESCLEES, a town of Swisserland, in the canton of Berne, seated on the Orbe, in the road to France; 8 miles S.W. of Yverdun.

CLEETA, in *Biography*, an ancient Greek architect and sculptor. He built the Palæstra, or large court near Olympius, used for the horse and chariot races at the celebrated Olympic games, which were held in this place at the close of every olympiad, that is every fifth year. It was magnificently decorated with porticoes and other ornaments, and the author was so proud of his performance, that he introduced the following inscription under one of the statues which he had made at Athens; "Cleeta, the son of Aristocles, who invented the Palæstra of Olympius, did this." Milizia. Mem. degli Arch.

CLEF, (from *clavis*, Lat. and κλεις, Gr. *a key*), a character in *Music* to denote what part of the general scale the sounds before which it is placed are to be sung or played. Previous to the time of pope Gregory, to whom the square and lozenge notes used in canto fermo are ascribed, and which are now best known by the name of *Gregorian notes*, there were various methods of pointing out the elevation and depression of the voice in chanting the mass, not only before the time-table was formed, but even before lines and spaces were used. These indications of change of voice were placed over the words long before a single line ascertained the difference of their situation. This was followed by a 2d, a 3d, and a 4th line, to which, with the spaces, canto fermo, in Roman missals, is still limited.

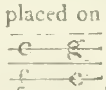
The names and examples of all the first characters used for the modulation of voice may be seen in the General History of Music, vol. ii. from p. 33 to 55.

After lines had increased to 8, in the 10th century, only the

the ſpaces were uſed, not for the notes, but ſyllables, the notes being placed in a kind of frame, on the left ſide, one to each ſyllable of the words. After this an alphabetic character was placed at the beginning of each line, capitals for the grave ſounds, and minuſcules for the acute. To this kind of notation *points* ſucceeded. Padre Martini has given three examples of only one line, to regulate the points uſed as notes over the words, a red line for the key of F, and a yellow one for that of C. This ſeems the origin of clefs, which are only Gothic letters corrupted.

Vincenzio Galilei (Dial. della Muſ. Ant. e Mod. p. 36.) ſays, that a little before the time of Guido the points were placed on ſeven lines only, without uſing the ſpaces; perhaps in imitation of the ſeven ſtrings of the ancient lyre.

Few, however, of theſe methods of notation ſeem to have been generally received in contemporary miſſals, after the Greek characters were diſuſed; for in the MS. ſpecimens which we have ſeen, the marks placed over the words, in the middle ages, previous to the time of Guido, often appear arbitrary, and to have been adopted only in ſome particular church, convent, or fraternity.

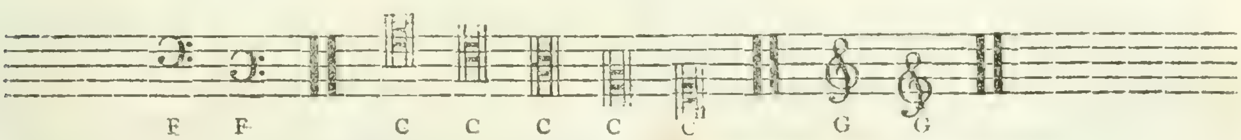
The ſinging clefs, or *claves ſignatæ* of the middle ages, were nothing but a c, a g, or an F, placed on one of the four lines uſed in canto fermo, as thus, 

Having traced the origin of clefs from ancient MSS., and the progreſſive improvements in ſimplifying them in proportion as the muſical art became more complicated, we ſhall waſte no time or paper in deſcribing new ſchemes of notation, and expedients for diminiſhing or augmenting the number of clefs in preſent uſe, but proceed to exhibit their form and explain their practical uſe in the moſt preciſe and clear manner we are able, without deviating from the method in which they have long been taught by the moſt learned, intelligent, and experienced muſicians, who have ſubmitted to the drudgery of inſtructing, not only pupils who receive pleaſure from the ſkill of others, and wiſh to entertain themſelves, but even thoſe on whom it is forced, and who having neither ear nor inclination for muſic, dread the ſight of a maſter, and regard him in no better light than a perſecutor.

The *tenor clef*, that ſtumbling block to the idle and liſtleſs, would be as legible as the treble or baſe, if learned in the ſame manner, and the pupils were accuſtomed to play favourite airs in all kinds of tenor clefs, and tranſpoſe by them early in their ſtudies. The printing new editions of old authors of organ and harpſichord pieces, without the admiſſion of tenor clefs, is a miſchievous indulgence, which having precluded the trouble of learning theſe clefs, renders all the old editions of the beſt authors of the laſt century unintelligible; as it does all the muſic in ſcore written or printed abroad; all vocal muſic from Italy, and harpſichord leſſons from Germany compoſed 20 or 30 years ago; all the works of Sebaſtian Bach, and the early productions of his admirable ſon, Emanuel, for the harpſichord, of which the treble or right-hand part is in the ſoprano clef, or tenor on the firſt line. Theſe, however excellent, are become totally obſolete and illegible to all but regular bred profeſſors, in our country only.

Three clefs, removeable from time to time, include the whole ſyſtem of muſical ſounds. Theſe are denominated Base, Tenor, and Treble.

It is to be remembered that theſe ſeveral clefs are always placed on a line at the beginning of the five-line ſtaff, never on a ſpace; and though removeable, always retaining the power of giving the name of F, C, or G, to whatever line they are removed: as the baſe clef makes every line on which it is placed F; the tenor C; and the treble G.

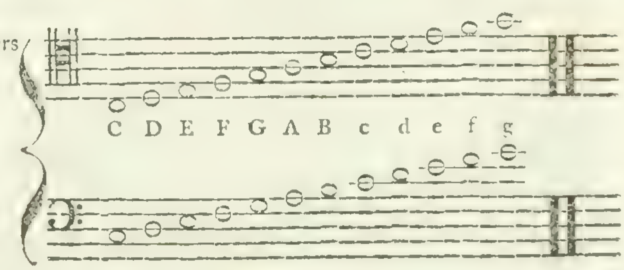


Now as theſe clefs have different appellations to diſtinguiſh them from each other, we ſhall give a gammut of thoſe leaſt in uſe, as a kind of dictionary, with equivalent ſounds in the two well-known clefs of G and F, to explain them.

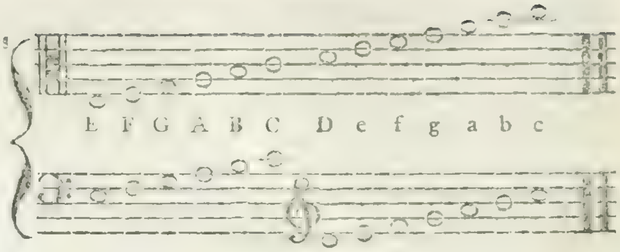
The baſe clef on the 3d line is called the *baritono clef*, and is 3 notes higher than the common baſe clef on the 4th line.

The tenor clef on the 5th line is equivalent to the baſe clef on the 3d line, and in old muſic, theſe two clefs are uſed promiſcuouſly.

Alto tenore, or high tenor clef on the 4th line, renders ſounds 5 notes higher than the baſe.

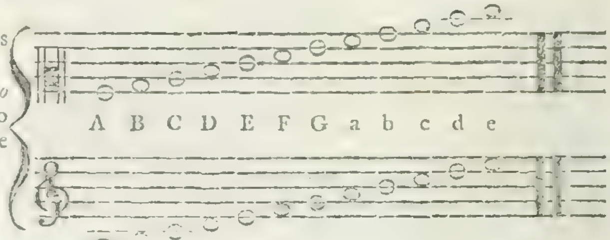


Contralto, or counter-tenor clef on the 3d line, 7 notes lower than the treble, and 7 notes higher than the base.



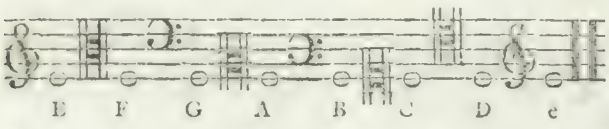
The *mezzo soprano*, or second treble clef on the 2d line, is 5 notes lower than the treble.

This clef is now seldom used; but in Purcell's time the *alto viola*, or instrumental-tenor part, was written in the mezzo soprano clef, which was the custom in France till the middle of the last century.

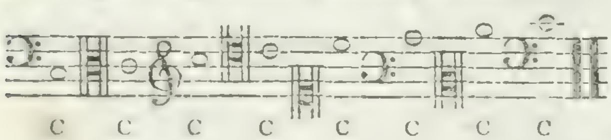


Soprano, or supreme clef, in which all treble voice-parts are composed in Italy and Germany, is the tenor clef on the first line, and renders every sound a 3d lower than the treble.

Dr. Pepusch, after giving his pupils a regular scale in each clef, made them familiarize themselves to the changes which they occasioned in the names of the notes and in their situation on the staff, by written exercises, giving them a series of 8 or more notes on the same line or space, and obliging them to find a clef for every note which will make it ascend or descend one degree, as thus:



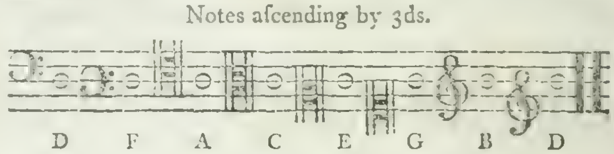
or, though seeming to ascend, remaining stationary,



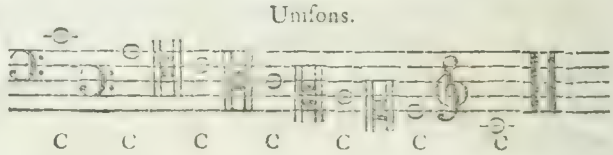
This method was recommended by Mr. Galliard, in his translation of "Tosi's Observations on florid Song," Pl. No. 2. p. 17. pointing out its utility in transposition. But he was not the first who suggested this expedient; we find it in "Cerone della Musica," p. 515. a work in Spanish, published at Venice 1614. See TRANSPOSITION.

Rousseau (Dict. de Mus.) has adopted the same method, and given in *Plate* A, *fig*. 4 and 8, the two following examples.

Notes ascending by 3ds.



Unisons.



CLEF *de mousquet, de carabine, de pistolet, d'arquebuse à rouet*, the spanner or lock of a musquet, carabine, &c.

CLEFMONT, in *Geography*, a town of France, in the department of the Upper Marne, and chief place of a canton in the district of Chaumont; 17 miles S. of Bourmont. The place contains 380, and the canton 6996 inhabitants; the territory includes 180 kiliometres and 21 communes.

CLEFS, a town of France, in the department of the Maine and Loire, and district of Baugé, 2 leagues N. of it.

CLEFS *d'une ville ou place de guerre*, the keys of all the gates of a strong place, as a fort, citadel, castle, town, or city of war, which an officer is charged with carrying every evening after the

the ſhutting of the gates, to the governor, or the perſon who commands in his abſence. The magazines, which contain pieces of artillery, are locked under three keys; one of which is carried to the commandant of the place, the ſecond to the commiſſary of artillery, and the third remains in the hands of the perſon who has charge of the magazine.

CLEFT, in *Grafting*. See Engrafting.

CLEFTS, or Cracks, in the heels of horſes, are occaſioned by hard labour, unwholeſome food, want of exerciſe, and waſhing them when hot. They are cured by cutting off the hair, and anointing with the oil of hemp-ſeed or linſeed, and keeping them clean.

CLEGG, John, in *Biography*, a pupil of Dubourg on the violin, who travelled into Italy with Lord Ferrers, where he improved himſelf ſo much, that, on his return in 1723, he excelled in force and execution every performer in England, till the year 1742, when he had ſo deranged his faculties by intenſe ſtudy and practice, that he was confined in the hoſpital of Bedlam; where, during intervals of ſanity, he was allowed the uſe of his inſtrument; and it was long a faſhionable, though inhuman, amuſement, to viſit him there, among other lunatics, in hopes of being entertained by his fiddle or his folly. He was long the ſubject of praiſe, and regarded as a young man of ſuch ſuperior genius and abilities, that no one who had ever heard him would allow that he was equalled by any performer, on the ſame inſtrument, in Europe.

CLEGHORN, George, a diſtinguiſhed practitioner in medicine, was born at Granton, near Edinburgh, in December 1716. Shewing early an inclination to the ſtudy of medicine he was ſent to Edinburgh, and placed under the tuition of Dr. Alexander Monroe. While there he became acquainted with Dr. Fothergill, by whom he was materially aſſiſted in his ſtudies. In the year 1736 he was appointed ſurgeon to the 22d regiment of foot, then ſtationed in the iſland of Minorca, where he continued thirteen years. During his reſidence in this iſland, he employed his leiſure time in diſſecting monkeys and other animals, with which the place abounded; he alſo examined and acquired a knowledge of the plants and other natural productions of the country. In theſe purſuits he was much aſſiſted by correſponding with Dr. Fothergill, who procured and ſent him the neceſſary books, accompanied with hints, ſuggeſting the objects moſt deſerving his attention. In 1749 he quitted Minorca, and went to Ireland, and the year following he came to London, and publiſhed his "Treatiſe on the Diſeaſes of Minorca," 8vo. the reſult of his obſervations during his long reſidence in the iſland. The work is valuable, containing accounts of the air and ſoil, with deſcriptions of the medicinal plants. Then follow accounts of the diſeaſes moſt frequent in the country, with the methods he found moſt efficacious in combating them. He now went to Dublin, and commenced lecturer in anatomy, in which he acquired ſuch celebrity, that in 1754 he was appointed profeſſor in that ſcience by the univerſity. In 1774 he was made honorary member of the College of Phyſicians in Dublin. He was alſo one of the original members of the Academy for promoting Arts and Sciences in that city; and, about the ſame time, he had the honour of being nominated fellow of the Royal Medical Society at Paris. As Dr. Cleghorn had no family, he ſent for the widow of his brother, with nine children, whom he adopted, and treated as his own. He died December 1789. Lettſom's Memoirs of Medicine.

CLEGUEREE, in *Geography*, a town of France, in the department of Morbihan, and chief place of a canton in the diſtrict of Pontivy, two leagues N.W. of it. The place contains 2793, and the canton 14,964 inhabitants; the territory comprehends 187½ kiliometres and 9 communes.

CLEIDES, or Clides *inſulæ*, in *Ancient Geography*, ſmall iſlands of the Mediterranean, lying to the eaſt of the iſland of Cyprus, and very near it. Strabo reckons two, and Pliny four. The promontory near theſe iſlands had the ſame name, according to Herodotus.

CLEIDION, in *Antiquity*, the ſame with *clavicula*. See Claviculæ.

CLEIDOMASTOIDEUS, in *Anatomy*, a name given by Albinus to that part of the ſterno-cleido-maſtoideus, which ariſes from the clavicle, and is deſcribed by him as a diſtinct muſcle. See Sterno-cleido-mastoideus.

CLELBY River, in *Geography*, one of the ſtreams which fall into Milford Haven in South Wales, navigable up to Canniſter bridge near Narberth. See Canal.

CLELLES, a town of France, in the department of the Iſere, and chief place of a canton in the diſtrict of Grenoble; the place contains 681, and the canton 3811 inhabitants; the territory includes 162½ kiliometres and 9 communes.

CLEMA, in *Antiquity*, a ſpecies of vine, a twig of which was the enſign of a centurion's office.

CLEMATIS, in *Botany*, (from κλημα, *riticula*, *ſarmentum*, becauſe it climbs trees, by means of its pliant twigs, like thoſe of the vine), Linn. Gen. 696. Schreb. 950. Willd. 1083. Gært. 456. Juſſ. 232. Vent. 3. 55. Claſs and order, *polyandria polygynia*. Nat. ord. *Multiſiliquæ*, Linn. *Ranunculaceæ*, Juſſ. Vent.

Gen. Ch. *Cal.* none. *Cor.* Petals four, rarely five, ſix or eight, oblong, lax, pubeſcent. *Stam.* Filaments numerous, awl-ſhaped, ſhorter than the corolla; anthers adnate to the filaments. *Piſt.* Germs from four to twenty, roundiſh, compreſſed; ſtyles awl-ſhaped, longer than the ſtamens. *Peric.* none. *Seeds* numerous, roundiſh, compreſſed, tailed with the long permanent ſtyle in various forms.

Eſſ. Ch. Calyx none. Petals four, five or ſix. Seeds tailed.

Obſ. 1. Gærtner calls the external integument of the ſeed a capſule; but acknowledges at the ſame time, that, as there is no viſible umbilical cord, the ſeed may not improperly be ſtyled naked.

Obſ. 2. La Marck aſſerts that there is no real generic diſtinction between clematis and atragene; and that Linnæus abſurdly calls the ſame part of the fructification *corolla* in one, and *calyx* in the other. According to him, what Linnæus took for petals in atragene are only enlarged and often barren filaments of the exterior ſtamens; a circumſtance which occurs in ſeveral acknowledged ſpecies of clematis, and in ſome of nymphæa.

* *Stems climbing.*

1. C. *cirrhoſa*, Linn. Sp. Pl. 7. Mart. 1. Lam. 9. Willd. 1. (Clematitis peregrina, foliis pyri inciſis, Bauh. Pin. 300. Petiv. Gaz. tab. 126. fig. 1. Tourn. Inſt. 293. C. altera bætica, Cluſ. Hiſt. 1. p. 123. C. cretica foliis nunc ſingularibus nunc ternis, Tourn. Cor. 20.) Ever-green virgin's bower. "Cirrhoſe; leaves ſimple." Linn. "Leaves generally ſimple; ſtem cirrhoſe; peduncles lateral, calycled under the flower." Lam. *Stem* woody, reſembling that of the vine, ten or twelve feet high, ſending out branches from every joint, which render it a thick buſhy plant. *Branches* cylindrical, leafy, attaching themſelves to neighbouring objects by means of a kind of cirri, which are, in fact, only the permanent petioles of fallen leaves, none of them being found on the young ſhoots. *Leaves* on the ſame plant both ſimple and ternate; thoſe on the woody part of the ſtem,

and on the branches of two years growth, simple, petioled, egg-shaped, toothed, a little resembling those of the pear tree, but smaller; growing on the knots, often several together, in the axils of the cirri; those on the young shoots commonly ternate, opposite, petioled; leaflets egg-shaped, a little cut or crenulate, smooth, green, shining. *Flowers* white; peduncles scarcely an inch long, lateral, axillary, one-flowered; petals large, elliptical, pubescent on the outside; calycle, or rather involucre, one-leafed, concave, two-lobed, situated two or three lines below the corolla. *Seeds* with a plumose or silky tail. A native of Andalusia and the island of Candia, but is sufficiently hardy to bear the cold of our winters without injury. There are plants in Chelsea garden which have stood more than fifty years in the open air without protection from the severity of the weather. It is used as a covering for arbours and other trellis-work, which it completely covers with its thick foliage, and adorns with its large flowers. Gerard, by whom it was cultivated in 1596, calls it "Travellers' joy of Cardia;" Johnson, "Spanish traveller's joy;" and Parkinson, "Spanish wild climber." 2. C. *florida*, Willd. 2. Hort. Kew. 2. p. 258. Thunb. Jap. 240. Bot. Mag. 894. "Leaves twice compound; leaflets binate and ternate; petals egg-shaped." *Root* perennial. *Stem* striated, purple, entirely smooth. *Leaves* opposite, pinnæ sessile, egg-shaped, acute, entire, or very rarely cut, villous. *Flowers* yellowish, large, spreading, axillary, solitary, peduncled; peduncle villous, one-flowered, longer than the leaves; petals egg-shaped, acuminate: stamens linear-lanceolate, purplish, unequal, half the length of the corolla, Thunb. A native of Japan. 3. C. *viticella*, Linn. Sp. Pl. 1. Mart. 2. Lam. 12. Willd. 3. Bot. Mag. 565. (Clematitis cærulea vel purpurea repens, Bauh. Pin. 300. —— flore pleno, 301. Tourn. 294.). "Leaves compound, and twice compound; leaflets egg-shaped, quite entire." Linn. "Leaves compound, and twice compound; petals margined, dilated at the tip, spreading." Lam. *Root* perennial. *Stems* slender, weak, branched, leafy, with many joints. *Leaflets* from nine to fifteen, ovate-acute, smooth, entire, sometimes with one or two lobes; upper ones simple or ternate. *Flowers* blue, obsolete-purple, bright purple or red, peduncled; petals bordered on each side by a thin, whitish, pubescent membrane, which grows broader near the tip, and makes them appear wedge-shaped; stamens small; filaments short; styles quite smooth. A native of Spain and Italy in hedges. Four varieties are cultivated in the nurseries: single blue, single purple, single red, and double purple. The latter is esteemed the most ornamental, and continues the longest in flower, opening its flowers in June or July, and retaining them to the end of August. There is another variety, but not much esteemed, with white flowers, only three or four feet high, which Miller received from mount Baldo. 4. C. *viorna*, Linn. Sp. Pl. 2. Mart. 3. Lam. 13. Willd. 4. (Flammula scandens, flore violaceo clauso, Dill. Elth. tab. 118. fig. 144.) Leathery-flowered virgin's bower. "Leaves compound and twice compound; some of the leaflets trifid." Linn. "Leaves compound and twice compound; petals coriaceous, acute, half shut." Lam. *Root* perennial. *Stems* three or four feet high, cylindrical, striated. *Leaves* opposite, petioled; leaflets from nine to twelve, three on each pinna, generally entire, a few trifid, ovate-acute, green and smooth on the upper surface, veined and paler underneath. *Flowers* purple or bluish violet, axillary, solitary; peduncles long, with a pair of simple leaves in the middle; petals with a whitish, cottony border, smaller than that of the preceding species; anthers terminated with a tuft of hairs. *Seeds* with long plumose tails. A native of Virginia and Carolina. 5. C. *crispa*, Linn. Sp. Pl. 3. Mart. 4. Lam. 14. Willd. 5. Dill. Elth. tab. 73. fig. 84. Curled virgin's bower. "Leaves simple and ternate; leaflets entire or three-lobed." Linn. "Leaves compound, and twice compound; leaflets lanceolate; petals half-shut, somewhat curled at the sides; margin membranous, undulated, wrinkled." Lam. *Root* perennial. *Stems* weak, fastening themselves to the neighbouring plants by the twining petioles of their leaves. *Leaflets* from nine to fifteen, narrower than those of the preceding species. *Flowers* large, reddish, solitary; peduncles short; petals less thick than those of C. viorna, with many longitudinal furrows; anthers hairy at the summit. Tails of the seeds thick, awl-shaped, not plumose, but pubescent with short close-pressed hairs. A native of Carolina. Thunberg describes a Japanese plant under the same name, with a stem striated, zig-zag, smooth; leaves five-nerved, petioled, acute, smooth; and flowers in a compound, trichotomous panicle; but its mode of inflorescence must surely determine it to be a distinct species. 6. C. *calycina*, Mart. 16. Willd. 6. Hort. Kew. 2. 259. Vahl. Symb. 2. 75. Bot. Mag. 959. (C. balearica, Lam. 10.). Minorca virgin's bower. "Involucre calycine, approximating; leaves ternate, middle one three-parted." Hort. Kew. "Leaves compound, finely laciniated; flowers calycled, lateral; petals spotted within." Lam. *Root* perennial. *Stem* six feet high or more, branched, leafy. *Leaves* opposite, green, smooth, continuing nearly all the year; petioles tripartite, remaining after the leaves, and discharging the office of tendrils. *Flowers* white, large, solitary, axillary; peduncles two inches long; involucre one-leafed, bell-shaped, two-lobed, changing sometimes into a pair of leaves; petals elliptic-oblong, nerved, pubescent on the outside; sprinkled on the inside with small, red, longish spots; filaments a little enlarged at their base; anthers small; styles plumose and silvery. A native of Minorca, flowering in autumn, and often in winter when the season is mild. 7. C. *orientalis*, Linn. Sp. Pl. 4. Mart. 5. Lam. 5. Willd. 7. (Clematitis orientalis apii folio, Tourn. Cor. 20. Flammula, Dill. Elth. tab. 119. fig. 145.). "Leaves compound; leaflets cut, angular, lobed, wedge-shaped; petals villous on the inside." Linn. "Leaves compound; leaflets wedge-shaped, three-lobed, somewhat toothed, acuminate; petals villous on the inside." Willd. *Root* perennial. *Stems* from four to eight feet high, striated, leafy. *Leaves* glaucous. *Flowers* yellowish, with a tinge of russet on the outside; petals lanceolate, almost smooth on the outside, in short panicles on tripartite peduncles. Tails of the *seeds* plumose, silky. A native of the Levant. 8. C. *glauca*, Willd. 8. Willd. Arb. tab. 54. fig. 1*. "Leaves compound; leaflets egg-shaped, sometimes lobed, obtuse, mucronate; petals smooth within side, pubescent at the edge." Perfectly distinct from the preceding in its whole habit, as well as in the particulars expressed in the specific character. 9. C. *hexapetala*, Linn. Jun. Supp. 271. Forst. Prod. n. 230. "Leaves compound; leaflets egg-shaped, serrated; peduncles two-leaved; corolla spreading, with six petals." *Root* perennial. *Flowers* yellowish, dioicous; peduncles branching, trichotomous. A native of New Zealand. 10. C. *triflora*, Willd. 10. Vahl. Symb. 3. p. 74. (C. mauritiana, Lam. 6.) "Leaves ternate; leaflets egg-shaped, mucronate; peduncles three-flowered." Vahl. "Leaves ternate; leaflets somewhat heart-shaped, serrated; tail of the seeds very long, plumose." Lam. *Root* perennial. *Stems* slightly striated. *Flowers* whitish; peduncles lateral, opposite, axillary near the end of the short pendant branches; petals oblong, villous on both sides. *Seeds* purple, villous. A native of the islands of Bourbon and Madagascar, in woods. The natives of Madagascar make

a cataa cataplasm of the leaves, and employ it as a cure for the tooth-ache. The cataplasm is carefully wrapped up in eight or ten folds of linen, and applied externally to the cheek of the patient. If suffered to touch the skin, it will produce a blister. 11. C. *virginiana*, Linn. Sp. Pl. 6. Mart. 7. Lam. 7. Willd. 11. Pluk. Mant. tab. 389. fig. 4. (C. Floridensis flore albo odoratissimo; Albin. Anat. tab. 7. C. aquatica trifoliata; Gron. Virg. n. 270.) "Leaves ternate; leaflets heart-shaped, somewhat lobed and angular; flowers dioicous." *Root* perennial. *Stems* numerous, six feet high, or more. *Leaves* smooth, dark green on the upper surface, almost three-nerved underneath; veins branched, reticulated. *Flowers* white, in short panicles, resembling umbels; peduncles once or twice ternate; petals villous on the outside, naked and veined within. The female flower has stamens, but the anther is destitute of pollen. 12. C. *japonica*, Mart. 9. Lam. 16. Willd. 12. Thunb. Jap. 240. "Leaves ternate; leaflets elliptic-ovate, serrated; flowers cylindrical." *Root* perennial. *Stem* filiform, striated, purple, villous. *Leaves* petioled, ternate, growing several from each joint; petiole three inches long, capillary, loose; leaflets an inch long, on short petioles, acuminate, uniformly serrated from the middle to the tip, nerved, villous, the terminating one largest. *Flowers* purple, solitary, lateral, peduncled; peduncles the length of the leaflets. A native of Japan, flowering in August and September. 13. C. *trifoliata*, Willd. 13. Thunb. in "Linnæan Transactions," vol. ii. p. 337. (Scandens, Flor. Jap. n. 43.) "Leaves opposite, ternate, smooth; leaflets egg-shaped, repand-toothed." A native of Japan. 14. C. *dioica*, Linn. Sp. 5. Mart. 10. Lam. 8. Willd. 14. Sloan. Jam. 84. Hist. tab. 128. fig. 1. "Leaves ternate, quite entire; flowers dioicous." *Root* perennial. *Stems* slender, tough, ten or twelve feet high. *Leaves* coming out on each side of the stem; leaflets large, egg-shaped, with three or five longitudinal nerves. *Flowers* white; peduncles on the joints close to the petioles, one on each side, long, naked, horizontal, extending beyond the leaves, before they divide and branch; branching into three or four pairs of subordinate peduncles, these dividing again into three smaller, each of which supports a single flower. The lowest pair of primary peduncles extends four or five inches, the others gradually diminishing to the top, and forming a pyramidal thyrse of flowers; petals narrow, reflexed; stamens erect. Miller. A native of South America. La Marck doubts whether it be specifically distinct from C. virginiana, but from Miller's description, the inflorescence is clearly different. Loureiro found a plant in Cochin China, which he supposed to be the same as the C. dioica of Linnæus. It has about eighty seeds disposed in a head, which are obtusely three-cornered, and compressed, with a very long tail, fringed with many white hairs. But its identity may justly be doubted. Its inflorescence seems to approach nearer that of C. virginiana. 15. C. *americana*, Mart. 17. "Leaves ternate; leaflets cordate-acuminate, quite entire; flowers in corymbs." *Root* perennial. *Stems* strong, twenty feet high, or more, fastening themselves by their claspers to the neighbouring trees. *Flowers* white; peduncles axillary, long, naked, branching. *Seeds* finely feathered. Sent to Miller from Campeachy, by Dr. Houston. 16. C. *indivisa*, Willd. 15. (C. integrifolia, Forst. Prod. n. 231.) "Leaves ternate; leaflets egg-shaped, quite entire, mucronate; peduncles axillary, panicled, two-leaved." A native of New Zealand. 17. C. *paniculata*, Willd. 16. Thunb. in "Linnæan Transactions," 2. 337. (C. crispa, Thunb. Jap. 239.) "Leaves quinate-pinnated; leaflets heart-shaped, egg-shaped, entire." *Root* perennial. *Stem* zig-zag, striated, smooth. *Branches* alternate. *Leaves* petioled; leaflets petioled, acute, undivided, smooth; lower ones the largest; petioles zig-zag. *Flowers* white, axillary; peduncles thrice-ternate-panicled, filiform. A native of Japan. 18. C. *chinensis*, Mart. 18. Willd 18. Retz. Obs. 2. tab. 2. "Leaves quinate-pinnated; leaflets lanceolate." *Root* perennial. *Stems* tetragonous, weak, so as to want support, scarcely climbing. *Leaflets* petioled, the pairs remote from each other. *Flowers* pale purple, small, opposite, axillary; peduncles three, or five-flowered; lateral pedicels with a pair of small bractes, far removed from the flower; end one naked; petals linear-lanceolate, inner edge marked with a tomentous line. Tail of the pistils scarcely shorter than the anthers. Retz. A native of China. 19. C. *sinensis*, Lour. Cochin. 345. 3. "Leaves quinate; leaflets ovate-lanceolate, nearly sessile." *Stems* round, very long, branched, climbing. *Flowers* red purple; peduncles axillary, many-flowered; corolla spreading. *Seeds* three to five. Common in China. Professor Martyn justly remarks, that this plant seems specifically distinct from the preceding. 20. C. *minor*, Mart. 21. Lour. Cochinch. 345. "Leaves quinate; leaflets conical, three-nerved; peduncles very long." *Stem* somewhat shrubby, not very long, cylindrical, slender, climbing, branched. *Leaflets* small, bluntish at the end, quite entire, smooth. *Flowers* white, axillary, several together; petals oblong, striated; stamens about forty, unequal; styles four, hairy, a little longer than the corolla. A native of the suburbs of Canton in China. 21. C. *vitalba*, Linn. Sp. Pl. 8. Mart. 11. Lam. 1. Willd. 17. Gært. tab. 74. fig. 3. Curt. Lond. Fasc. 4. tab. 37. Jacq. Aust. tab. 308. Eng. Bot. tab. 612. (C. sylvestris latifolia, Bauh. Pin. 300. Viorna, Ger. em. 886.) Common virgin's bower, Traveller's joy, or Old man's beard. "Leaves pinnated; leaflets heart-shaped; petioles twining." β. C. Canadensis. "Leaves broader; leaflets growing by threes." *Root* perennial. *Stems* branched, leafy, furrowed, twining round other plants by means of the twisted petioles of the fallen leaves. *Leaves* opposite, unequally pinnated; leaflets growing by fives, petioled, egg-shaped, acute, either entire, or irregularly cut, rather smooth. *Flowers* white, sweet-scented; panicles axillary, dichotomous, pubescent, with small bracteal leaves; petals coriaceous, villous on both sides. *Seeds* with long plumose tails, which adorn the hedges in autumn, and during great part of the winter. Dr. Smith. *Seeds* about twenty, membranous, slender, reddish; on a small villous, somewhat globular receptacle. Gært. The recent leaves, when rubbed on the skin, produce blisters, and are said to be used by beggars, to give the appearance of foul ulcers on different parts of the body or limbs, for the sake of exciting compassion. But these ulcers, though large, are never deep, and are very little troublesome, being easily removed at pleasure, by an application of beet-leaves, to preserve them from the influence of the atmospheric air. A native of England, and the south of Europe, chiefly on a calcareous soil. Though not enumerated by Messrs. Dawson, Turner, and Dilwyn, among the rare plants in their "Botanist's Guide;" it is certainly very local. We have never observed it north of Alconbury hill, on the great north road; nor of Northampton, on the middle one. Where it terminates on the Chester road, we cannot exactly ascertain, but suppose it must disappear nearly in a continuation of the same line, not having met with it in Warwickshire, or any of the counties farther north, on that side of England. In the "Botanist's Guide through the Counties of Northumberland and Durham," it is mentioned as growing only on the Ballast hills of St. Anthony's, and Willington Quay, in Northumberland, where no one will suppose it indigenous. It is, we believe,

believe, a total ſtranger to the great limeſtone tracts in Yorkſhire, and the biſhoprick of Durham; nor was it found by Lightfoot in Scotland. The pith of the ſtems is ſo porous, that if one end of a piece, cut off between the knots, be ſet on fire, ſmoke may be copiouſly drawn into the mouth from the other. This, we well remember, was a favourite amuſement of our boyiſh days, in the neighbourhood of Northampton, when we knew the plant by no other name than that of tobacco-pipe tree. Variety β is a native of Canada. 22. C. *flammula*, Linn. Sp. Pl. 9. Mart. 12. Lam. 4. Willd. 19. (Clematitis ſive flammula repens, Bauh. Pin. 300. Tourn. Inſt. 293. Rai. Hiſt. 621). "Lower leaves pinnated, twining, laciniate; upper ones ſimple, quite entire, lanceolate." Linn. "Leaves twice pinnated; pinnæ generally three-leaved; leaflets ſmall, egg-ſhaped, rarely lobed." Lam. *Root* perennial. *Stems* numerous, about two feet long, rather creeping than climbing, ſlender, ſtriated, leafy. *Flowers* white, ſmall, ſweet-ſcented, in a kind of terminal panicle; peduncles once or oftener divided in a ternate manner; with ſmall, oppoſite, ciliated bractes under their diviſions. *Seeds* few, with a plumoſe tail.

* * *Stems erect.*

23. C. *maritima*, Linn. Sp. 10. Mart. 13. Lam. 3. Willd. 20. (C. maritima repens; Bauh. Pin. 300. Prodr. 135. Tourn. 294. Allion: Nic. 122.) "Leaves pinnated, linear; ſtems ſimple, hexagonal." Linn. *Root* perennial. *Stems* a foot and half high, ſlender, ſtriated, decumbent near the bottom, afterwards aſcending, or quite erect. *Leaves* oppoſite; leaflets linear, narrow, clothed with ſhort hairs, ſomewhat rigid, nearly ſeſſile, generally undivided, ſometimes bifid or trifid. Magnol and Ray make it a variety of C. flammula; but Linnæus thinks it more nearly allied to C. recta, and perhaps only changed by difference of ſituation. A native of the ſea coaſt in the ſouth of France and the neighbourhood of Venice. 24. C. *anguſtifolia*. Willd. 21. Jacq. Ic. Rar. 1. Tab. 104. (C. hexapetala, Pall. Itin. 3. App. n. 96. tab. Q. fig. 2. Atragene; Gm. Sib. iv. p. 194.) "Leaves pinnated; leaflets lanceolate, obtuſe; lower ones tripartite; ſtems ſimple, ſtriated, erect; corollas polypetalous." Willd. *Root* perennial. *Flowers* white; petals ſix or eight. A native of Siberia and Auſtria. 25. C. *recta*, Linn. Sp. Pl. 11. Mart. 14. Lam. 2. Willd. 22. Jacq. Auſt. tab. 291. Hall. Helv. n. 1144. Wood. 21. Med. Bot. tab. 62. (Flammula recta; Bauh. Pin. 300. Clematitis ſive flammula ſurrecta alba, Tourn. Inſt. 294.) "Leaves pinnated; leaflets ovate-lanceolate, quite entire; ſtem erect; flower pentapetalous and tetrapetalous." Linn. *Stems* three feet high, leafy, ſtriated, herbaceous, greeniſh or reddiſh. *Leaves* large, oppoſite; leaflets from five to nine, pubeſcent underneath, petioled. *Flowers* white; in upright, ſtiff, terminal umbels; peduncles ſeveral times ternate; petals oblong, obtuſe, ſomewhat villous, a little longer than the ſtamens. *Seeds* few, dark brown, ſmooth, orbicular, much compreſſed; tails long, yellowiſh, plumoſe. A native of uncultivated hills in the ſouth of France, Spain, Switzerland, Auſtria, Hungary, and Tartary. This, like ſome of the other ſpecies of this genus, is extremely acrid, on which account it was called flammula by the old botaniſts, and has obtained a place in the Edinburgh diſpenſatory. It had long been mentioned as an external remedy, but was firſt recommended by baron Stoerck of Vienna in 1769, as an uſeful internal medicine in inveterate ſyphilitic diſeaſes, and ulcers proceeding from other cauſes, cancers, &c. He employed the leaves and flowers, as well as an extract made from the former; but he chiefly uſed an infuſion of two or three drams of the leaves in a pint of boiling water, of which he gave four ounces three times a day, and applied the powdered leaves as an eſcharotic to the ulcers. Unhappily the phyſicians of this country have not found it equally efficacious. See Woodville's Medical Botany. 26. C. *ochroleuca*, Mart. 19. Willd. 23. Hort. Kew. 2. p. 260. Pluk. Mant. tab. 379. fig. 5. "Leaves ſimple, egg-ſhaped, pubeſcent, quite entire; flowers erect." A low unbranched ſhrub. *Stem* pubeſcent. *Leaves* oppoſite, ſeſſile, ſtrongly nerved. *Flower* terminating, ſingle, pale yellow. A native of North America. 27. C. *integrifolia*, Linn. Sp. Pl. 12. Mart. 15. Lam. 15. Willd. 24. Jacq. Auſt. tab. 363. Bot. Mag. 65. (C. nutans, Crantz. Auſt. p. 124. C. inclinata, Scop. Carn. p. 668. Clematitis cærulea erecta. Bauh. Pin. 300. Tourn. Inſt. 294.) "Leaves ſimple, ſeſſile, ovate-lanceolate, flowers drooping." Linn. *Root* perennial. *Stems* a foot and half or two feet high, annual, erect, ſimple, ſometimes with two branches near the top, angular, ſtriated, almoſt ſmooth, leafy. *Leaves* oppoſite, quite entire, pubeſcent at their edges. *Flowers* blue, large, ſolitary, terminal, ſcentleſs; petals large, lanceolate, acute, waved, thick, ſpreading very much. (half open, Lam.); filaments very pale yellow; villous, twice the length of the petals. *Seeds* roundiſh, compreſſed, ſomewhat villous, with a long plumoſe tail. A native of Germany, Auſtria, Carniola, Hungary, and Tartary, flowering from June to Auguſt. Cultivated by Gerard in 1596; and now not uncommon in the nurſeries about London. Forſter, Flor. Auſt. n. 231. has given the ſame name to a very different plant from New Zealand with ternate leaves; the leaflets ovate, entire, mucronate; the peduncles axillary, panicled, two-leaved.

C. *alpina*, Lam. —— *geranifolia*, Bauh. Pin. —— Pluk. —— Moriſ. —— Mill. Ic. tab. 284. See ATRAGENE *alpina*.

C. *zeylanica*, Herm. See ATRAGENE *zeylanica*.

C. *indica ſpinoſa foliis luteis*, Bauh. Pin. See STRICHNOS *colubrina*.

C. *minor et major*, Bauh. Pin. See VINCA *major et minor*.

C. *arborea americana*, Pluk. See PLUMERIA *alba*.

C. *pentaphylla, pediculis alatis*, Plum. See PAULLINIA *alata*.

C. *indica, folio bifido, arbores tranſcendens*, Rai. Supp. See BAUHINIA *ſcandens*.

C. *anguloſo folio, aceris fructu*, Plum. Rai. Supp. See BANISTERIA *anguloſa*.

C. *quadrifolia flore digitalis luteo*, Plum. —— *myrſinites Americana tetraphyllos*, Pluk. See BIGNONIA *unguis*.

C. *americana ſiliquoſa tetraphyllos*, Dod. —— *tetraphylla Americana*, Bocc. Lan. Rai. See BIGNONIA *capreolata*.

C. *peruana*, Pluk. See BIGNONIA *peruviana*.

C. *indica alia*, Plum. —— *murucuia*, Moriſ. See PASSIFLORA *pallida*.

C. *indica latifolia*, Plum. Rai. See PASSIFLORA *maliformis*.

C. *indica, fructu citriformi*, Plum. Rai. See PASSIFLORA *laurifolia*.

C. *indica polyanthus*, Plum. Rai. See PASSIFLORA *multiflora*.

C. *indica, flore clavato ſuaverubente*, Plum. Rai. See PASSIFLORA *rubra*.

C. *indica, flore puniceo*, Plum. Rai. See PASSIFLORA *murucuia*.

C. *paſſionalis triphyllos*, Mor. See PASSIFLORA *lutea*.

C. *indica, folio hederaceo major, et folio anguſto trifido*, Plum. See PASSIFLORA *ſuberoſa*.

C. *indica, flore minimo pallido*, Plum. See PASSIFLORA *hirſuta*.

C. *indica hirſuta fœtida*, Plum. See PASSIFLORA *fœtida*.

C. *trifolia*,

C. *trifolia*, Bauh. Pin. Morif. See PASSIFLORA *incarnata*.

C. *quinquefolia*, Rob. See PASSIFLORA *cærulea*.

C. *indica polyphylla major*, Plum. Rai. See PASSIFLORA *ferrata*.

C. *indica polyphylla, flore crifpato*, Plum. Rai. See PASSIFLORA *pedata*.

C. *baccifera glabra et villofa*, Plum. Sloan. See CISSAMPELOS *pareira*.

C. *indica perficæ foliis*, Bauh. Pin. 304. See OPHIOXYLON *ferpentinum*.

CLEMATIS, in *Gardening*, comprehends plants of the flowery, perennial, and fhrubby kinds of hardy growth; of which the fpecies chiefly cultivated are; the purple virgin's bower, (C. *viticella*); the leathery-flowered virgin's bower, (C. *viorna*); the oriental virgin's bower, (C. *orientalis*); the virginian virgin's bower, (C. *virginiana*); the curled-leaved virgin's bower, (C. *crifpa*); the evergreen virgin's bower, (C. *cirrhofa*); the fweet-fcented virgin's bower, (C. *flammula*); the upright virgin's bower, (C. *erecta*); the entire-leaved virgin's bower, (C. *integrifolia*). They have all climbing flender ftems and branches, except the two laft, in which they are upright with numerous flowers. Of the firft fort there are varieties with fingle blue, fingle purple, fingle red, and double purple flowers, in cultivation.

And of the eighth fort there is a variety with only two or three pairs of leaflets, which are narrower and ftand farther afunder, having fhorter ftalks and larger flowers.

Method of Culture.—The firft or purple virgin's bower, and the different varieties, as well as the fix following forts, are capable of being readily increafed by layers, and fome of them even by cuttings of the young fhoots, planted out in the fpring or fummer months, but the firft is the moft ufual method.

In this the layers fhould be made from the fhoots of the preceding or the fame year, and be laid down in the fummer before they become woody, as in this way they fucceed with greater certainty. The branches fhould have their tops left a few inches out of the earth, a little water being given at the time. When they are become well rooted, as in the following autumn or fpring, they may be taken off and planted out where they are to remain, or in the nurfery, to remain till they have attained fome growth.

The fhoots of the evergreen fort may however be laid down at any feafon, but the above is the beft. It is alfo capable of being raifed from cuttings of the young fhoots planted out in either the fpring or fummer months in pots of good earth, plunging them in a very moderate hot-bed. The fuckers from the roots may likewife be taken off and be planted out in the fame manner as the layers, when they will often produce good plants, and in a fhort time. The two laft forts are capable of being readily increafed by parting the roots, and planting them out either in the autumn or the early fpring months, in a bed of good mould. In this way every part which has fibres preferved at the bottom, and a bud in the upper part, will readily take root and become a plant. And thefe forts, as well as fome of the others, may alfo be propagated by fowing the feeds either where the plants are to remain, or in a fpot of good mould in the early autumn or fpring feafon, in the latter cafe removing the plants into their proper fituations, when of fufficient growth. In this mode the plants are, however, longer in arriving at the flowering ftate. The roots may be divided every two or three years, according to the number of divifions that are to be made. Where the foil is dry the plants fhould be new planted in the autumn; but in the contrary circumftances, in the fpring, in order to make them flower ftrong and in a perfect manner. All thefe plants are of a hardy growth; and capable of fucceeding in almoft any fort of foil. The climbing forts require proper fupport, to prevent their trailing upon the ground, and are well adapted for ornamenting naked walls, arbours or other fimilar places, as well as for running upon trees or fhrubs in particular fituations. And the two laft forts are well fuited for ornament in the clumps and borders of pleafure-grounds, to be fet out fingly or in affemblage with other plants of fimilar growths.

CLEMATITIS, in *Botany*, Bauh. Pin. Tourn. See CLEMATIS.

CLEMATITIS *novum genus*, Pluk. See EUPATORIUM *fcandens*. The older botanifts were accuftomed to call almoft every climber either clematis or clematitis.

CLEMENCY, in *Antiquity*, a deified perfonage, to whom an altar was erected at Athens, by the kindred of Hercules, and to whom a temple was dedicated by order of the Roman fenate, after the death of Julius Cæfar, on fome of whofe denarii this goddefs appears. She is defcribed by the poets as the guardian of the world, and exhibited, holding a branch of laurel or olive, and alfo a fpear, fhewing that gentlenefs and pity ought principally to diftinguifh victorious warriors. The Greeks and Romans gave the name of Afylum to the temples that were erected to this goddefs. According to Mr. Spence, "the diftinguifhing character of Clemency, both in her ftatues and in the poets is, the mildnefs of her countenance; fhe has an olive branch in her hand as a mark of her peaceful and gentle temper." The term "clemency" in common language, denotes a remiffion of feverity towards offenders, and particularly on the part of princes or perfons invefted with high authority. In praife of clemency joined with power, it is obferved, that the exercife of it is not only the privilege, the honour, and the duty of a prince, but that it alfo contributes to his perfonal fecurity and that of his dominions more effectually than all his garrifons, forts, and guards; that the prince is truly royal who mafters himfelf, looks upon all injuries as below him, and governs by equity and reafon, and not by paffion and caprice. Many remarkable inftances occur both in the Grecian and Roman hiftory, in which clemency was exercifed with great honour and correfponding advantage.

The council of Thirty, eftablifhed at Athens by Lyfander, committed the moft execrable cruelties; but they were overthrown by Thrafybulus, who, after the recall of the exiles propofed the celebrated amnefty, by which the citizens engaged upon oath that all paft tranfactions fhould be buried in oblivion. The government was re-eftablifhed upon its ancient foundation, the laws reftored to their priftine vigour, and magiftrates elected with the ufual forms. This, fays Rollin, (Anc. Hift. vol. iii. p. 309.) is one of the fineft events in ancient hiftory, worthy of the Athenian lenity and benevolence, and has ferved as a model to fucceffive ages in good government. Never had tyranny been more cruel and bloody than that from which the Athenians had been refcued. Every houfe was in mourning; every family bewailed the lofs of fome relation. It had been a feries of public robbery and rapine, in which licence and impunity had authorifed all manner of crimes. The people feemed to have a right to demand the blood of all accomplices in fuch notorious malverfations, and even the intereft of the ftate to authorife fuch a claim, that by exemplary feverities fuch enormous crimes might be prevented for the future. But Thrafybulus rifing above thofe fentiments, from the fuperiority of his more extenfive genius, and the views of a more difcerning and profound policy, forefaw, that by giving way to the punifhment of the guilty eternal feeds of discord and enmity would remain, to weaken the republic by domestic divisions, which it was necessary to unite against the common enemy, and occasion the loss to the state of a great number of citizens, who might render it important services from the view itself of making amends for past misbehaviour. Such a conduct, continues Rollin, after great troubles in a state, has always seemed, with the ablest politicians, the most certain and ready means to restore the public peace and tranquillity. Another instance occurs in the history of Pausanias, one of the kings of Sparta, when at the head of the Grecian army. After the victory of Platæa, as Herodotus relates the fact, (Lib. v.) one of the principal citizens of Ægina advised him to revenge upon the body of Mardonius the death of so many brave Spartans as were slain at Thermopylæ, and the unworthy treatment which his uncle Leonidas had met with from Xerxes and Mardonius, who fixed his body to a gibbet. "Would you advise me then, says he, to imitate the barbarians in the the thing we hate? If the esteem of the people of Ægina is to be bought at so dear a rate, I shall be content with pleasing the Lacedæmonians, who set a value upon virtue and merit. As to Leonidas and his companions, they are without doubt sufficiently revenged by the blood of so many thousand Persians as have been slain in the battle." In this battle out of 300,000 men commanded by Mardonius, scarcely 40,000 escaped.

When two patricians, adverting to the history of Rome, conspired against Titus the Roman emperor, (Suet. c. 9.) they were discovered, convicted, and sentenced to death by the senate. But the clemency of Titus dictated a very different conduct. Having sent for them, he privately admonished them, that in vain they aspired to the empire, which was given by destiny; exhorting them to be satisfied with the rank in which Providence had placed them, and offering them any thing else which it was in his power to bestow. At the same time he dispatched a messenger to the mother of one of them, who was then at a great distance, and deeply concerned about the fate of her son, to assure her, that her son was not only alive, but forgiven. Another instance is recorded by Zosimus (ii. 674). When Licinius had raised an army of 130,000 men, he endeavoured to wrest the government out of the hands of his brother-in-law, Constantine, the emperor. But his army having been defeated, he fled to Nicomedia, whither he was pursued by Constantine, who immediately invested the place. On the second day of the siege, the emperor's sister intreated him with tears to forgive her husband, and grant him at least his life. Constantine was prevailed upon to comply with her request; and the next day, Licinius, finding no way of escape, presented himself before the conqueror, and throwing himself at his feet, yielded to him the purple and the other ensigns of sovereignty. Constantine received him in a friendly manner, entertained him at his table, and afterwards sent him to Thessalonica, assuring him, that he should live unmolested as long as he raised no new disturbances. Another instance occurs in the conduct of Cicero, when Rome was divided into two factions upon the occasion of the death of Cæsar, who had been killed by the conspirators; recollecting the celebrated amnesty of Thrasybulus above-mentioned, he proposed, after the example of the Athenians, to bury all that had passed in eternal oblivion.

In a manner somewhat similar, cardinal Mazarine observed to don Lewis De Haro, prime minister of Spain, that this gentle and humane conduct in France had prevented the troubles and revolts of that kingdom from having any fatal consequences, and "that the king had not lost a foot of land by them to that day;" whereas "the inflexible severity of the Spaniards was the occasion that the subjects of that monarchy, whenever they threw off the mask, never returned to their obedience but by force of arms; which sufficiently appears, (says he) in the example of the Hollanders, who are in the peaceable possession of many provinces, that not an age ago were the patrimony of the king of Spain."

Montesquieu observes (Spirit of Laws, vol. i. p. 134.) that clemency is the peculiar characteristic of monarchs. In monarchies great men are governed by honour, which frequently requires what the law forbids, and they are so much punished by disgrace, by the loss (though often imaginary) of their fortune, credit, acquaintances, and pleasures, that rigour in respect to them is needless. It can lead only to divest the subjects of the affection they have for the person of their prince, and of the respect they ought to have for public posts and employments. So many are the advantages which monarchs gain by clemency, such love, such glory attend it, that it is generally a point of happiness with them to have an opportunity of exercising it.

However, when there is danger in the exercise of clemency, the danger is visible: it is an easy matter to distinguish it from that imbecility which exposes the princes to contempt, and to the very incapacity of punishing. The emperor Maurice formed a resolution never to spill the blood of his subjects. Anastasius punished no crimes at all. Isaac Angelus made an oath that no one should be put to death during his reign. These Greek emperors had forgotten that it was not for nothing that they were entrusted with the sword.

CLEMENS NON PAPA, in *Biography*, an excellent Netherlandish musical composer, principal maestro di cappella to the emperor Charles V. Ludovico Guicciardine tells us, that this musician was dead when he wrote his "Description of the Low Countries," 1556. Seven books of his motets in four parts ("Cantionum Sacrarum") were published after his decease, at Louvain, 1567, as was his "Missa Defunctorum," 1580. We have found no better music of the kind, than that of this composer; his style is clear, his harmony pure, and every subject of fugue or imitation simple and natural. In each of the great number of his works that we have scored, there is always some excellence; the last, however, that is seen, always appears the best. The several parts, in his French songs, sing better, and the composition is, in general, more pleasing, and like the best productions of a much better period, than any of the songs in the collections to which he was a contributor, that were published at Louvain about the middle of the sixteeth century, under the title of "Livres des Chansons a 4 Parties."

CLEMENS *Romanus*, *St.* CLEMÉNT, one of the apostolical fathers, and first bishop of Rome of that name, was a native of that city, as some have said; on mount Coelius, his father's name being Faustinus and his mother's Mattidia; but these particulars are uncertain. Some have asserted, that he was a Jew, or of Jewish extraction, alleging a passage in his epistle to the Corinthians, in which he calls Jacob our father; but such an expression, it has been said, is not unusual even among those who had been converted from Paganism to Christianity. Nothing is more natural than for Christians to speak as if they were Abraham's children; as if the law, and the prophets, and the patriarchs, belonged to them as well as to the Jews. (See Jortin's Remarks on Eccl. Hist. vol. i. p. 336, &c.). It is generally allowed, that he had been acquainted with apostles and apostolical men; and that he was the Clement, to whom St. Paul bears testimony (Phil. iv. 3.), and whom he mentions among others of his "fellow-labourers, whose names are in the book of life." Some, indeed, such are Mr. Wolff of Hamburgh, and Dr. Wall, have thought, that the Clement mentioned in this passage was a different person, and that he was a Philippian and not a Roman. To the arguments alleged by these writers, Dr. Lardner replies, that Clement, bishop of Rome, was well acquainted with some of our Lord's apostles, whether he be the person mentioned by St. Paul or not. This learned writer, whose judgment in every case of this kind challenges great deference, says, that he sees no proof that Clement mentioned by the apostle was a Philippian; and if Paul's calling Clement his helper or "fellow-labourer," in his epistle to the Philippians, is a proof that Clement had laboured with him at Philippi, his salutation of Aquila and Priscilla, in the epistle to the Romans (xvi. 3.), would prove that they had been the apostle's "helpers" at Rome, before he had been there. He adds, Dr. Wall's argument from the age of Clement has no weight at all; because there is no great distance between the supposed times of his and St. John's death; and yet St. John had been an apostle of Christ some while before Paul was converted. Clement therefore, bishop of Rome, without any inconsistency, may be supposed to have been a companion and fellow-labourer of Paul at several places, and yet live to about the end of the first century. Some difference of opinion has prevailed concerning the time when Clement obtained the bishopric of Rome. Bishop Pearson supposes, that Clement was bishop of Rome from the year of our Lord 69 or 70 to the year 83, the second of Domitian. Pagi is of opinion, that Clement succeeded Linus in 61, and occupied the see of Rome till 77, when he abdicated, and died long after a martyr in the year 100. Those learned men, who place the bishopric of Clement so early, or who suppose that he might have written his epistle to the Corinthians before he was bishop, (as Dodwell,) usually place it before the destruction of Jerusalem. Others suppose, that this epistle was written shortly after the end of the persecution under Nero, between the 64th and 70th year of Christ. Le Clerc places it in the year 69, and Dodwell in 64. Du Pin, Tillemont, and others think, that he was not bishop till the year 91 or 93. This was the opinion of Dr. Cave, when he wrote his Apostolici (*vid.* Life of St. Clement, § 4.) but he altered it afterwards. This, says Dr. Lardner, is the more common opinion, and is agreeable to the sentiments of Irenæus, Eusebius, and others, the most ancient Christian writers. Irenæus makes Clement the third in succession after the apostles. Eusebius also says, that in the 2d year of Titus, A. D. 79, Linus, bishop of the church of Rome, when he had governed it 12 years, delivered it to Anencletus; and in the 12th year of the reign of Domitian, A.D. 92, Anencletus, having been bishop of the church of Rome 12 years, was succeeded by Clement, whom the apostle mentions in his epistle to the Philippians. In another place Eusebius says, that in the beginning of Trajan's reign Clement still governed the church of Rome, who was the third in that succession, after Paul and Peter; for Linus was the first, and after him Anencletus; and he afterwards says, that Clement died in the 3d year of Trajan, (that is, A.D. 100); having been bishop 9 years. St. Jerom agrees with Eusebius; and he observes, that it was indeed the more common opinion of the Latins, that Clement was next after Peter, but he does not follow them. Tertullian, the most ancient Latin father remaining, though not so ancient as Irenæus, says, that Clement was ordained by Peter. But in this particular Tertullian might be mistaken; and the testimony of Irenæus, confirmed by Eusebius, is much more valuable than his. Dr. Lardner has suggested several methods of reconciling Tertullian with others. According to the most credible testimonies, Clement's bishopric of Rome must have commenced in the year 91 or 92. Some have supposed that our Clement was of the family of the Cæsars and that he suffered matyrdom. But both these suppositions seem to be originally owing to his having been confounded with "Flavius Clemens," the consul; who was a near relation of Domitian, and was put to death by him on account of his attachment to Christianity. That Clement was no martyr is fairly concluded from the silence of Irenæus, Tertullian, Eusebius, and others; who could not have omitted this circumstance, if there had been any ground for it.

The "Epistle" of Clement, still extant, appears to have been written in the name of the whole church of Rome to the church of Corinth, and therefore it is called at one time the epistle of Clement, and at another the epistle of the Romans, to the Corinthians.

The main design of it is to compose some dissensions, which subsisted in the church of Corinth about their spiritual guides and governors; which dissensions had been excited by a few turbulent and selfish persons. Clement recommends not only concord and harmony, but love in general, humility, and all the virtues of a good life, and several of the great articles and principles of religion. The style of it is clear and simple. It is called by the ancients an excellent and useful, or great and admirable epistle; and though Photius, upon the whole, commends it, yet he says that it contains several things liable to censure, or, in modern language, that it is a Socinian epistle. It should be recollected, however, that Photius is apt to censure the writers, who did not come up to the orthodoxy of his time. Nevertheless, the epistle deserves the commendations that have been bestowed upon it. It is not indeed entire, some pages being deficient in the MS. of it; and as we have only one MS. of it remaining, it cannot be altogether so correct, as if we had a number of copies to compare together.

As to the precise time when it was written, there has been some difference of opinion. It appears from expressions that occur in it, to have been written after some persecution, or at the conclusion of it; either the persecution of Nero about 64, or that of Domitian in 94, or 95. Several passages seem to intimate, that it was written after the latter, and not so soon as that of Nero. Irenæus says, that in the time of Clement, when many were alive, who had been taught by the apostles and when there was no small dissension among the brethren of Corinth, the church at Rome sent a most excellent letter to the Corinthians, persuading them to peace among themselves, &c. Eusebius also bears testimony to the excellence of this epistle, and to the dissension at Corinth which occasioned it; and he adds, that this epistle has been formerly, and is still publicly read in many churches. St. Jerom also says, that Clement wrote a very useful epistle in the name of the church of Rome to the church of Corinth, which in some places is read publicly. Upon the whole we may conclude, with Dr. Lardner, that this epistle was written at the latter end of the reign of Domitian, in the year 95, or rather 96. In this epistle there is but one book of the New Testament expressly named, which is the first epistle of St. Paul to the Corinthians, and which, it is said, was written by the apostle Paul. It contains frequent references and allusions to the Scriptures both of the Old and New Testament. Words of our blessed Lord, found in the gospels of Matthew, Mark, and Luke, are recommended with a high degree of respect, though without the names of the Evangelists. There are also supposed allusions to the Acts of the Apostles, the epistle of Paul to the Romans, both the epistles to the Corinthians, the epistles to the Galatians, Ephesians, Philippians, Colossians, the first to the Thessalonians, first and second to Timothy, the epistle to Titus, the epistle to the Hebrews, the epistle of James, and

and the first and second of Peter; but all without any name, or so much as a mark of citation. Mill allows, that it appears from this epistle, that Clement had in his hands not only our first three gospels, but also the Acts of the Apostles, and the epistle to the Romans, both the epistles to the Corinthians, and the epistle to the Hebrews: and the testimony thus given to the antiquity, genuineness, or authority, of the books of the New Testament, is to be esteemed not only the testimony of Clement, but likewise of the church of Rome in his time. Moreover, it ought to be allowed, that the Corinthians likewise, to whom this epistle was sent, were acquainted with, and highly respected, the books quoted, or alluded to. In this epistle there are not any quotations or references to any of the apocryphal gospels, as they are called. "Nor do I remember," says Dr. Lardner, "that any of the passages of the gospel according to the Hebrews, or that according to the Egyptians, which have been collected by learned men from the writings of the ancient Christians, are taken out of this epistle."

The epistle of which we have given the above account, is the only piece of Clement, which can be relied on as genuine. The second epistle, which some have been inclined to own as such, is expressly rejected by Photius; and Grabe has observed, that Dionysius, bishop of Corinth, in the second century, mentions only one epistle of Clement; that Clement of Alexandria and Origen, who have quoted the first, never take any notice of the second; nor yet Irenæus, who has particularly mentioned the first, and could not well have omitted to mention the other also, if he had known any thing of it. From all these circumstances Grabe concludes with great probability, that this piece was not written before the middle of the third century. As to the Constitutions, and Recognitions, ascribed to Clement; see these articles. Cave's Hist. Lit. t. i. p. 28. Jones's Canon, vol. i. Lardner's Works, vol. ii.

Clemens, Titus Flavius, Clemens Alexandrinus, or St. Clement *of Alexandria*, was born and educated, as some say, at Athens, or, according to others, at Alexandria, where he resided a considerable time, after his return from his travels through Greece, Calabria, Italy, the East, Palestine, and Egypt. Eusebius intimates that he was originally a heathen. He flourished in the latter part of the second, and the beginning of the third century, in the reign of Severus and his son Antoninus Caracalla; that is, between the years 192 and 217. Du Pin supposes, that he lived to the time of Heliogabalus, and that he did not die before the year 220; but it is the more general opinion, that he died sooner. Several of the ancients give him the title of Presbyter; and he was likewise president of the catechetical school of Alexandria, having succeeded Pantænus in this office, when he went to Ethiopia, about the year 190. Sidetes, indeed, is of a different opinion, and says that Pantænus was the successor of Clement, and that Clement was the successor and disciple of Athenagoras. Dodwell has adopted this opinion, though it is contradicted by the more credible testimonies of Eusebius, Jerom, and Photius. It is very probable, however, that upon the publication of the edicts of Severus against the Christians, in the 10th year of his reign, A.D. 202, Clement was obliged to resign this office and to retire from Alexandria. The place and time of his death are not ascertained; but he probably died at Alexandria, whither he returned from his peregrinations to Jerusalem, Antioch, &c. in the reign of Antoninus Caracalla. Among the eminent men who proceeded from the school of Clement, we may mention Origen, Alexander, bishop of Jerusalem, and Hippolytus. Clement wrote a great number of books, of which Eusebius and Jerom have given catalogues, and they are also enumerated by Fabricius and Cave. The works which now remain, are "Protrepticum," or an Exhortation to the Gentiles; "Pædagogus," or the Instructor, in three books; the "Stromata," or Various Discourses, in eight books; and a small treatise entitled, "Who is the rich Man that may be saved." The Stromata were written after the death of Commodus, in the reign of Severus, as Eusebius has observed from a passage in the work itself. Dodwell was of opinion, that all the works of Clement, which are remaining, were written between the beginning of the year 193 and the year 195. Beside these, Eusebius frequently mentions another book of Clement, called "Hypotuposes," or Institutions, which is lost. But we have in Greek two small pieces, one called "an Epitome of the Writings of Theodotus and the Oriental Doctrine;" the other "Extracts from the Prophets;" both which are generally supposed to be collected out of the lost book of Institutions, or to be fragments of it. There is likewise in Latin a small treatise or fragment, called "Adumbrations" on some of the Catholic epistles, which, if it be Clement's, was probably traslated from the same work called "Institutions," as we learn from Eusebius and others, containing short explications of many books both of the Old and New Testament. Many of the ancients speak in high terms of the excellent character and distinguished learning of Clement. Many testimonies to this purpose, collected from Eusebius, Alexander bishop of Jerusalem, St. Jerom, &c. may be seen prefixed to the Oxford or Potter's edition of St. Clement's works, in 2 vols. folio, 1715.

In the writings of Clement we have a very valuable testimony to the four gospels of St. Matthew, St. Mark, St. Luke, and St. John, all which were owned and received by him; and he has also preserved a tradition concerning the order in which they were written, which he had received from proselytes of more ancient times. We have also an assurance of the genuineness of the genealogies in the first chapter of St. Matthew and the third chapter of St. Luke; which he had also received from more ancient presbyters. "This testimony to the first chapter of St. Matthew's gospel is so strong," says Dr. Lardner, "that it seems to put the antiquity and genuineness of it out of question." Clement's account of the occasion of writing St. Mark's gospel agrees with that of Papias and Irenæus, which informs us that this gospel contains the substance of Peter's preaching; and that it was composed by one who had been long a companion and follower of Peter, and who retained in his memory the things that had been spoken by that apostle. Clement supposes that St. John, who wrote last, had seen and approved the other three gospels. He owns the Acts of the Apostles, and ascribes it to Luke as the author, who is said to have likewise translated the epistle to the Hebrews. He also admits all the fourteen epistles of Paul, except the epistle of Philemon; but his omitting to mention this epistle might be owing to its brevity. He also quotes the first epistle of Peter, the first and second epistles of John, the epistle of Jude, and the book of Revelation; but we have in Clement no quotations from the epistle of James, the second of Peter, or the third of John, nor any evidence that these were owned by him. The epistle of Barnabas, that of Clement of Rome, and the shepherd of Hermas, are quoted by Clement with higher marks of respect than others, as they are deserving of it on account of their early age, and their authors' acquaintance with the apostles or apostolical men. But he affords us no evidence that he had the same respect for them which he had for the gospels and the epistles of the apostles. There are also other books, called apocryphal, which are cited by Clement; such are the Gospels according to the

Hebrews,

Hebrews, and according to the Egyptians; the Preaching of Peter, the Revelation of Peter, and the Acts of Peter, and the Traditions of Matthias. But there is no sufficient reason for supposing, that St. Clement received as "Scripture," in the highest sense of the word, any Christian writings, besides the books of the New Testament, now commonly received by us. Cave's Hist. Lit. t. i. p. 88, &c. Fab. Bib. Græc. t. v. p. 102, &c. Lardner's Works, vol. ii. p. 206 – 243.

CLEMENT, a name assumed by several of the bishops of Rome. Of *Clement* I. we have already given an account under the article CLEMENS ROMANUS.

Clement II. was the name assumed by Suiger, a native of Saxony, and bishop of Bamberg, upon his elevation to the pontifical throne, in 1046, in order to supply the vacancy occasioned by the death of Gregory VI. On the day of his election he crowned Henry emperor, and his queen Agnes empress; and in a council speedily assembled at Rome, he issued several canons against simony, which had prevailed almost universally all over the West. In this council he settled a dispute between the archbishops of Ravenna and Milan concerning precedency; determining, by his apostolical authority, in favour of the former, whom he ordered always to sit on his right hand, unless the emperor should be present, and, in that case, to sit at his left. This pope died at Rome on the 9th of October 1047, after a pontificate of 9 months and 15 days; and his remains were interred at Bamberg. St. Wiborada, a virgin martyred by the Hungarians in 925, was canonized by this pope, and the day of her death appointed as an annual festival.

Clement III. was Paul, cardinal bishop of Palestrina, and a native of Rome, who, being elected at Pisa on the 19th of December, 1187, as successor to Gregory VIII. was crowned the next day under this name. Soon after his election, he exerted himself in terminating a contest that had subsisted for 50 years between the pope and the Roman people. Accordingly an agreement was concluded, in 1188, after several previous conferences, upon the following terms: *viz.* that the pope should be invested with the sovereignty of Rome:—that the office of patrician should be abolished, and a prefect with more limited power appointed in his room:—that senators should be created annually, with the approbation and by the authority of the pope, who should take an oath of allegiance to his holiness, and promise to assist him when required:—that St. Peter's church and its revenues should be restored to the apostolic see:—that the tolls and all other public revenues should be at the disposal of the pope, on condition that he expended one-third of them for the use of the Roman people:—that the senate and the people should reverence the majesty and maintain the honour and dignity of the high pontiff:—that the Roman pontiff should bestow the usual gifts and largesses upon the senators, judges, advocates, and other officers of the senate:—that he should pay yearly a certain sum for the reparation of the walls of the city:—and that he should allow the walls of Tusculum to be razed to the ground, and assist the Romans in that undertaking. The papal dominion over Rome being thus established, Clement set out from Pisa for Rome without delay, and was cordially received by the senate, the nobility, and the people. The pope, having secured his sovereignty, zealously engaged in the prosecution of the holy war, and left no attempt untried for inducing all Christian princes to unite in a new crusade. His active efforts were crowned with singular success not only in Italy but in Germany, France, and England; and heavy taxes were imposed in order to defray the expence of the intended expedition. In England, particularly, a tenth was exacted of all revenues, of all moveables and chattels. Having thus provided a large sum of money, a war in the east was carried on, though with little success, by Richard, the son and successor of Henry II., after the death of his father in 1189. Clement, having compromised the difference that subsisted between William king of Scotland and the apostolic see, and exempted the church of Scotland from all submission to the English church, and having enjoyed the satisfaction of hearing that the kings of France and England had departed for the Holy Land at the head of two numerous armies, was humbled and grieved by the unexpected news of the death of the emperor Frederic, who, after having adjusted all his differences with the apostolic see, had taken the cross, and obtained many signal advantages over the infidels. Whilst he was pursuing these advantages, he fell from his horse in crossing a river, and lost his life before his assistants could afford him any assistance. The pope did not long survive this distressing intelligence. He died on the 27th of March in the following year, *viz.* 1191, and, being greatly beloved by the Romans, was buried with extraordinary pomp in the Lateran church. Before his death, he canonized Otto, bishop of Bamberg, the first who preached the gospel to the Pomeranians, and Stephen de Mureto, founder of the order of the Grandimontenses.

Clement IV. succeeded Urban IV. in 1265. His family name was Guido, and he was a native of St. Gilles on the Rhone, in the province of Narbonne. In his youth he followed the military profession, and afterwards applied himself to the study of the law, with such assiduity and success, that he was reckoned one of the best civilians of his time. Upon the death of his wife he entered into holy orders; and after several gradations of ecclesiastical preferment, he was created by Urban IV. in 1261, cardinal bishop of Sabina; and in 1263, he was sent, under the character of the pope's legate *à latere*, into England, to mediate a reconciliation between the king and his barons, who were then at open war. But, being forbidden to enter the kingdom, he stopped at Boulogne, and, summoning thither some of the English bishops, he solemnly excommunicated, in their presence, all who should thenceforth disturb the public peace of the kingdom, and ordered the bishops to publish that sentence, and to see it executed. In his return to Italy, he received the news of his election to the papacy; and having arrived safe at Perugia, he was there, or, as some say, at Viterbo, consecrated and crowned, assuming the name of Clement, because he was born on St. Clement's day. Instead of following the example of other popes, who had enriched and aggrandized their families at the expence of the church, he gave his relations to understand, that they must expect nothing from him as pope, but content themselves with the wealth and the rank which they possessed before his promotion. Clement is said to have abhorred plurality of benefices, as a most scandalous abuse; and he obliged even his own nephew, who had three, to resign two of them, allowing him to choose which of the three he pleased. The character of Clement was, in many respects, unexceptionable; nevertheless, in conformity to the conduct of his predecessors, he made it the whole business of his pontificate, utterly to extirpate the family of Frederic, to drive Manfred from the kingdom of Sicily, and settle Charles of Anjou upon the throne. Charles was accordingly invested with the kingdom of Sicily by four cardinals appointed by the pope; but under so many conditions annexed to the investiture, that he became, in effect, a tributary of the apostolic see. On the 6th of January, 1266, Charles was solemnly crowned in the church of St. Peter, as king of Sicily on this and the other side of the Pharos, or the straits of Messina; and hence probably originated.

ginated the modern title of king of both Sicilies. His wife, Beatrix, who had long panted for a crown, received it at the same time. Charles, however, was obliged to contest the possession of the kingdom, first against Manfred, who was defeated and slain in battle, and afterwards against Conrad, or Conradin, who was invited by the discontented barons to possess himself of his paternal and hereditary kingdom, which the pope had unjustly wrested from him, and conferred upon one who had not the least shadow of right to it. Conradin, in defiance of the citations and menaces of the pope, entered Italy; and at Rome he was received by the senate, the nobility, and the people, with the greatest demonstrations of joy. These measures so enraged the pope, that he thundered out the sentence of excommunication against Conradin, and all who should assist him, accompanied with menaced forfeitures, and with a declaration, that Conradin himself was incapable of holding any kingdom, fief, or dignity whatever. The Romans, however, protected Conradin, and supplied his army, as long as he remained in their city, with all necessaries, at their own expence. One of his generals having gained a victory in Sicily, Conradin was proclaimed king in all the chief cities of the island, and the Sicilians every where declared for him. However, Conradin having heard of the victory, left Rome in order to engage Charles; and the two armies having met at the lake of Celano, engaged in a combat, which proved disastrous to Conradin, and terminated in a complete victory on the part of Charles. The consequence of this event was an order issued by Charles, that all the cities which had declared for Conradin, should be given up to be plundered, and then laid in ashes. The citizens who had taken part with the rebels, as they were called, were either put to a cruel death, or confined for life. Conradin himself was publicly executed, and several of his partizans, of distinguished rank, shared the same fate. Clement, however, did not live to hear of these barbarous executions. He died at Viterbo, in the latter end of November 1268; whereas Conradin was not beheaded till October 1269. Clement, exclusively of his conduct in the events above related, and his implacable and unprovoked enmity to Conradin and his family, pursued a conduct that merited commendation. He relieved poverty and distress, rewarded virtue and merit, and left his relations at his death in the same rank and condition they were in when he first ascended the pontifical throne. Several learned treatises upon the canons, and canon law, are ascribed to Clement. But some of these were undoubtedly written by one Guido Papa, who has been mistaken for pope Clement, whose name, before his promotion, was Guido. The life of Clement has been elegantly written by the Jesuit, Claudius Clemens, and was printed at Lyons in 1629.

Clement V. was elected the successor of Benedict XI., after a contest in the conclave of cardinals which lasted near a year, in the year 1305. He was the son of Berald de Got, a nobleman of Aquitain, and, by favour of Boniface VIII. preferred in 1299 to the archbishopric of Bourdeaux. The ceremony of his coronation was performed at Lyons, whither he summoned the cardinals; and, on his return from the church of St. Justus to his palace, with the crown on his head, his horse was led part of the way by the king of France on foot, and afterwards by Charles de Valois and the duke of Brittany, likewise on foot. But the fall of a wall during the procession, which killed several persons of distinction, and caused the crown to fall from the head of the pope, excited a great alarm among the people, and gave occasion to the Italian writers to observe, that such were the auspices under which the holy see was translated from Italy to France, from Rome to Avignon, where it remained for an interval of more than 70 years. The first and chief care of Clement, after his elevation, was to fulfil his engagements to the French king, thus recompensing him for the effectual service which he had rendered in promoting his election. Besides the creation of 10 cardinals, all of whom were Frenchmen, and the restoration of the two Colonnas to the cardinalate, from which they had been degraded; he granted to the king the tenths of all the ecclesiastical revenues in his kingdom, for the space of 5 years; and he revoked and annulled a law, which declared, that the kingdom of France, and of course all other kingdoms, are subject to the see of Rome in temporals, as well as spirituals. In the year 1309, the pope transferred his see to Avignon, which was at that time subject to Charles, king of Sicily; and in 1311 he summoned a general council at Vienne, in order to determine with regard to the knights templars, who were charged with many enormous crimes, to procure immediate relief and supply for the Christians in the Holy Land, to reform the manners of the ecclesiastics, and to restore the decayed discipline of the church. The prosecution against the knights templars was carried on in different countries under the authority of the pope, and the order was suppressed by him in a private consistory in the year 1312. See KNIGHTS TEMPLARS. At the third session of this council, an order was issued for preaching a new crusade through all Christian countries, and great indulgences were granted to all who should engage in it. In the same session, the doctrines of the Beguardi and Beguines were condemned; and the constitution of Gregory X. relating to the conclave, confirmed by Celestine V. and Boniface VIII., was confirmed anew by this council; and it was further ordained, that no cardinal, under any pretence of excommunication, suspension, or interdict whatever, should be excluded from the election. In the year 1313, after the breaking up of this council, Celestine V. was canonized by the pope. Among the last acts of his pontificate, were the coronation of Henry VII. as emperor, and the creation of Robert king of Sicily, a senator of Rome, and a vicar of the empire. Soon after these events Clement died, at a place called Requemaure, in the diocese of Nismes, in his way to Bourdeaux, his native place, on the 20th of April 1314, (or as others say, 1316) when he had held the see from the day of his election, on the 5th of June 1305, 8 years, 10 months, and 15 days. The ambition of this pontiff was unbounded; and he acted during his whole pontificate as a mere tool of the French king, to whom he had owed his promotion. Clement wrote many constitutions relating to different subjects, and ordered them to be distinguished by the title of "The Seventh book of the Decretals." Since his time they have been known by the name of "The Clementines;" they were approved by the council of Vienne, and published by Clement at Montil, not long before his death, that is, on the 21st of March, 1314. As he was prevented by his illness and death, that soon ensued, from sending them to the universities; they remained in a manner suspended till the year 1317, when his successor, John XXII, sent authentic copies of them to all the universities, ordering them not only to be taught in the schools, but to be quoted, as standing laws, in the courts of justice. See CANON *Law*.

Clement VI. succeeded Benedict XII. and was crowned on the 19th of May 1342. His family name was Peter Roger. He was born in 1292, in the diocese of Limoges, and embraced a religious life among the Benedictines at the age of 10 years; having studied at Paris, and being admitted by the university of that city, at the age of 30, to the degree of master or doctor in divinity, he rose through several subordinate gradations of preferment to that of cardinal

 presbyter

presbyter of St. Nereus and Achilleus, to which rank he was advanced in 1338 by pope Benedict XII. Soon after his election he created 10 new cardinals, among whom was his brother Hugh Roger, who refused the pontificate upon the death of Innocent VI. The Romans congratulated him on his elevation to the papal see by a solemn embassy, and requested that he would reside at Rome, and order the jubilee to be celebrated every 50th year. They also conferred upon him, as Peter Roger, the supreme magistracy, but not as pope, least his predecessors should claim it. One of the deputies on this occasion was the celebrated Petrarch, who was very favourably received. Although he declined for the present complying with their request of residence at Rome, he ordered a jubilee according to their desire. Differences having subsisted for a long time between the emperor Lewis and the apostolic see, an embassy was sent by the emperor to the pope in the second year of his pontificate, proposing an accommodation and requesting absolution. Clement received the embassadors in a very haughty manner, and having advised with his cardinals, proposed, as the only terms of absolution, that he should own himself guilty of the heresies, with which he was charged, and abjure them all; that he should surrender the title of king or emperor, resign the government of the empire, and not resume it without the permission of the apostolic see; that he should submit to the absolute disposal of the pope himself, his children, and all his hereditary dominions and estates; and that he should acknowledge the empire to be in the gift of the apostolic see. These articles, however humiliating to the emperor, were agreed to by the ambassadors; and the emperor, astonished at the extravagant demands of the pope, resolved to improve them to his own advantage. Accordingly he sent copies of them to all the princes and states of the empire, and convoked a diet at Frankfort for the purpose of deliberating, concerning the most proper means of defeating the ambitious views and effectually resisting the encroachments of the pope. At this diet it was agreed, that these terms of conciliation should be rejected by the German states and princes. The pope, incensed at their refusal, confirmed all the sentences that had been pronounced against the emperor by his predecessor pope John, or himself, and ordered the electors to proceed immediately to the election of a new king of the Romans: Lewis of Bavaria having forfeited, "as an avowed and impenitent heretic," all right to that title and to the imperial crown, and to every other kind of dignity. This order was accompanied with the recommendation of Charles duke of Moravia, the son of John king of Bohemia, after he had previously stipulated the conditions on which his interest was to be employed in advancing the duke to the Imperial throne. The electors complied; Charles was elected; and the election was ratified by the pope's bull, issued Nov. 6th, 1346. About this time a revolution happened in the kingdom of Naples, which was occasioned by the murder of the king, in consequence of which the kingdom was invaded by the king of Hungary, the brother of the deceased sovereign. Upon this invasion queen Joan retired from the kingdom and repaired to Avignon in order to plead her cause before the pope and the cardinals. This she did with such effect, that Clement dispatched an apostolic legate into Hungary to negotiate a reconciliation between Joan and her husband, Lewis of Taranto, and the Hungarian king. In the meanwhile the Neapolitan nobility, who had become weary of the government of the Hungarians, invited Joan back to her own kingdom; who, in order to furnish herself with money for defraying the charges of her expedition, sold Avignon to the pope for 80 thousand florins of gold. The bargain was confirmed by Charles, who had been lately elected king of the Romans, and also renounced all the right claimed by the empire over that city and its territory. The bull containing this renunciation is dated Nov. 1, 1348. In this year a very dreadful plague raged over all Europe; and in this general calamity Clement was liberal and active in affording the sufferers necessary and seasonable relief. In 1349, a new sect arose called the "Flagellants;" but, being threatened excommunication by the pope, they were very soon extirpated. On occasion of the jubilee, which took place in the year 1350, Rome was crowded with pilgrims; and the number that thronged thither was so great, that one would have thought, says Petrarch, who was present, that the plague which had almost unpeopled the world, had not so much as thinned it. The pope distinguished himself by his active endeavours in restraining the exactions and oppressions which the pilgrims suffered from the cruelty and avarice of the Romans. In Germany many of the princes and cities refused to acknowledge Charles, who had been imposed upon them by the interference and influence of the pope; and actually proceeded to elect another emperor in his room. After some unsuccessful efforts for this purpose, the Germans, tired out with a long war, chose rather to submit to Charles than to involve their country in new troubles by new elections. In 1351, Clement undertook the defence of the mendicant friars, that had been eminently useful during the plague, and to whom many had left their estates in recompence of their services, against the secular clergy, who complained to the pope of their having degenerated from their original institution, and demanded the entire suppression of that order. At the close of this year Clement was taken dangerously ill, and the cardinals, apprehending the event of his death, prevailed upon him to mitigate the rigour of the constitution of Gregory X. with respect to the conclave. (See CONCLAVE.) During the same malady he issued another constitution, importing that if in disputing, preaching or teaching, either before or since his promotion to the apostolic see, he had advanced any thing contrary to the catholic doctrine, as to good morals, he retracted it; and submitted the whole to the judgment of his predecessors; and hence we perceive that he entertained but an indifferent opinion of his own infallibility. Having in the following year dispatched a legate into Sicily to crown Joan queen of Jerusalem and Sicily, and her husband Lewis king, Clement, towards the close of the year, was seized with a fever, which terminated his life on the 6th of December, after he had held the Roman see, from the day of his coronation, 10 years six months and 18 days. This pope was fond of pomp and grandeur, and lived more like a monarch than a bishop. It was his favourite object to aggrandize his family, and enrich his relations, several of whom he furnished with estates in France, and others of them he made cardinals, though they were under the stipulated age, or led scandalous lives. In his promotions, it is said, that he paid little respect to learning or virtue. Petrarch speaks of him as possessing an uncommon memory, so that he never forgot any thing he had read or heard, as a person of very great learning, and as no less eloquent than learned. He is said, by some of his biographers, to have preached frequently, and to have composed many excellent sermons. The only writings of Clement, extant in print, are a treatise on ecclesiastical power, some speeches, letters, decretals, and a book upon the canonization of St. Ivo, which took place in 1347. Among other acts of his pontificate he granted to the kings of France the privilege of receiving the sacrament in both kinds, whenever they pleased; he appointed Lewis, earl of Clermont, descended from

from the royal families of France and Castile, king of the Fortunate islands, now the Canaries, which were discovered in his time, for which grant he obliged Lewis and his heirs to pay yearly 400 florins of gold to him and his successors, as an acknowledgement of their holding their kingdom of the apostolic see; he disposed of some rich benefices in England to foreigners, which in 1343 occasioned a quarrel between him and Edward III.; he embellished, at a great expence, the pontifical palace at Avignon; and, exclusively of other charities, he founded at Rouen, and richly endowed a college, called the "Pope's College," or the college of "Clementine Priests."

Clement VII. was the name assumed by the cardinal de Medici, who succeeded Adrian VI., Nov. 28, in the year 1523. This choice, after a contest in the conclave which lasted fifty days, was universally approved. High expectations were formed of a pope, whose great talents, and long experience in business, seemed to qualify him no less for defending the spiritual interests of the church, exposed to imminent dangers by the progress of Luther's opinions, than for conducting its political operations with the prudence requisite at such a difficult juncture; and who, besides these advantages, rendered the ecclesiastical state more respectable by having in his hands the government of Florence, together with the wealth of the family of Medici. By this election the ambitious views of cardinal Wolsey, who aspired to the papal throne, were a second time disappointed; notwithstanding the interest employed in his favour by Henry VIII. with the emperor Charles V., and the activity of Wolsey himself, who instructed his agents at Rome to spare neither promises nor bribes in order to gain his end. The cardinal, after all his expectations and endeavours, had the mortification to see a pope elected of such an age, and of so vigorous a constitution, that he could derive little comfort from the chance of succeeding him. Wolsey was extremely indignant on the occasion; and though Clement endeavoured to soothe his vindictive nature by granting him a commission to be legate in England during life, with such ample powers as vested in him almost the whole papal jurisdiction in that kingdom, the injury he had received entirely dissolved the tie, which had united him to Charles, and from that moment he meditated revenge. However he had art enough to disguise his resentment; and he abounded on every occasion, private as well as public, in declarations of his high satisfaction with Clement's promotion. Clement had scarcely taken secure possession of the pontifical chair, before ambassadors were sent to him both by the emperor and the king of France, then at war in the Milanese, to engage him in their interest. The pope, however, instead of taking a decisive part with either of the contending parties, laboured with the zeal which became his character, to bring about a reconciliation; but his endeavours were ineffectual. The war was pursued with greater vigour than ever, and the French were expelled both out of the Milanese and the republic of Genoa; but Francis, the king of France, having gained considerable advantages over the Imperialists, who had invaded Provence and laid siege to Marseilles both by sea and land, and compelled them to abandon his dominions, crossed the Alps at mount Cenis, and advancing rapidly into the duchy of Milan, made himself master of that capital, and laid siege to Pavia. The pope, who already considered the French as superior in Italy, became impatient to disengage himself from his connections with the emperor, of whose designs he was extremely jealous, and to enter into terms of friendship with Francis. He laboured hard to bring about a peace that would secure Francis in possession of his new conquests; and as Charles, who was always inflexible in the prosecution of his schemes, rejected the proposition with disdain, and with bitter exclamations against the pope, by whose persuasion, while cardinal de Medici, he had been induced to invade the Milanese; Clement immediately concluded a treaty of neutrality with the king of France, in which the republic of Florence was included. Whilst the siege of Pavia was slowly carried on, the Imperialists attacked the French with a very powerful force, defeated them in what is called the battle of Pavia (Feb. 24, 1525) with great slaughter, and took the king prisoner. This victory excited the greatest alarm among the Italian states, and Clement, instead of pursuing the measures which he had concerted with the Venetians for securing the liberty of Italy, either intimidated by threats or allured by promises, entered into a separate treaty with Charles, binding himself to advance a considerable sum in return for certain emoluments which he was to receive. The money was instantly paid; Charles afterwards refused to ratify the treaty; and the pope remained exposed at once to infamy and ridicule; to the former, because he had deserted the public cause for his private interest; to the latter, because he had been a loser by that unworthy action. In the year 1526, an alliance was concluded between the pope, the Venetians, and Sforza, duke of Milan, for the security and liberty of Italy. The king of France, who had been released from captivity, and Henry VIII., king of England, acceded to it. The latter was declared protector of this league, which they dignified with the name of "holy," because the pope was at the head of it; and in order to allure them more effectually, a principality in the kingdom of Naples, of 30,000 ducats yearly revenue, was to be settled on him, and lands to the value of 10,000 ducats on his favourite Wolsey. Clement, as soon as this league was concluded, by the plenitude of his papal power, absolved Francis from the oath which he had taken to observe the treaty of Madrid, which had been the stipulated condition of his release; but the discovery of Francis's intentions to elude this treaty filled the emperor with a variety of disquieting thoughts, and he determined to insist on the strict execution of it. As soon also as he had received an account of the holy league, he exclaimed against Francis, as a prince void of faith and of honour; nor did he less complain of Clement, whom he solicited in vain to abandon his new allies. He, moreover, threatened him not only with all the vengeance which the power of an emperor could inflict, but by appealing to a general council, called up before him all the terrors arising from the authority of these assemblies, so formidable to the papal see. At the same time he exerted himself with unusual vigour, in order to send supplies not only of men, but of money, which was still more needed, into Italy. The Colonnas, who retained their attachment to the Imperial interest, and who, by placing themselves under the protection of the emperor, preserved the quiet possession of their own territories and privileges, took an active part against the confederacy, and particularly against the pope; and after for some time amusing and deluding him, marched to Rome, and made themselves masters of the city. Clement, terrified at the danger that threatened him, ashamed of his own credulity, and deserted by almost every person, fled with precipitation into the castle of St. Angelo, which was immediately invested. After a general plunder of the Vatican, the church of St. Peter, and the houses of the pope's ministers and servants, Clement, deprived of every thing necessary for subsistence or defence, was soon obliged to demand a capitulation; and the Imperial ambassador, Moncada, with the haughtiness of a conqueror, prescribed conditions, which it was not in his power to reject. The chief of these was, that Clement should not only grant a full pardon to the Colonnas, but receive them into favour, and immediately withdraw all the

 troops

troops in his pay from the army of the confederates in Lombardy.

The Colonnas, who talked of nothing less than deposing Clement, and of placing Pompeo, their kinsman, in the vacant chair of St. Peter, exclaimed loudly against a treaty, which left them at the mercy of a pontiff justly incensed against them. But Moncada, attentive merely to his master's interest, paid little regard to their complaints, and by this fortunate measure, broke intirely the power of the confederates. Clement, regardless of the treaty with Moncada, degraded the cardinal Colonna, excommunicated the rest of the family, seized their places of strength, and wasted their lands with all the cruelty excited by a recent injury. After this he turned his arms against Naples, and as his operations were aided by the French fleet, he made some progress towards the conquest of that kingdom; the viceroy being no less destitute than the other Imperial generals of the money requisite for a vigorous defence. The Colonnas and the other friends of the emperor soon retaliated on the pope; for the duke of Bourbon who commanded the Imperial army, wanting money to pay his troops and to purchase provisions for their subsistence, determined to force his way into the State of the Church, and to let his army live upon plunder. However, he concealed his intentions so succesfully, that Clement, though alarmed, could not discover whether Rome or Florence would be the first object of his depredation; and he was therefore kept for some time in a state of disquieting suspenee. Thus circumstanced, the pope concludes an agreement with Lannoy, viceroy of Naples, March 15, 1527, comprehending the following principal articles, *viz.* that a suspension of arms should take place between the pontifical and Imperial troops for eight months; that Clement should advance 60,000 crowns towards satisfying the demands of the Imperial army; that the Colonnas should be absolved from censure, and their former dignities and possessions be restored to them; and that the viceroy should come to Rome, and prevent Bourbon from approaching nearer to that city, or to Florence. On this treaty Clement fixed his reliance; a reliance which Guicciardini ascribes wholly to an infatuation which those who are doomed to ruin cannot avoid. Lannoy having thus detached Clement from the confederacy, wished to turn Bourbon's arms against the Venetians; but Bourbon had other schemes to accomplish. Although he received a message from the viceroy he paid no regard to it, but continued to ravage the ecclesiastical territories, and to advance towards Florence. Upon this Clement renewed his application to Lannoy, and intreated and conjured him to put a stop to Bourbon's progress. Lannoy made some ineffectual efforts for this purpose; but Bourbon's soldiers, having heard of the truce, raged and threatened, demanding the accomplishment of the promises in which they had confided. Whilst every person in Rome perceived the approaching and irresistible storm, Clement alone, relying on some ambiguous and deceitful professions which Bourbon made of his inclination towards peace, sunk back into his former security. Bourbon being under a necessity of changing his rout towards Florence by the arrival of the duke d'Urbino's army, determined to attack and plunder Rome. The resolution was bold, and the execution of it no less rapid. Clement was rouzed from his security; and though, under his feeble conduct, all was consternation, disorder, and irresolution, yet he collected such of his disbanded soldiers as still remained in the city; he armed the artificers of Rome, and the footmen and train-bearers of the cardinals; he repaired the breaches in the walls; he began to erect new works; he excommunicated Bourbon and all his troops, branding the Germans with the name of Lutherans, and the Spaniards with that of Moors. Thus prepared, he determined to wait the approach of an enemy whom he might easily have avoided by a timely retreat. Bourbon advanced with speed, and encamped in the plains of Rome on the evening of the 5th of May. Having animated his soldiers by presenting to their view the palaces and churches of the capital of the Christian commonwealth, into which the wealth of all Europe had flowed during many centuries, without having been violated by any hostile hand, he commenced the assault early on the next morning, and at the head of his troops he led them to scale the walls. They were at first received with a fortitude equal to their own; and whilst Bourbon's troops were ready to give way, their leader threw himself from his horse, seized a scaling ladder from one of the soldiers, and as he began to mount it, a musket ball from the ramparts gave him a deadly wound, which, at the moment of expiring, he endeavoured to conceal from his troops. As soon as this fatal event was known to the army, it seemed to animate them with new valour; the name of Bourbon resounded along the line, accompanied with the cry of blood and revenge. The veterans on the walls were overpowered, the enemy rushed on with incredible violence, and the city was taken. During the combat, Clement was employed at the altar of St. Peter's in offering up to heaven unavailing prayers for victory. But as soon as he heard that his troops began to give way, he fled with precipitation; and instead of making his escape, such was his infatuation, he shut himself up, with thirteen cardinals and others, in the castle of St. Angelo, which he had before found to be an insecure retreat. The misery and horror of the scene that followed may be more easily conceived than described. The pillage and cruelty that were exercised on this occasion exceeded those of the Huns, Vandals, or Goths, in the 5th and 6th centuries. The booty in ready money alone amounted to a million of ducats; and what they raised by ransoms and exactions far exceeded that sum. Clement himself, deprived of every resource, and reduced to such extremity of famine as to feed on asses' flesh, was obliged to capitulate on such conditions as the conquerors were pleased to prescribe. He agreed to pay 400,000 ducats to the army; to surrender to the emperor all the places of strength belonging to the church; and, besides giving hostages, to remain a prisoner himself until the chief articles were performed. The emperor feigned grief for the plunder of Rome, and the captivity of the pontiff; but it was, without doubt, mere hypocrisy. The concern felt by the kings of France and England on this occasion was more sincere; though perhaps not altogether disinterested. Francis and Henry, alarmed at the progress of the Imperial arms in Italy, had, even before the taking of Rome, entered into a closer alliance; this alliance was now cemented by the common desire of rescuing the pope out of the emperor's hands, a measure no less political than it appeared to be pious. With this view they perceived the necessity of abandoning their designs in the Low Countries, and of rendering Italy the seat of war, that they might thus deliver Rome and set Clement at liberty. Wolsey neglected no measure that could incense his master against the emperor. Besides these considerations of a public nature, Henry was influenced by a more private and selfish motive; because he had begun about this time to form his scheme of divorcing Catharine of Arragon, towards the execution of which he knew that the sanction of papal authority would be necessary; and he was therefore desirous of acquiring as much merit as possible with Clement, by appearing to be the chief instrument of his deliverance.

In the mean while, whilst the two kings were negociating their new alliance, the pope, unable to fulfil the conditions of his capitulation, remained a prisoner. The Florentines, as soon as they heard of his captivity, ran to arms in a tumultuous manner; expelled the cardinal de' Cortona, who governed their city in the pope's name; defaced the arms of the Medici; demolished the statues of Leo and Clement; and declaring themselves a free state, re-established their ancient popular government. The Venetians, taking advantage of the calamity of their ally the pope, seized Ravenna, and other places belonging to the church, under pretext of keeping them in deposit. The dukes of Urbino and Ferrara likewise laid hold on part of the spoils of the unfortunate pontiff, whom they considered as irretrievably ruined. At length, however, the progress of the confederates in Italy and other political considerations induced the emperor to concert measures for setting the pope at liberty. As he wanted a large supply of money, he thought of the resource which presented itself in the ransom of Clement. The pope himself had contrived to disarm the resentment of cardinal Colonna, and he had also by favours and promises gained Moroné, chancellor of Milan; and by the address and influence of these two men the treaty for his liberty was the more speedily concluded, upon the following conditions. He was obliged to advance 100,000 crowns for the use of the army, to pay the same sum at the distance of a fortnight, and at the end of three months 150,000 more. He engaged not to take part in the war against Charles, either in Lombardy or Naples; he granted him a crusade, and a tenth of ecclesiastical revenues in Spain; and he not only gave hostages, but put the emperor in possession of several towns, as a security for the performance of these articles. Having raised the first moiety by a sale of ecclesiastical dignities and benefices, and other expedients equally uncanonical, a day was fixed for his release. But Clement, impatient to be free, after a confinement of six months, and indulging the suspicion and distrust natural to the unfortunate, was so fearful of fresh obstacles on the part of the Imperialists, that he disguised himself the preceding night in the habit of a merchant, and made his escape undiscovered. Before next morning he arrived at Orvieto, and from thence wrote a letter of thanks to Lautrec, the commander of the French troops, as the chief instrument of procuring him liberty. Afterwards Clement, though he always acknowledged his being indebted to Francis for the recovery of his liberty, and often complained of the emperor's cruel treatment, was not influenced by gratitude, nor was he swayed by the desire of revenge. Whilst he amused Francis with promises, he secretly negociated with Charles; and in June 1529, he had the address and diligence to get the start of his allies, by concluding, at Barcelona, a particular treaty for himself. The terms were more favourable than Clement could have reason to expect. Among other articles, the emperor engaged to restore all the territories belonging to the ecclesiastical states; to re-establish the dominion of the Medici in Florence; to give his natural daughter in marriage to Alexander, the head of that family; and to put it in the pope's power to decide concerning the fate of Sforza, and the possession of the Milanese. In return for these ample concessions, Clement gave the emperor the investiture of Naples, without the reserve of any tribute, but the present of a white steed in acknowledgment of his sovereignty; absolved all who had been concerned in assaulting and plundering Rome; and permitted Charles and his brother Ferdinand to levy the fourth of the ecclesiastical revenues throughout their dominions. The dissensions already mentioned between the pope and the emperor proved extremely favourable to the progress of Lutheranism. Charles, exasperated by the conduct of Clement, and fully employed in opposing the league which he had formed against them, had little inclination and less leisure to take any measures for suppressing the new opinions in Germany. In a diet of the empire held at Spires, June 25, 1526, the state of religion came to be considered, and all that the emperor required of the princes was, that they would wait patiently, and without encouraging innovations, for the meeting of a general council which he had demanded of the pope. They acquiesced; but to his advice, concerning the discouragement of innovations, they paid so little regard, that even during the meeting of the diet at Spires, the divines who attended the elector of Saxony and landgrave of Hesse-Cassel thither, preached publicly, and administered the sacraments, according to the rites of the reformed church. The emperor's own example emboldened the Germans to treat the papal authority with little reverence. A manifesto against the pope, little inferior in virulence to the invectives of Luther himself, was industriously dispersed over Germany; and being eagerly read by persons of all ranks, much more than counterbalanced the effect of all Charles's declarations against the new opinions. (See LUTHER and REFORMATION.) Soon after the conclusion of the pope's treaty with Charles, they had an interview at Bologna. On this occasion the emperor, at the head of 20,000 veteran soldiers, able to give law to all Italy, kneeled down to kiss the feet of that very pope whom he had so lately detained a prisoner. After the re-establishment of the authority of the Medici at Florence in 1530, the publication of the peace at Bologna, and the ceremony of his coronation as king of Lombardy and emperor of the Romans, which the pope performed with the accustomed formalities, Charles prepared for his journey into Germany. During the long residence of the emperor and pope at Bologna, they held many conferences concerning the most effectual means of extirpating the heresies which had sprung up in Germany. Clement dissuaded the emperor from convening a general council; Charles, on the contrary, thought the convocation of a council no improper expedient for reconciling the Protestants; but promised, that if these gentler arts failed of success, he then would exert himself with vigour in reducing those stubborn enemies of the Catholic faith. For the measures which he pursued, see REFORMATION, AUGUSTAN *Confession*, and AUGSBURG.

Charles, in his way to Spain in 1532, had another interview with the pope at Bologna. On this occasion they differed with regard to the expediency of calling a general council. Charles urged the salutary effects of such a measure, whilst Clement, by all the artifices in his power, attempted to delay, in hopes of thus entirely defeating, the convocation of such an assembly. Besides the negotiation with Clement about calling a council, the emperor carried on another, of greater importance in his estimation, for securing the peace established in Italy. With this view he proposed that the Italian states should enter into a league of defence against all invaders, and that, when danger occurred, an army should be raised and maintained at the common charge. The proposal was not unacceptable to Clement; accordingly a league was concluded; and all the Italian states, the Venetians excepted, acceded to it. At this interview the emperor is said to have proposed a match between Sforza, the duke of Milan, and Catharine de Medici the daughter of the pope's cousin Laurence de Medici; but this match was rejected by the pope; and another was negotiated by Francis and Clement between Henry, the

king

king of France's second son, duke of Orleans, and Catharine. Clement was so highly pleased with an honour which added such lustre and dignity to the house of Medici, that he offered to grant Catharine the investiture of considerable territories in Italy by way of portion; he seemed ready to support Francis in prosecuting his ancient claims in that country; and consented to a personal interview with that monarch. Charles's jealousy was excited by this proposed interview, and he could not bear that Clement, after he had twice condescended to visit him in his own territories, should confer such a distinction on his rival, as to venture on a voyage by sea, at an unfavourable season, in order to pay court to Francis in the French dominions. But the pope's rashness to accomplish the match overcame all scruples of pride, or fear, or jealousy, by which he was likely to be influenced on any other occasion. The interview, notwithstanding several artifices of the emperor to prevent it, took place at Marseilles with extraordinary pomp, and demonstrations of mutual confidence; and the marriage, which the ambition and abilities of Catharine (See CATHARINE) rendered in the sequel as fatal to France, as it was then thought dishonourable, was consummated. The pope and Francis, however, were so careful to avoid giving any cause of offence to the emperor, that no treaty was concluded between them; and even in the marriage-articles Catharine renounced all claims and pretensions in Italy, except to the duchy of Urbino. Whilst Clement was carrying on these negotiations and forming a connection with Francis, which gave so great offence to the emperor, such were the artifice and duplicity of his character, that he suffered the latter to direct all his proceedings with regard to the king of England. Henry's suit for a divorce from Catharine of Arragon (See that article), had now continued six years, during which period the pope negotiated, promised, retracted, and concluded nothing. Cranmer's sentence annulled the king's marriage with Catharine; her daughter was declared illegitimate; and Anne Boleyn acknowledged queen of England. Henry, displeased with the conduct of Clement, began to make innovations in the church, of which he had formerly been such a zealous defender. Clement, who had already seen so many provinces and kingdoms revolt from the holy see, became apprehensive lest England should follow their example, and partly from his solicitude to prevent that evil, and partly in compliance with the French king's solicitations, he determined to give Henry such satisfaction as might still retain him within the bosom of the church. But the violence of the cardinals, devoted to the emperor, did not allow the pope leisure for executing this prudent resolution, and hurried him, with a precipitation fatal to the Roman see, to issue a bull, rescinding Cranmer's sentence, enforcing Henry's marriage with Catharine, and declaring him excommunicated, if, within a time specified, de did not abandon the wife he had taken, and return to her whom he had deserted. The consequence of this measure is well known. Henry was enraged; his subjects concurred in his indignation; an act of parliament was passed, abolishing the papal power and jurisdiction in England; by another act, the king was declared supreme head of the church; and all the authority of which the popes were deprived was vested in him. A short delay might have prevented the unhappy consequences to the see of Rome of Clement's precipitance. Soon after his sentence against Henry, he fell into a languishing distemper; which terminated his life after he had lived 56 years 4 months, on the 25th of September, 1534, and his pontificate, after a duration of 10 years, 10 months, and 7 days; the most unfortunate, both whilst it continued and in its effects, that the church had known for many ages. He died hated by the court, suspected by the princes, and generally reputed a man of no faith, and naturally averse from doing any man a good office. He was grave, circumspect in all his actions, much master of himself, a great dissembler, and endowed with excellent parts, and uncommon penetration. But the extreme timidity to which he was subject after his imprisonment seldom allowed him to make a free use of his own judgment. During his pontificate he created 31 cardinals; but none, his nephew Hyppolitus de Medici excepted, of his own choice; the rest he raised to that dignity, against his will, to gratify those, who recommended them, especially the emperor and the king of France. Bower's Hist. of the Popes, vol. vii. Robertson's Hist. ch. v. vols. ii. and iii.

Clement VIII. was the name assumed by Hippolito Aldobrandini, cardinal of St. Pancras, a Florentine, when he succeeded Innocent IX. in the see of Rome. He was chosen Jan. 30, 1592, and crowned on the 2d of February following. His pontificate is chiefly remarkable for the three following events; the conversion, absolution, and reconciliation of Henry IV. of France in 1595; the reversion of the dechy of Ferrara to the apostolic see, upon the death of duke Alphonsus II. in 1597; and the peace, concluded at Vervins in 1598, between France and Spain, by the mediation of Clement. The famous controversy between the Jesuits and Dominicans, concerning grace, free-will, and predestination, arose in the time of this pope, and was likely to produce fatal divisions in the church. This controversy was carried on with great asperity and violence till the year 1594, when Clement imposed silence on the contending parties, promising to examine the points in dispute. For this purpose he appointed a particular congregation, called "De Auxiliis" or of aids; but as nothing had been determined by this body in 1602, the pope resolved to preside at it in person, and he accordingly heard both parties with the greatest attention and patience. But as each ably defended the cause with great zeal and dexterity, Clement, not chusing to exercise his infallibility, lest he should disoblige one or other of the two most learned orders of the church, left the final decision of the points in dispute to his successor. He died March 3, 1605, after having presided in the see 13 years, one month, and three days. This pope has been represented by cotemporary writers as a man of uncommon abilities and of great prudence. It was by the urgent interference of this pope, that the Jesuits, who had been expelled France upon the murder of Henry III. were restored in 1603 by his successor Henry IV. Bower vol. vii. Mosheim E. H. vol. v.

Clement IX. and *Clement* X. were elected successively to the papacy in the years 1667 and 1670; but they were concerned in few transactions that deserve to be transmitted to posterity. The former was of the family of Rospigliosi, and several instances of his conduct are recorded that do him honour, and prove his dislike of nepotism, and his love of peace and justice. His pontificate commenced in 1667 and terminated in 1670; that of his successor closed in 1676. Mosheim.

Clement XI. was the name assumed by John Francis Albani, when he was raised to the head of the Roman church in the year 1700. He surpassed in learning the whole college of cardinals, and was inferior to none of the preceding pontiffs in sagacity, lenity, and a desire, at least, to govern well; but he was very far from opposing, with a proper degree of vigour and resolution, the inveterate corruptions and superstitious observances of the church over which he presided; on the contrary, he inconsiderately aimed at, what he thought, the honour and advantage of the church (that is, the glory and interest of its pontiff), by measures that proved detrimental to both, and thus shewed, by a striking example, that popes, even of the best sort, may fall imperceptibly into the greatest mistakes, and commit the most pernicious blunders, through an imprudent zeal for extending their jurisdiction, and augmenting the influence and lustre of their station. His pontificate closed in 1721. Mosheim.

Clement XII. began his pontificate in 1730, and terminated it in 1740.

Clement XIII. was elevated to the papacy in 1758, and held it till the year 1765.

Clement XIV. commenced his pontifical office in 1769, and closed it in 1775.

Clement, John, received his education at Oxford, where he made such progress in the knowledge of the Greek and Latin languages, as to attract the notice of sir Thomas More, who took him into his family to instruct his children. By the recommendation of sir Thomas, he was invited to settle in Corpus Christi college, Oxford, and appointed professor in rhetoric, in the year 1519, and soon after, to succeed to Linacre in the Greek professorship. It may not be improper to mention, that the first two public teachers of the Greek language at Oxford were physicians, for Clement, probably incited by the fame acquired by his predecessor, applied himself diligently to the study of medicine, which he practised with success. He was soon after made fellow of the Royal College of physicians, lately established in London. In 1529, he was ordered by his sovereign, Henry VIII. to attend cardinal Wolsey, who was dangerously ill at Esher; but the malady of that great statesman was not removeable by medicine. On the accession of king Edward VI., Clement, with a few other catholics, was excepted from the general pardon granted by that prince; he therefore went to Mechlin. What drew on him this severe treatment is not known, unless it was his rigid attachment to the Romish religion, which he imbibed while residing in the house of his patron sir Thomas More. On the death of Edward he returned to England, and resumed the practice of medicine in a part of Essex, near London. In this place he continued during the reign of queen Mary. On her demise he again migrated to Mechlin, where he died July 1, 1572. Of his medical knowledge he has left no memorial, his only works being some translations of pieces of divinity, and a book of Latin epigrams and other verses, now little known. Aikin's Biog. Sketches of Medicine.

Clement, Julian, a celebrated accoucheur, who contributed largely towards the improvement of the art of midwifery, was a native of Arles, in the department of the Rhone. It was there he received the rudiments of his education; but he was at an early age sent to Paris, and placed under the direction of James la Fevre, who then enjoyed considerable reputation for his skill in the practice of surgery, particularly that branch of it which teaches the method of delivering women in difficult labours. In time he succeeded to the practice of Le Fevre, whose daughter he had married. In December, 1663, he was called to assist the duchess de la Valiere; but as it was not usual at that time to employ men in this office, except in cases of difficulty or danger, the duchess is said to have removed to a private house, and even to have received him in a mask, so that he was not apprised of the quality of the lady he was attending. His success in this case was so agreeable to the king, Lewis XIV., that he was appointed accoucheur to the princesses of France, with a considerable pension. This circumstance, and his being employed in the subsequent labours of the duchess, and of many of the principal ladies about the court, added greatly to his popularity, and had a powerful influence in introducing the custom, which soon became general, of employing men to attend women in child-birth, instead of one of their own sex. Clement soon saw the absurdity of treating lying-in women as diseased persons, and introduced several salutary regulations for the women and children, particularly those of abridging the time of confinement of the women, and allowing a freer introduction of air into the room than had been before permitted. He also simplified and improved the method of turning the fœtus, in certain cases of wrong presentation, and first suggested the propriety of breaking the membranes early in labour, in cases of hæmorrhage, which was afterwards so successfully practised by his pupil and assistant, Puzos. The reputation of Clement became by these means, and by the general success of his practice, so great, that he was sent for to Madrid, to attend the queen of Spain, in three successive pregnancies, the last in the year 1720. About the year 1684, he was honoured by his sovereign and patron with letters of noblesse, with the condition attached to them, that he should continue to practise midwifery as long as his health and age should permit. He died on the 7th of October, 1729, being 80 years of age. Essais Historiques sur l'Art des Accouchmens, par M. Sue le jeune.

Clement, *Constitutions of.* See *Apostolical* Constitutions, and Clemens *Romanus.*

Clement, *Recognitions of.* See Recognitions, and Clemens *Romanus.*

Clements' *strait*, in *Geography*, a branch of the great strait, that lies between Banca and Billiton in the East Indian ocean, being the "East Passage," between Middle or Passage island and Billiton. It is so called from captain Clements, the commander of a fleet of Indiamen, who is the first known navigator who attempted this passage in 1781, and struck out this new track to the ships of his own nation. The name of "Clements' Strait" distinguishes it from the "West Passage," or "Gaspar's Strait." See Banca.

Clements' Danes, St. a parish in the liberties of Westminster and county of Middlesex, which adjoins to the city of London: the situation of its church steeple, in the Strand, was determined in the government "Trigonometrical Survey," in 1788, by an observation from Argyle Street observatory, distant 6,074 feet; and another from Primrose-hill station, distant 14,391 feet: whence is deduced its bearing from the cross on the dome of St. Paul's cathedral 85° 57′ 37″ W. of the south meridian, and distance 3,592 feet. This steeple contains a singular clock with four dials, which strikes the hours, first on one of the great bells, and then repeats the same on a smaller bell; it repeats the quarters, and chimes the old hundredth psalm at 12, 5, and 9 o'clock.

CLEMENTE, Prospero, in *Biography*, a Modenese sculptor, who, according to Vasari, possessed considerable talents. In the Duomo of Reggio is a monument of white marble by this master, erected to the memory of bishop Rangone, who is represented in a sitting posture as large as life, with the accompaniment of two little angels beautifully executed. There is another monument by him at the Duomo of Parma, raised in 1548 to the memory of Bernardo degli Uberli of Florence, who was a cardinal, and bishop of Parma. Vasari ediz. di Bologna, tom. iii. p. 11. Orlandi.

Clemente, San, Don Bartolomeo di. See Lella Gatta.

CLEMENTI, in *Geography*, a town of European Turkey,

Turkey, in the province of Albania; 44 miles N. of Dulcigno.

CLEMENTINA, or CLEMENTINE HOMILIES, in *Ecclesiastical History*, are 19 homilies in Greek, published by Cotelerius, with two letters prefixed; one of them written in the name of Peter, the other in the name of Clement, to James bishop of Jerusalem; in which last letter they are entitled "Clement's Epitome of the Preaching and Travels of Peter." But it may be questioned, says Dr. Lardner, whether one or both of these letters do not belong to the "Recognitions." Photius seems to favour this supposition; at least, in his time, they were both prefixed to some editions of the "Recognitions." The 19th Homily is imperfect at the end; and there is wanting another whole homily to complete the number of twenty. Le Clerc thinks these Clementine Homilies were composed by an Ebionite in the second century. Montfaucon supposes that they were forged at a much later period, and that they were not mentioned by any author, till long after the age of St. Athanasius. This is one of his arguments, *viz.* that the Synopsis, in which the Clementines are mentioned, was not composed by that father. Grabe says, that the Clementines spoken of in that Synopsis, are not the same with our Clementine Homilies, which is very probable;—those Clementines mentioned in the Synopsis not being the Clementine Homilies, but the Clementine Epitome, published by Cotelerius at the end of the Homilies. Although these Clementine Homilies are ancient, they were not cited by the name of Clementines; but were reckoned either another edition of the Recognitions, or called the "Travels of Peter," or the "Disputation of Peter and Appion." There is a great agreement between these Homilies and the Recognitions, in several particulars. Dr. Lardner inclines to the opinion, that the Clementine Homilies were the original or first edition, and the Recognitions an improvement of them, because they appear more finished and artificial. This work is not improbably the same with that censured by Eusebius under the title of "Dialogues of Peter and Appion." The whole work is prolix; and in the 4th, 5th, and 6th Homilies is a history of Appion, and of a dispute with him. If this be the work of an Ebionite, as is generally supposed, and seems not improbable, it may be argued, that when the author wrote, the four gospels were owned by that sect, or at least by some branch of it; for though there may be some interpolations in these Homilies, there is no reason to think that any texts have been added. Although neither of these books, *viz.* the Homilies and Recognitions, be of any sacred authority, they may both be of some use; and deserve to be particularly examined. From what has been said it is probable, that the Clementine Homilies, and also the book of Recognitions, which Mr Whiston has recommended to us "as certainly to be esteemed in the next degree to that of the really sacred books of the New Testament," are the work of an Ebionite; and therefore if there is in it (says Dr. Lardner) any Arianism, it has been interpolated. As to the "Clementine Epitome," already mentioned, it seems to be the work of a later age; and to have been composed out of the Recognitions and Homilies, and perhaps some other works, leaving out some things, and adding others. To this Clementine Epitome, or some similar piece, the author of the Synopsis, ascribed to Athanasius, refers, when, among the contradicted or apocryphal books of the New Testament, such as the Travels of St. Peter, the Gospel according to St. Thomas, and some others, he mentions the "Clementines," "out of which," he says, "those things have been selected which are true and divinely inspired." This is probably the book of which Nicephorus speaks, as being in his time approved by the church. But in the composition of it, not only those things were selected which are true and right in the ancient Clementines, but several other things were added. The hand of an Ebionite in the Clementine Homilies is generally acknowledged by learned moderns. But that there was no good foundation, in the most early antiquity, for supposing St. Clement to be the author of any of those pieces, may be concluded from Eusebius. Moreover, it is notorious that the Clementine Epitome was composed by an orthodox christian. But it may be said in favour of the Catholics, that none of them appear to have had any hand in any of these Clementines during the first three centuries. It may be also added, that it was known the Clementine Epitome was not an original piece; and that it was not pretended to be really written by Clement, but was allowed to consist of things selected out of some other work or works. Lardner's works, vol. ii.

CLEMENTINE, a term used among the Augustins, who apply it to a person, who, after having been nine years a superior, ceases to be so, and becomes a private monk, under the command of a superior.

The word has its rise hence, that pope Clement, by a bull, prohibited any superior among the Augustins from continuing above nine years in his office.

CLEMENTINES, the name of a party which took its rise in Europe in the 14th century on the following occasion. After the pope had resided many years at Avignon, Gregory XI. was persuaded to return to Rome; and upon his death, which happened in 1380, the Romans, resolute to fix, for the future, the seat of the papacy in Italy, besieged the cardinals in the conclave, and compelled them, though they were mostly Frenchmen, to elect Urban VI., an Italian, into that high dignity. The French cardinals, as soon as they recovered their liberty, fled from Rome, and protesting against the forced election, chose Robert, son of the count of Geneva, who took the name of Clement VII. and resided at Avignon. All the kingdoms of Christendom, according to their several interests and inclinations, were divided between these two pontiffs. The court of France adhered to Clement, and was followed by its allies, the king of Castile, and the king of Scotland: England, of course, was thrown into the other party, and declared for Urban. Thus the appellations of "Clementines" and "Urbanists" distracted Europe for several years; and each party damned the other as Schismatics, and as rebels to the true vicar of Christ. This circumstance contributed in some degree to weaken the papal authority; but had not so great an effect as might naturally be imagined. Though any king could easily at first make his kingdom embrace the party of one pope or the other, or even keep it some time in suspence between them, he could not so easily transfer his obedience at pleasure. The people attached themselves to their own party, as to a religious opinion, and conceived an extreme abhorrence to those of the opposite party, whom they regarded as little better than Saracens or infidels. Crusades were even undertaken in this quarrel; and the zealous bishop of Norwich in particular led over, in 1382, near 60,000 bigots into Flanders, against the Clementines; but, after losing a great part of his followers, he returned with disgrace into England.

CLEMENTINES, in the *Canon Law*, are the constitutions of pope Clement V. and the canons of the council of Vienne. See CANON *law*, and CLEMENT V.

CLEMENTINES, in *Geography*, a tribe of Hungarians, so called from their leader, who emigrated in 1463, from Albania, baria, and arrived in 1737, through Servia at Sclavonia. They are dispersed in two villages.

CLEMENTINUS, Clement, in *Biography*, a learned physician of Amelia, near Spoleto in Italy, was in great credit towards the end of the 13th and the beginning of the 14th centuries. He was one of the restorers of medicine, and was well versed in the works of Hippocrates, and the rest of the fathers in that science. He taught philosophy and mathematics for some years at Padua, and appears to have imbibed the principles of astrology, with which his medical works are tinged. From Padua he was called to Rome, where he was appointed physician to Pope Leo X. whom he outlived only a short time. The work by which he is known is intitled, "Clementia Medicinæ, sive de Præceptis Medicinæ, et de Arte Medica, Romæ 1512, fol." Astruc says there was an earlier edition of this work, *viz.* in 1505. It was reprinted in 1535. He treats of temperaments and humours, of the pulse and urine, as indicating disease; of fevers, the plague, &c. He supposed the lues venerea, which made its first appearance in his time, was occasioned by the predominance of the constellation Scorpio. Haller. Bib. Med. Eloy. Dict. Hist.

CLEMONT, in *Geography*, a town of France, in the department of the Loiret, 9 leagues S.W. of Gieno. See also Clermont.

CLENCH-*nails*. See Nails.

CLENCHING, in *Sea Language*, denotes making fast the point of a bolt or nail, on a ring or rove of iron, by battering the point and making it spread. The cable is fastened or clenched to the ring of the anchor.

CLENZE, Lower, in *Geography*, a town of Germany, in the circle of Lower Saxony, and principality of Luneburg-Zell; 8 miles S.W. of Luckow.

CLEOBULUS, in *Biography*, one of the seven wise men of Greece, or, as some have called him, tyrant of Rhodes, was born at Lindus, in the isle of Rhodes, or, as some will have it, in Caria. He invited Solon to come and live with him, when Pisistratus had usurped the sovereignty of Athens. He flourished in the 54th Olympiad, about 564 years B.C.

CLEOBURY Mortimer, or Cleebury, in *Geography*, a small market-town of Shropshire, England, is situated at the base of a mountain, called the Clee-hills. These abound with iron-ore, lime, and coal, the latter of which is found in a vein 5 feet thick. The church is a large, handsome building; and near it is the site of an ancient castle, which was built by Hugh de Mortimer, and destroyed in the time of Henry II. Here is a free school, founded by sir Lacon William Child.

On Cleebury hill is an ancient encampment, another at Titterstone Clee, and another on the Urchin.

Here are a small weekly market on Thursday, and three annual fairs. Cleobury is 137 miles N.W. from London, and about 17 S. of Shrewsbury. Camden's Britannia, vol. ii. 1789.

CLEOFANTE, in *Biography*, an ancient painter, a native of Corinth, where he is said, by Pliny, to have first attempted to imitate in his figures the colour of the flesh, by means of bricks pounded. He flourished before the 40th Olympiad, and accompanied Demeratus, the father of Tarquinius Priscus, to Rome; when flying from the anger of Cipselus, prince of Corinth, he took refuge in Italy.

There existed at Lanuvio, in the time of Pliny, a picture of Atalanta, and another of Helen, by this master, both of which were well drawn. Winkelman. Orlandi.

CLEOME, in *Botany*, (from Κλειω, *claudo*, a name adopted by Linnæus, from Theod. Priscianus, called also Octavius, or Octavianus Priscianus, a medical writer of the fourth century). Linn. Gen. 826. Schreb. 1099. Willd. 1249. Gært. 479. Juss. 243. Vent. 3. 118. (Sinapistrum, Tourn. 116.) Class and order, *tetradynamia siliquosa*. Nat. Ord. uncertain, Linn. Philos. Botan. *Putamineæ*, Linn. Prælec. *Capparides*, Juss. Vent.

Gen. Ch. *Cal.* Perianth four-leaved, very small, spreading, the lower leaf more open than the others, caducous. *Cor.* Petals generally four, ascending and spreading, two intermediate ones smaller, and nearer together. *Stam.* Filaments varying in number, in different species, from six to more than twenty; awl-shaped, declining; in some species placed near the petals, on the common receptacle; in others attached to a pedicel which supports the germ; anthers lateral, ascending. *Pist.* Germ either sessile, or supported by a pedicel, differing very much in length in different species, generally surrounded by three nectariferous glands, one under each of three upper calyx leaves; style, in most species, none; stigma capitate. *Peric.* Silique pedicelled, or nearly sessile, oblong, cylindrical, one-celled, two-valved. *Seeds* numerous, kidney-shaped; attached to the inner side of a filiform, circular, or elliptic receptacle placed between the valves.

Ess. Ch. Three nectariferous glands; one under each division of the valves. Petals all ascending. Silique one-celled, two-valved.

This is a very anomalous genus, and imperfectly accords with the other genera of the Linnæan class tetradynamia, which form a completely natural family. Tournefort had before classed it among his plants with cruciform flowers, under the generic name of sinapistrum; but had placed it with chelidonium and epimedium, as having, like them, a one-celled capsule or silique. Linnæus, though he could not find a better station for it than at the tail of his class, tetradynamia, did not venture to pronounce it of the same natural family. In the "Philosophia Botanica," it appears among the vagæ, or plantæ incertæ sedis; in the "Prælections," published after his death by Gisecke, it stands in the natural order of putamineæ, which corresponds with the capparides of Jussieu and Ventenat. A few of the species at present admitted into the genus, are equally at variance with the essential character, nor is it, perhaps, possible to form one, which will include all of them. In the general character, we have thought it expedient to make considerable alterations.

Species. 1. C. *juncea*, Linn. jun. Supp. 300. Mart. 5. Poiret. 22. Willd. 1. Sparm. in Act. Upsal. Nov. vol. iii. p. 192. "Stem shrubby, leafless; flowers in lateral corymbs, eight-stamened, gynandrous; stamens and pedicel elongated; silique linear, tomentous." *Stem* from one to two feet high, scarcely the thickness of a goose-quill. *Branches* rigid, like spines, generally acute, greenish, cylindrical, spreading, smoothish. *Leaves* none; but, instead of them, minute scales, coming out here and there on the stem and branches. *Flowers* dirty yellow; common peduncle very short; partial ones from half an inch to an inch long, filiform, somewhat woolly, yellowish. *Calyx-leaves* rather spreading, somewhat orbicular, concave; two outer ones a little larger than the others, smooth within, somewhat rough, with crowded glands on the outside, and edged with others which are supported by pedicels; corolla none. *Nectary* short, tubular, two-lipped, fastened by the side to the base of the pedicel; upper lip very short, somewhat helmet-shaped, sometimes entire, sometimes toothed; lower lip more prominent, ascending, either sharpish and entire, or truncate-toothed; tube with a depression or channel on the outside, and at the top; pedicel lengthened out to an inch and half, the whole tubular, a third of its upper part staminiferous; stigma oblong. *Seeds* blackish, orbicular, some-

what

what compreſſed, and each, as it were, in its proper cell. Sparm. A native of the Cape of Good Hope, found near the Black river by Dr. Sparman. 2. C. *heptaphylla*, Linn. Sp. Pl. 2. Mart. 2. Poir. 1. Willd 2. (Sinapiſtrum, Tourn. Burm. Zeyl. 215. 3. Herm. Lugd. 564. Sloan. Jam. 1. 194. 4. Pentaphyllum, Moris. hiſt. 2. 288. 2.) "Flowers gynandrous; leaves with about ſeven leaflets; ſtem prickly." *Root* annual. *Stem* from three to five feet high, herbaceous, upright, angularly grooved, branched; branches ſpreading, grooved, viſcid, villous. *Leaves* alternate, ſcattered, ſpreading, digitate; common petioles erect, cylindrical, ſtreaked, hirſute, viſcid: leaflets lanceolate, acuminate, nerved, pubeſcent, ſpringing from a centre at their baſe; prickles in pairs at the baſe of the petioles, oppoſite, thick, ſhort, yellow, very pungent. *Flowers* white, or fleſh-coloured, in long looſe terminal ſpikes; peduncles two inches long, pubeſcent, cylindrical; bracte, one at the baſe of each peduncle, and half ſurrounding it, heart or almoſt creſcent-ſhaped, ſeſſile, entire, pubeſcent, white; calyx-leaves linear-lanceolate, acute, ſpreading, convex, pubeſcent; two of them a little longer than the others; petals with claws, oblong, concave, entire; filaments ſix, longer than the corolla, patulous, attached to the pedicel of the germ, red-purple; anthers long, erect, linear, brown; germ linear, quadrangular, green; ſtigma obtuſe, black. *Silique* five inches long, thick, tapering, pendulous. A native of Jamaica, whence it was ſent to Miller by Dr. Houſton. It is ſuppoſed to be a native alſo of Egypt and the Eaſt Indies. 3. C. *pentaphylla*, Linn. Sp. Pl. 3. Mart. 3. Poir. 2. Willd. 3. Jacq. Hort. tab. 24. Lam. Ill. tab. 576. fig. 1. Loureiro Cochin. 482. (Laganſa rubra, Rumph. Amb. tab. 96. fig. 2. Sinapiſtrum, Herm. Lugd. 564. Sloan. Jam. 80. Hiſt. 1. 294. Rai. Hiſt. 899. Papaver, Pluk. Alm. 280. Quinquefolium lupini folio, Bauh. Pin. 326. Capa-veela, Rheed. Mal. 9. tab. 24.) "Flowers gynandrous; leaves quinate; ſtem without prickles." *Root* annual. *Stem* about two feet high, herbaceous, upright; branches ſpreading, villous. *Leaves* on long, ſlender, villous petioles; leaflets roundiſh, acute, finely ſerrated, on ſhort petioles; floral leaves ternate, inverſely egg-ſhaped, obtuſe. quite entire; the loweſt on ſhort petioles, the reſt ſeſſile. *Flowers* white or fleſh-coloured, in a long terminal raceme or ſpike; peduncles axillary, ſolitary, one-flowered, ſpreading; calyx-leaves lanceolate; petals rounded, open, with long filiform claws; ſtamens ſix, attached to the pedicel of the germ about the middle, equal, ſpreading; pedicel of the germ long, ſlender, purple. *Siliques* three inches long, rough with rigid, blunt, very ſhort hairs, wrinkled or dotted. *Seeds* kidney-ſhaped, in ſix rows. We have blended the deſcription of Jacquin and Loureiro, as there ſeems no doubt with reſpect to the identity of their reſpective plants. A native of the Eaſt and Weſt Indies, Cochinchina, Guinea, and Syria. 4. C. *triphylla*, Linn. Sp. Pl. 2. Mart. 4. Poir. 3. Willd. 4. (Sinapiſtrum, Herm. Lugd. tab. 565.). "Flowers gynandrous; leaves ternate; ſtem without prickles." *Root* annual. *Stem* about two feet high, herbaceous, upright, almoſt ſmooth, branched. *Leaves* on long petioles; leaflets almoſt ſeſſile, oval, lanceolate; the middle one larger than the two others. *Flowers* fleſh-coloured, in a ſhort terminal ſpike; peduncles long, ſolitary; floral leaves lanceolate, acute, terminated by a ſhort point, ſlightly ciliated at their edges: filaments ſhort, ſtraight; ſtigma flattened. *Siliques* four inches long, oblong, obtuſe at the ſummit. A native of the Eaſt and Weſt Indies. *Obſ.* Linnæus, judging from a ſimilarity of habit, and a conformity in ſeveral ſtriking characters, was inclined to think that the laſt three are rather varieties than diſtinct ſpecies. He alſo calls them gynandrous, conſidering the pedicel of the germ as a proper ſtyle, and founding his opinion, we preſume, on the analogy of paſſiflora; but we cannot think that either one or the other has a right to be termed gynandrous. The pedicel does not appear to us to perform the office of a ſtyle in [illegible] reſpect whatever, any more than that which ſupp[illegible] germ in the genus euphorbia. 5. C. *pungens*, Willd. [illegible] Berol. Annals of Botany. 1. 567. "Leaves quinate; ſtem prickly." *Leaves* viſcid. *Flowers* fleſh-coloured. A native of South America. 6. C. *polygama*, Linn. Sp. Pl. 8. Mart. 6. Poir. 4. Willd. 5. (Sinapiſtrum, Sloan. Jam. 80. Hiſt. 1. tab. 124. fig. 1). "Upper flowers maſculine, tetrandrous; leaves ternate; leaflets ſeſſile, ſomewhat prickly at the edges." *Stem* not above twenty or twenty-five inches high, a little branched, erect, almoſt ſmooth. *Leaves* on long petioles; leaflets ovate-lanceolate, a little rough at their edges. *Flowers* in a long raceme; the loweſt fertile; the reſt minute, male germ ſeſſile within the calyx. A native of Jamaica, in moiſt bottoms. 7. C. *icoſandra*, Linn. Sp. Pl. 5. Mart. 9. Poir. 5. Willd. 6. Lour. Cochin. 483. (Sinapiſtrum, Burm. Zeyl. tab. 99. Laganſa alba, Rumph. Amb. tab. 96. fig. 3.) "Flowers icoſi-tetrandrous; leaves quinate." *Root* annual. *Stem* two feet high, herbaceous, erect, ſtriated, viſcid-villous, without prickles; branches aſcending. *Leaflets* ovate-lanceolate, ſeſſile, quite entire, a little rough. *Flowers* yellowiſh, in ſolitary axillary ſpikes along the branches; calyx campanulate; leaves four, lanceolate, caducous; petals twice the length of the calyx, ſpreading, ovate-oblong, almoſt equal; ſtamens from eighteen to twenty-two; filaments ſhort, awl-ſhaped, equal, placed on a flattiſh receptacle; anthers awl-ſhaped, recurved; germ ſeſſile, oblong, terminated by a ſhort ſtyle and obtuſe ſtigma. *Silique* long, awl-ſhaped, obliquely ſtriated, without nectariferous glands at its baſe. *Seeds* kidney-ſhaped. A native of cultivated ground in China and Cochinchina. The whole plant, except the petals and ſtamens, is cloathed with viſcid hairs. It has an acrid, hottiſh taſte, ſimilar to that of muſtard, and is eaten by the natives in ſallads mixed with other herbs. 8. C. *viſcoſa*, Linn. Sp. Pl. 6. Mart. 10. Poir 6. Willd. 7. (Sinapiſtrum, Mart. Cent. tab. 25. Aria-veela, Rheed. Mal. 9. tab. 23?) "Flowers dodecandrous; leaves quinate and ternate." *Root* annual. *Stem* two or three feet high, upright, ſtiff, almoſt woody, angular, cloathed with viſcid hairs, branched. *Leaves* alternate, on long petioles; leaflets oval, ſomewhat rhomboid, ſlightly petioled. *Flowers* yellow, ſmaller than thoſe of the preceding ſpecies, axillary and ſolitary along the branches, with a terminal raceme; calyx-leaves erect at the bottom, ſpreading a little at the top, all expanding regularly, lanceolate, equal; petals lanceolate-ovate; two lower ones more divaricated than the others; ſtamens from eight or nine to thirteen, placed on the receptacle, unequal; germ ſeſſile. *Silique* about two inches long, very villous, viſcid, ſlender, longitudinally ſtriated, terminated by a ſtigma on a ſhort ſtyle. A native of Malabar and the iſland of Ceylon. 9. C. *dodecandria*, Linn. 7. Mart. 11. Poir. 7. Willd. 8. (Sinapiſtrum, Burm. Zeyl. 216. tab. 100. fig. 1.) "Flowers dodecandrous; leaves ternate." *Root* annual, long. *Stem* about half a foot high; ſometimes erect, ſimple; ſometimes almoſt creeping, with decumbent branches, ſlightly villous, ſomewhat viſcid. *Leaves* ſmall, petioled; leaflets ſmooth, elliptical, quite entire, ſeſſile. *Flowers* white, axillary, ſolitary; upper ones abortive; calyx nearly as long as the corolla, purple; petals emarginate; ſtamens from ten to fourteen, placed on the receptacle. *Siliques* ſeſſile, ſmooth, compreſſed, erect, almoſt tranſparent, ſpindle-ſhaped, a little inflated. *Seeds* very ſmall, ſmooth, ſhining, brown, convex on one ſide, concave on the other, nearly kidney-ſhaped. A native of the Eaſt Indies. There is a plant cultivated in the botanic garden at Paris, under the name of C. canadenſis, which greatly reſembles this ſpecies. It is, however, larger in all its parts, and more branched; its ſiliques are alſo villous, at leaſt when young, and all its flowers fertile. It has an unpleaſant bituminous ſmell. In other reſpects it agrees with C. dodecandria. 10. C. *felina*, Linn. jun. Supp. 300. Mart. 8. Poir. 20. Willd. 10. "Polyandrous, hiſpid; leaves ternate, ſtrigoſe, wedge-ſhaped; flowers axillary, ſolitary, peduncled; ſiliques linear, compreſſed." *Leaves* ſomewhat retuſe. *Flowers* red, ſmall, angular. *Siliques* ſhort, ſmooth. This diminutive plant is ſingular in its hiſpid leaves; the hairs much dilated at the baſe, very ſtiff, preſſed cloſe to the leaves, and pointing towards their extremity, ſo as to give it ſomewhat of the roughneſs of a cat's tongue. Found in Ceylon, by Koenig. 11. C. *chelidonii*, Linn. jun. Supp. 300. Mart. 7. Poir. 20. Willd. 10. "Polyandrous, hirſute; leaflets five or ſeven, wedge-ſhaped, ſcabrous; racemes terminal; ſiliques filiform." *Leaves* on long petioles, digitate; leaflets acute. *Flowers* red, reſembling thoſe of chelidonium hybridum; calyx three or five-leaved, ſtrigoſe; petals five; ſtamens yellow. *Silique* quite ſmooth. It has clearly a great affinity to chelidonium. Poiret obſerves, that a more accurate inveſtigation is neceſſary before its real genus can be determined. A native of the Eaſt Indies, found by Koenig near Tanſchaur. 12. C. *gigantea*, Linn. Mant. 430. Mart. 12. Poir. 8. Willd. 11. Jacq. Obſ. 4. p. 1. tab. 76. "Flowers hexandrous; leaflets in ſevens; ſtem without prickles." *Root* perennial. *Stem* from ſix to twelve feet high, erect, pubeſcent, always green; branches ſimple, diffuſe, ſcarred. *Leaves* alternate, petioled; petioles longer than the leaves; leaflets quite entire, lanceolate, pubeſcent, ſilky on the upper ſurface, acute, ſeſſile. *Flowers* greeniſh; raceme terminal, erect, near two feet long; peduncles glutinous, longer than the flowers, without bractes; calyx-leaves linear, ciliated, ſpreading, caducous; petals oblong, obtuſe, undulated, cloſely cohering, except in front, where the ſtamens appear; claws diſtinct, the length of the petals; filaments inclining, longer than the petals, attached to the receptacle; anthers erect, oblong, yellow; germ pedicelled; pedicel the length of the ſtamens; ſtigma ſeſſile, obtuſe; receptacle globular, exuding a ſweet liquor at the baſe of the claws. It is a beautiful plant, but has a ſtrong diſagreeable ſmell, and very cauſtic taſte. A native of Cayenne: introduced into England by Dr. Fothergil in 1774. 13. C. *aculeata*, Linn. Syſt. Nat. iii. p. 232. Mart. 13. Poir. 9. Willd. 12. "Flowers hexandrous; leaves ternate, quite entire; ſtipules ſpineſcent; ſiliques ſeſſile." *Stem* herbaceous. *Leaves* elliptic-lanceolate, on long petioles; leaflets lanceolate, acute, ſomewhat ciliated and thorny at the edges, almoſt ſmooth, on very ſhort petioles; ſtipules two, very ſhort, recurved, citron-coloured, pale yellow, ſmall, ſolitary, peduncled; bractes at the baſe of the peduncles, ſimple; calyx-leaves acute, lanceolate, tomentous, whitiſh, caducous; claws of the petals long, almoſt filiform; ſtamens ſhorter than the corolla, placed on the receptacle; germ ſeſſile. *Silique* cylindrical, beſet with fine white hairs. Obſerved in America by Zoega. 14. C. *ſpinoſa*. Linn. Sp. Pl. 9. Mart. 14. Poir. 10. Willd. 13. Jacq. Amer. 190. 3. Pict. 93. Swartz. Obſ. 252. Brown Jam. 273. n. i. (Tarieraga, Marcgr. Braſ. 33. tab. 34.) "Flowers hexandrous; leaflets ſeven or five; ſtem thorny; ſiliques peduncled." *Root* annual. *Stems* five or ſix feet high, erect, villous, branched. *Leaves* alternate, on long petioles; leaflets entire, lanceolate, nerved, almoſt wrinkled, ſlightly viſcid-pubeſcent, edged with ſhort hairs, only three towards the extremity of the branches; ſpines two at the baſe of each petiole, oppoſite, ſhort, recurved, acute, yellowiſh. *Flowers* white, in a long terminal raceme; peduncles ſolitary, one-flowered; bractes ſhorter than the peduncles; heart-ſhaped, ſeſſile, obtuſe, approximating, nerved, pubeſcent; calyx-leaves linear-lanceolate, acute, ſpreading, concave, as long as the claws of the petals; petals oblong, entire, with elongated claws, and a roundiſh gland at the baſe of each; ſtamens unequally placed on the receptacle; filaments nearly equal, ſpreading, filiform, longer than the corolla, purple; anthers erect, long, two-celled, yellow; pedicel of the germ filiform, twice the length of the corolla. *Silique* three or four inches long, cylindrical, toruloſe, pubeſcent, viſcid, terminated by the obtuſe ſtigma. *Seeds* numerous, oblong. A native of the Weſt Indies. Sent from the Havannah to Miller by Dr. Houſton in 1731. 15. C. *ſerrata*, Linn. Sp. Pl. 10. Mart. 15. Poir. 11. Willd. 14. Jacq. Amer. tab. 190. fig. 43. "Flowers hexandrous; leaves ternate; leaflets linear-lanceolate, ſerrated." *Root* annual. *Stem* two feet high, erect; branches looſe, ſimple. *Leaves* petioled; leaflets almoſt equal; the middle one on a ſhort petiole. *Flowers* white; ſtamens tetradynamous. *Silique* about three inches long, cylindrical. A native of moiſt woods in South America, about Carthagena. 16. C. *ornithopoides*, Linn. Sp. Pl. 12. Mart. 16. Poir. 12. Willd. 15. (Sinapiſtrum, Tourn. Cor. p. 17. Dill. Elth. tab. 266. fig. 345. Buxb. Cent. i. tab. 9. fig. 2.) "Flowers hexandrous; leaves ternate; leaflets oval-lanceolate." *Root* annual. *Stem* about two feet high, pale green, cloathed with ſhort, ſtiffiſh hairs. *Leaves* ſtrong-ſcented, on rough petioles; leaflets of a pale glaucous colour on both ſides, commonly bent back, ſmooth in appearance, but roughiſh to the touch, edged with numerous ſhort hairs, on very ſhort peduncles. *Flowers* pale yellow, ſmall, axillary; calyx-leaves very ſmall, ovate, concave; ſtamens placed on the receptacle, inclining, ſcarcely longer than the petals; anthers ſmall, ſaffron-coloured; germ ſeſſile. *Siliques* two inches long, ſlender, a little hirſute, appearing jointed when ripe, like the legume of ornithopus. Obſerved in the Levant by Tournefort, and at Peru by Buxbaum. Cultivated in England by Dr. James Sherard in 1732. 17. C. *violacea*, Linn. Sp. Pl. 13. Mart. 17. Poir. 13. Willd. 16. Gært. tab. 76. fig. 6. Lam. Ill. tab. 567. fig. 3. "Flowers hexandrous; leaves ternate and ſimple; leaflets lanceolate-linear, quite entire. *Root* annual. *Stem* erect, ſometimes crooked; branches diffuſe. *Leaves* on long petioles; leaflets nearly equal, obtuſe, ciliated at their edges. *Flowers* violet-coloured, ſolitary, in a looſe ſpike; calyx-leaves yellow, with purpliſh tips, ſhort, ovate, concave; the two upper petals purple-violet, with ſmall yellow ſpots; the two others of an uniform colour, heart-ſhaped, clawed, ſlightly crenulate, ſtamens inclining, attached to the receptacle; anthers violet; germ ſeſſile, longer than the ſtamens; receptacle furniſhed, above the inſertion of the ſtamens, with three yellowiſh glands, Poir. *Peric.* a ſiliquoſe capſule on a very ſhort pedicel, oblong, obtuſe, compreſſed, villous. *Seeds* twelve or more, ſomewhat globular, with a ſmall pit on each ſide, acuminate towards the navel, ſmooth, of a ruſty red colour, Gært. The whole plant is pubeſcent and viſcid. A native of Spain and Portugal. 18. C. *arabica*, Linn. Sp. Pl. 11. Mart. 18. Poir. 14. Willd. 17. Linn. Decad. iii. tab. 8. (Sinapiſtrum, Shaw. Afr. fig. 557.) "Flowers hexandrous; leaves ternate; leaflets lanceolate, obtuſe; ſeeds hirſute." *Root* annual. *Stem* about two feet high, herbaceous, viſcid, rough with hairs; branches diffuſe. *Leaves* alternate petioled; petioles as long as the leaves, hiſpid,

hispid, viscid; leaflets sessile, scabrous underneath, lanceolate, obtuse, finely toothed. *Flowers* yellow, tinged with purple at the summit, twice as large as the calyx; stamens inclining, a little longer than the corolla, placed on the receptacle; germ sessile. *Silique* almost transparent, a little curved at the summit, somewhat inflated, obtuse, short; peduncle inclining. *Seeds* globular, kidney-shaped, very hispid, with erect whitish hairs. A native of Arabia. 19. C. *tenella*, Linn. jun. Supp. 300. Mart. 22. Poir. 22. Willd. 18. Retz. Obs. 4. 28. n. 91. "Flowers hexandrous; leaves ternate; leaflets filiform, linear." *Root* annual. *Stem* about seven inches high, upright, branched. *Leaflets* sessile, the length of the petals. *Siliques* linear, Linn. jun. *Flowers* yellow, on solitary peduncles, Retz. A native of the East Indies. 20. C. *angustifolia*, Poir. 19. Forskal. Flor. Arab. p. 120. (C. filifolia, Mart. 23. Willd. 19.) "Leaflets in sevens and threes, filiform." *Root* annual. *Stem* a foot high or more, cylindrical branched, Forsk. *Stem* erect, weak, herbaceous, striated; dotted towards the summit, with elevated minute, scattered points, Vahl. *Leaves* alternate, digitate; petiole two inches long; leaflets seven, flat, linear, smooth, rather thick; three linear ones at the base of the peduncles, sustaining the office of bractes, Forsk. *Leaves* petioled; petioles shorter than the leaves; lower leaflets in sevens, upper ones ternate, Vahl. *Flowers* yellow, with a violet base in terminal racemes; peduncles half an inch long, straight, spreading, cylindrical, solitary, one-flowered; calyx-leaves equal; petals all united in their upper part; outer ones larger, nearly oval; the two inner ones only half the length of the others, oblong, linear; stamens six; filaments violet-coloured, diminishing in size by pairs; the two lower pairs taper at the summit, with black and yellow erect anthers; the stamens of the upper pair yellow, barren, with a club-shaped summit; rudiment of the anther globular, yellow, small, sessile at the top of the filament. *Silique* two inches long, at first erect, afterwards pendulous. *Seeds* smooth, Forsk. *Silique* pedicelled, attenuated at the tip, Vahl. A native of Egypt and Arabia. 21. C. *guianensis*, Poir. 18. Willd. 20. Aubl. Guian. ii. p. 675. tab. 273. "Flowers hexandrous; leaves simple, linear-filiform, sessile." *Root* annual. *Stem* a foot high, branched from the bottom. *Leaves* green, alternate, very narrow, acute. *Flowers* yellow, axillary, solitary, on long slender peduncles; calyx-leaves small, long, acute; petals oval, ending in a point, leaning to one side; stamens inserted into the receptacle; filament yellow, slender, the length of the pistil; anthers arrow-shaped, attached to the filament by their middle; germ long, inflated, a little curved, green; separated from the petals, and leaning to the opposite side; stigma obtuse. *Silique* long, smooth, a little inflated. *Seeds* small, roundish. A native of Guiana, on the sea-coast. 22 C. *monophylla*, Linn. Sp. Pl. 14. Mart. 19. Poir. 15. Willd. 21. (Sinapistrum, Burm. Zey. tab. 100. fig. 2. —— tsjeru-vela, Rheed. Mal. 9. p. 63. tab. 34. —— papaver, Pluk. Alm. p. 280.) "Flowers hexandrous; leaves simple, ovate-lanceolate, petioled." *Root* annual. *Stem* a foot and half high, herbaceous, erect, striated, villous, branched near the top. *Leaves* alternate, long, narrow, entire, somewhat villous, viscid, ending in a point, finely toothed; petioles shorter than the leaves. *Flowers* yellow, solitary, peduncled at the extremity of the branches; calyx-leaves small, linear, villous; stamens placed on the receptacle, the length of the petals; anthers greenish-blue; germ sessile. *Silique* slender, cylindrical, somewhat villous, striated, ending in a point. A native of the East Indies. 23. C. *capensis*, Linn. Sp. Pl. 15. Mart. 24. Poir. 16. Willd. 22. (C. juncea, Berg. Plant. cap. 164?) "Flowers hexandrous; leaves simple, sessile, linear-lanceolate; stem angular." *Stem* simple, stiff and upright, resembling that of an epilobium. *Leaves* like those of the common broom, stiff, smooth. *Flowers* corymbed, as in epilobium. Linn. Bergius describes his plant thus: *Stem* more than a foot high, herbaceous, erect, cylindrical, striated, smooth; branches alternate, simple, long, upright. *Leaves* an inch long, alternate, smooth, obtuse, fleshy. *Flowers* yellow, tinged with purple, in thin racemes; peduncles alternate, one-flowered; calyx-leaves ovate, rather acute, small, equal, permanent; petals wedge-shaped, obtuse, erect, equal, several times longer than the calyx; claws yellowish, short, linear; filaments short, awl-shaped; germ sessile, almost heart-shaped, compressed; style very short, thickened, compressed, permanent; stigma obtuse. *Silique*, when young, heart-shaped, rough with strong points, two-celled, two-valved. *Seeds* orbicular, flat, one in each cell. Bergius did not see the fruit in a state of maturity. The real genus of the plant does not appear to have been satisfactorily ascertained. A native of the East Indies and the Cape of Good Hope. 24. C. *procumbens*, Linn. Sp. Pl. 16. Mart. 21. Poir. 17. Willd. 23. Jacq. Amer. 189. tab. 120. Swartz. Obs. p. 254. (Sinapis, Brown Jam. 273. 2. Leucoium, Sloan. Hist. 1. tab. 123.) "Flowers hexandrous; leaves simple, lanceolate, petioled; stems procumbent." *Root* perennial, spindle-shaped, striking deep into the earth. *Stem* almost woody, branched from the bottom; branches spreading on the ground, finally ascending and dividing into smaller ones, smooth. *Leaves* alternate, smooth, quite entire, acute. *Flowers* yellow, turning to orange or red, axillary, solitary; peduncles one-flowered, purple; calyx-leaves five, lanceolate, concave, acute, open, equal; petals oblong, expanding, twice the length of the calyx; stamens equal, the length of the petals; anthers blackish, ovate, revolute, two-celled; germ on a very short pedicel, acuminate, compressed; style awl-shaped; stigma obtuse. *Silique* pedicelled, erect, cylindrical, somewhat torulose. *Seeds* echinate, black. No nectariferous glands have been observed. A native of the West Indies.

Propagation and Culture. Most of the species being natives of very warm climates, will not thrive in England without artificial heat. They are raised from seeds sown in the spring, and require the same treatment as other tropical plants.

CLEOME *fruticosa*, Linn. See CADABA *indica*.

CLEOMENES, in *Biography*, the son of Apollodorus the Athenian, is engraved in the Greek characters on the base of the celebrated statue of the Venus de Medicis. The name is by many, however, supposed a spurious introduction of the fifteenth or sixteenth centuries. Carlo Dati. Orlandi.

CLEOMENES, the name of several kings of Lacedæmon. The most celebrated of these was the last or *Cleomenes* III. He ascended the Spartan throne on the death of his father Leonidas, in the 2d year of the 136th olympiad, 235 years B.C.; and in the commencement of his reign, though he was then very young, he found himself obliged to exert both his conduct and his courage. Aratus, at the head of the Achæans, had formed a project of uniting all the states of Peloponnesus in a league; and soon after the death of Leonidas, despising the youth of Cleomenes, he determined to try the disposition of the Spartans, who had not acceded to this league, and with this view he invaded the Arcadians, who were their neighbours and friends, and lived under their protection. When the Ephori heard of this aggression, they ordered Cleomenes to take the field, and to seize on a pass into Laconia, which was then in the hands of the allies

allies of the Achæans. Having performed this fervice, he afterwards difappointed Aratus in his defign of feizing Pegæa and Orchemanium. Upon the retreat of the Achæan general, the young king fent a taunting meffage to him; but the old ftatefman, deriding his youth, afked Democritus, a Spartan exile, who lived with him, "What fort of a perfon this Cleomenes was?" "Why, my friend," replied the Spartan, "I will anfwer you in few words; if you have any thing to do againft the Lacedæmonians, let me advife you to begin before this young eagle's talons are grown." Such was the difparity in number between the troops of Cleomenes, which amounted to no more than 5000, and thofe of the Achæans, confifting of 20,000 foot and 1000 horfe, that Cleomenes, having compelled the enemy to retreat, reminded his fellow-citizens of an expreffion ufed by one of their ancient kings, who faid, "That the Lacedæmonians never inquired after the number of their enemies, but where they were." In the courfe of the war, however, Aratus, by his great fkill, obtained fome advantages over the Spartans; but the reputation of Cleomenes for courage and military virtues was fuch, that the people of Sparta feemed to acquire a new fpirit from the martial prowefs of their fovereign. The Ephori, dreading the rifing fame and correfponding influence of Cleomenes, wifhed to put an end to the war: the king perceived their defign; and in order to counteract it, he determined to fupprefs the Ephori, and thus to fecure his own power, and at the fame time to reftore the glory of his country. For this purpofe he contrived, by money, to engage the Ephori in a war, and to give him the command of their army. Cleomenes, having fucceeded in this meafure, took with him into the field thofe perfons whom he had the greateft reafon to fufpect; and having performed feveral acts of valour, he marched his army with a rapidity which haraffed it, and induced many to be left behind in Arcadia; and with the reft he advanced flowly towards Lacedæmon. As he approached the place, he difpatched a fmall party, who, furprifing the Ephori at fupper, inftantly killed four of them, and would alfo have flain the fifth, if he had not feigned himfelf dead, and thus gained an opportunity of retiring to a temple, where he remained uninjured.

On the next morning Cleomenes went into the forum, and caufed all the feats of the Ephori to be removed, except one, which he referved for himfelf, and then artfully apologized to the people for his conduct. He perfuaded them, that it was neceffary to reftore the inftitutions of Lycurgus; and affured them, that notwithftanding the violence to which he had been obliged to recur for the accomplifhment of this purpofe, he was determined, for the future, to pay a ftrict regard to the laws, though the prefent occafion, and his perfonal fafety, required him to profcribe 80 citizens. He was the firft who delivered up his whole fubftance to the public ftock, and his example was followed by his father-in-law, and other friends. In affigning the lands, he gave fhares to all whom he had banifhed, promifing to recal them as foon as the public fafety would admit of it; and immediately after he reftored the old Laconic mode of educating youth, of eating in public, and performing their exercifes together; he alfo raifed a confiderable body of troops, and difciplined and armed them in a new manner. In order to manifeft his abhorrence of tyranny, and to prevent any offence from his purfuing thefe meafures by his own authority, he affociated his brother Euclides in the kingdom, declaring, that for the future, there fhould be always two kings in Sparta, according to ancient cuftom, and that he would not erect a monarchy, in order to tranfmit it to pofterity. Befides, in order further to ingratiate himfelf with the people, and to eftablifh his own popularity and power, he adopted a courfe of life, which was not in any refpect more expenfive than that of the meaneft citizen. In his houfe he had no purple furniture, no canopies, or cloths of ftate, no fuperb chairs, nor couches for indulging eafe, but every thing about him was diftinguifhed by its plainnefs and fimplicity. When any perfon offered petitions, he very readily received them; converfed freely with thofe that had eafy accefs to him; redreffed all injuries that were committed by others, and did no injury himfelf; and at the fame time his virtue was altogether free from affectation or aufterity. Having thus eftablifhed his intereft with the people, notwithftanding the alterations he had introduced, he marched with a body of troops into the territories of the Achæans, and gained feveral important advantages over Aratus. Neverthelefs he did not avail himfelf of his victories, in oppreffing any of the cities which he acquired, but reftored their liberty, and, when occafion offered, recalled their ancient inhabitants. The Achæans, difcouraged by his fucceffes, were difpofed to accede to any terms which he propofed; and Cleomenes, with a generofity that feldom attends very decifive conquefts, merely defired to be acknowledged general of the Greeks, ftipulating at the fame time, to deliver up his prifoners without ranfom, and to reftore the cities which he had taken. Lerna was appointed as the place of treaty, and the Achæans were willing to acquiefce; but in his way thither, Cleomenes fell into a fever, which rendered it neceffary for him to adjourn the meeting to another time and place. Aratus feized the advantage offered to him by this delay, and concerted meafures for preventing his advancement to the dignity after which he afpired, and to which his merit gave him a juft claim. After his recovery, he proceeded towards Argos, where the Achæans held their affembly; but, as he approached it, Aratus difpatched a meffenger to inform him, that he muft either enter the city alone, or be content to treat without the place. This meffage he confidered as an act of hoftility, and he foon after declared war. Encouraged by the difcontent and divifions that prevailed among the Achæans, he took Pellene by furprife, and expelled the Achæan garrifon; and, after taking poffeffion of other places, he furprifed Argos, and raifed himfelf to a greater degree of power than any of his predeceffors had poffeffed, and his city to a greater pre-eminence than fhe had ever held in Greece. He wifhed, however, to treat with Aratus, and to engage his friendfhip; but the Achæan general, having determined to deftroy the Spartan greatnefs, was invincible. In the courfe of the war, Cleomenes, with a force inferior to that of the enemy, who had called Antigonus to his affiftance, defended the far greater part of Peloponnefus, till Argos was betrayed; even then he exerted himfelf, and, when overpowered by numbers, made a moft glorious retreat. At this time he received from Sparta the intelligence of the death of his wife, to whom he was affectionately attached; but he bore the afflictive news with fortitude, and refumed the functions of a monarch and a general, without fuffering his private concerns to interfere with the conduct of public affairs. Ptolemy offered him his friendfhip; but impofed a condition which much affected him, and that was his fending his mother, Crateficlia, and his fon, as hoftages. Whilft he was unable to communicate this demand to his mother, and hefitating to explain himfelf, fhe laughingly faid, "Well, was it this which you were afraid of imparting? Why do you not put me on fhip-board, and fend this carcafe where it may be ferviceable to Sparta, before age has wafted it unprofitably here?" Before fhe embarked, fhe retired with her fon into the temple of Neptune, where, while he wept, fhe tenderly embraced him,

him, and faid, "Come, king of Sparta, let us dry our tears, that no figns of grief may appear when we go out, nor any token of weaknefs unworthy your dignity, or the honour of our country, fince our actions are all that are within our power, and events belong wholly to providence." Afterwards writing to Cleomenes from Egypt, fhe addreffed him in thefe words: "King of Sparta, do what is worthy of your country, and what may redound to its advantage; nor, for the fake of an old woman, and a little child, ftand in fear of what Ptolemy may do." In the profecution of the war, Cleomenes difplayed his conduct and valour; and though unequally matched againft the number and difcipline of his enemies, he kept the war out of Laconia, took the city of Megalopolis, which was larger than Sparta, in the midft of the armies of king Antigonus; and then generoufly offered to reftore it untouched to its citizens; but when they rejected his offer, he abandoned it to the plunder of his foldiers. He afterwards haraffed the territory of Argos, and, as the ftate of his army required fpeedy action, he provoked Antigonus to engage, whilft he had the advantage of the ground; however, this cautious and fkilful officer declined a conteft till a more proper opportunity offered. At length the two armies engaged at Sellafia, where Cleomenes was defeated with very great flaughter. After the termination of this difaftrous battle, he retired to Sparta; and, after fome deliberation, in which he manifefted diftreffing anxiety, he determined to retire to Egypt. In the execution of his purpofe, he embarked at Gythium, and paffed over to Ptolemy Euergetes, who entertained him honourably while he lived; but his fon, indulging fufpicion of him, deprived him of his liberty; an outrage which Cleomenes after fome time refented, fo that he, with 12 friends, forced the place where he was confined; but afterwards finding it impracticable to efcape, they flew each other. Thus died Cleomenes, in the firft year of the 140th Olympiad, 220 years B. C. after having reigned 16 years over Sparta. Ptolemy Philopater, actuated by a fpirit of brutal revenge, caufed his body to be hanged on a crofs, and ordered his mother, children, and all the women who attended them, to be put to death. When that unhappy princefs was brought to the place of execution, the only favour fhe afked was, that fhe might die before her children. But they began with them; a torment more grievous to the affectionate parent than death itfelf; after which fhe prefented her neck to the executioner, merely faying, "Ah! my dear children, to what a place did you come!" With Cleomenes ended the Herculean race of Spartan kings, if we except the fhort reign of Agefipolis, his fucceffor. Plut. in Cleom. apud opera T. i. p. 795. Polyb. lib. ii. Anc. Un. Hift. vol. v. Rollin's Anc. Hift. vol. v.

CLEON, an Athenian general, who rofe from obfcurity to the command of the armies of the ftate, by his intrigues and eloquence. He was rafh and obftinate, and was killed at Amphipolis, in a battle with Brafidas, the Spartan general, B.C. 422.—There was alfo a famous ftatuary of this name; alfo a poet, who wrote a poem on the Argonauts; alfo an orator of Halicarnaffus, who compofed an oration for Lyfander, in which he intimated the propriety of making the kingdom of Sparta elective; and a Magnefian, who wrote fome commentaries, in which he fpeaks of portentous events, &c.

CLEONÆ, in *Ancient Geography*, a maritime town of Macedonia, on a peninfula of Mount Athos, between Thyffus and Acro-Athos, according to Thucydides and Pliny. It was a colony of Chalcidians, according to Heraclides.—Alfo, the laft town of the Argolide on the fide of Corinth. In the time of Paufanias, it had a temple and ftatue of Minerva. Homer applied to it the epithet of Ευκτιμενας, which fuggefts the idea of a fine city.—Alfo, an ancient town of Greece, in the Phocide, near Hyampolis, according to Plutarch.—Alfo, an ancient town of Peloponnefus, in Arcadia, according to Pliny, who diftinguifhes it from that of Achaia.

CLEONEO, CIMONE, in *Biography*, a very ancient painter of Greece, who is faid to have firft attempted to give a variety to the actions of his figures, by making them look up or down, or fore-fhortening them as the fubject required; befides which he defcribed the joints and the veins of his figures better than any of his predeceffors, and imitated the folds of drapery with fome fuccefs. Borghini. Della Valle. Vite dei Pitt. Ant.

CLEONIA, in *Botany*, κλεωνυκιαν or κλεωνια, Theophraft. lib. 7. cap. 4. Diofc. lib. i. in Append. cap. 27. Cleonæum, Plin. lib. xix. cap. 5.) Linn. Gen. 736. Schreb. 991. Gært. 407. Clafs and order, *didynamia gymnofpermia*. Nat. Ord. *Verticillatæ*, Linn. *Labiatæ*, Juff.

Gen. Ch. *Cal.* perianth one-leafed, tubular, angular, two-lipped; upper lip flattifh, broad, three-toothed; lower lip two-parted, fhort. *Cor.* one-petalled, ringent; upper lip ftraight, bifid, keeled; lower lip trifid, middle fegment two-lobed; fide ones fpreading. *Stam.* Filaments four, forked at the end; the two lower longeft; anthers feated on the lateral branch of one of the filaments, croffed in pairs. *Pift.* Germ four-parted; ftyle filiform, the length of the ftamens; ftigmas four; fetaceous, equal; Linn. Four-cleft, Gært. *Peric.* none, except the permanent calyx clofed with hairs. *Seeds* four, nearly columnar, fmooth.

Eff. Ch. Filaments forked, with an anther at the end of each lateral branch; ftigma four-cleft.

Sp. C. *lufitanica*, Linn. Sp. Mart. Willd. Gært. tab. 66; fig. 7. Desf. Atl. 2. p. 32. (Brunella odorata, Lam. Juff. Vent. Prunella odorata lufitanica; Barr. Ic. 561. Clinopodium lufitanicum fpicatum et verticillatum, Tourn. Inft. 195.) *Root* annual. *Stem* fix or eight inches high, erect, very villous, a little branched towards the top. *Leaves* elongated, narrowed at the bafe, obtufe at the end, ftrongly toothed; upper ones pinnatifid; bractes deeply laciniated, narrow, acute, ciliated. *Flowers* violet-coloured or bluifh, large, in a terminal hifpid fpike; upper lip of the calyx large, flightly three-toothed, each of the teeth bearing a feeble fpine; lower one narrow, deeply bifid, fimilarly fpinous; anthers crefted at the back. La Marck never obferved the filaments fpinous as defcribed by Linnæus. *Seeds* roundifh, turgidly lenticular, mucronate at the bafe, rufefcent, with a white umbilicus, fhaped like the letter *y*. A native of Spain and Portugal. It differs little from prunella, except in its four-cleft ftigma, and laciniated bractes; characters which La Marck, Juffieu, and Ventenat have not thought fufficient to conftitute a generic diftinction.

CLEOPATRA, in *Biography*, the name of feveral princeffes and queens of Egypt. Of thefe we fhall felect

CLEOPATRA III., queen of Egypt, the eldeft daughter of Ptolemy Auletes, who gave his crown to her and her brother Ptolemy (Dionyfius II.) and ordered by his will, that they fhould marry together, according to the cuftom of that houfe, and govern jointly. And becaufe they were both very young, the daughter, who was the eldeft, being only 17 years of age, he left them under the tuition of the Roman fenate. She afcended the throne in the fecond year of the 182d olympiad, the 703d year of Rome, and the 51ft year before Chrift. Little is known of the beginning of Cleopatra's and her brother's reign. Ptolemy, being a minor, under the tuition of Pothinus, an eunuch, and Achillas, commander in chief of the Egyptian forces, thefe two ministers engrossed the whole power to themselves, and in the king's name, deprived Cleopatra of her share in the sovereignty left her by the will of her father. Thus injured, she retired into Syria, and having raised in that country and in Palestine a considerable army, led it into Egypt, in order to assert her right by military force. Ptolemy also, having collected all the forces in his power, took the field and marched against his sister. Both armies encamped between Pelusium and Mount Casius; but declined hazarding an engagement. At this conjuncture of the difference between the brother and sister, Pompey, whom the people had appointed guardian to the young king, after his defeat at Pharsalia, sought an asylum in Egypt, but on his arrival off Pelusium, he was basely murdered by the council of the reigning ministers and that of Theodotus, a rhetorician, who was the king's preceptor. In the mean time Cæsar, in his pursuit of Pompey, arrived at Alexandria, and there hearing of his death, caused him to be interred with all the usual solemnities. During his detention in this city by the Etesian winds, he solicited the payment of the money due to him from Auletes, and took cognizance of the difference subsisting between Ptolemy and his sister Cleopatra. The rigour with which the money was exacted for the payment of Auletes' debt, and the haughty manner in which Cæsar conducted himself in arbitrating between Ptolemy and his sister, incensed the Egyptians against him; but their indignation was appeased by concession and explanation on the part of the Roman, and the cause being brought before his tribunal, advocates were appointed to state the respective claims of the brother and sister. Cleopatra, in the mean while, justly apprehending that female youth and beauty would make an impression upon Cæsar in her favour, determined on an attempt to attach him first to her person and then to her cause. Having obtained leave to appear before Cæsar, or as Plutarch says, having been invited to plead her own cause in his presence, she concerted measures for being secretly conveyed into his apartment; and for this purpose caused herself to be tied up in a mattrass, and carried thither through the streets of Alexandria on the back of Apollodorus. Cæsar applauded the stratagem, and when Cleopatra presented herself, he was charmed with her person and detained her all night. Such was her influence over him, that he next morning sent for Ptolemy, and pressed him to receive his sister upon her own terms. When the young prince found that Cæsar, instead of being an impartial judge, was become the advocate of Cleopatra, and that she had taken up her abode in that part of the palace where the Roman lodged, his indignation was roused, and running through the streets of Alexandria in a frantic manner, he excited an insurrection of the populace against Cæsar. The Roman, however, contrived to repel the attack that was made upon his palace and to appease the tumult, by shewing himself from a balcony to the enraged multitude, and promising to do whatever they should think fit to suggest. On the following day he convened a general assembly of the people, and as guardian and arbitrator, he decreed that Ptolemy and Cleopatra should reign jointly in Egypt, agreeably to their father's will, which he had caused to be publicly read. Cæsar's decree gave general satisfaction; but Pothinus, whose interest and power were likely to be materially affected by it, inspired the people with new jealousies, and suggested to them that it was part of the plan of the Roman dictator, however disguised, to place Cleopatra alone on the throne. The reports to this purpose which he industriously circulated excited a fresh disturbance among the populace, and measures were adopted for expelling Cæsar from the city. The contest on both sides was active and violent; but Cæsar prevailed. Having secured the person of the king, and caused Pothinus to be put to death, he gained several victories over the Egyptians; and after his last victory, on occasion of which 20,000 Egyptians were slain, 12,000 taken prisoners, and Ptolemy drowned in the Nile in his attempt to escape, Cæsar returned to Alexandria, and entering the city without opposition, bestowed the crown on Cleopatra, obliging her to marry Ptolemy, her younger brother, at that time no more than 11 years of age. When this object was accomplished, Cæsar was roused from the lethargy into which he had been lulled by Cleopatra's charms, by the success of Pharnaces, king of the Cimmerian Bosphorus, in the recovery of his father's dominions; and accordingly he left part of his forces in Egypt to protect Cleopatra, and with the rest marched into Syria. Cleopatra remained undisturbed in the possession of the crown, but dreading the interference of her brother, when he attained his 15th year, at which age, according to the laws of the country, he was to share the royal authority as well as the name, she caused him to be poisoned, in the fourth year of his reign, and from that time she became the sole sovereign of Egypt. After the death of Cæsar, when the triumvirate was formed, Cleopatra declared herself in its favour; and being delivered from all apprehensions of an invasion, she sailed with a numerous fleet to join Antony and Octavianus; but was prevented by illness from prosecuting her design and obliged to return to Egypt, after having lost a great number of her ships by a storm.

Antony, after the battle of Philippi, having received information that Cleopatra, or some of her governors, had sent succours to Cassius against Dolabella, summoned her to appear before him at Tarsus in Cilicia. The queen, confiding in the power of her charms, already experienced, flattered herself that, at the age of 25 years, when the improvement of her understanding would render her conversation no less agreeable than her person, she should be able to captivate Antony. Having provided herself with rich presents, large sums of money, and magnificent habits and ornaments, she embarked in a stately galley, attended with the rest of her fleet, and crossing the sea of Pamphylia, and entering the Cydnus, arrived at Tarsus, where Antony waited her arrival. Her galley was all over gilt, the sails were of purple, and the oars plated with silver. The queen appeared under a canopy of cloth of gold, raised on the deck, in an attire and attitude resembling those in which Venus was generally painted, surrounded by a great number of comely youths fanning her like Cupids, and beautiful virgins, representing, some of them the Nereids, and others the Graces. The dales and hills echoed, as she sailed up the river, with the melodious sounds of various instruments, with which the oars keeping time, increased the harmony. The perfumes, that were burnt on the deck in great abundance, diffused their odours on each side of the river to a considerable distance, and filled the air with fragrance. As she drew near the city, curiosity induced crowds of citizens to abandon their houses and occupations, and to go out to meet her; and Antony, who was distributing justice in the forum, found himself deserted. Upon her landing, Antony invited her to supper; but the queen, observing the decorum usual on these occasions, declined accepting his invitation, and requested a visit from him in the tent, which would be soon pitched on the banks of the river. Antony instantly complied, and was entertained with a magnificence which no words can adequately describe. At this first interview, he was no less charmed by her conversation than by her form and features; and such was the ascendant which she had gained over him, that it

was

was not in his power to refuse her any thing she asked, however repugnant to the laws of justice, humanity, or religion. At her request assassins were dispatched to murder her sister Arsinoe; and in order to increase and perpetuate her influence over the deluded Antony, she spent immense sums of money in the entertainments she prepared for him and the chief officers of his army. On one occasion, she presented him with a vast number of gold cups, enriched with jewels, which he admired; and on another, she gave him all the gold and silver plate which had been used during a sumptuous banquet. At one of these entertainments the queen had ear-rings consisting of two of the finest and largest pearls that ever had been seen, each valued at 52,500 *l.* of our money. One of these she caused to be dissolved in vinegar, and then swallowed it, in order to shew in what low estimation she held such toys, and how much she could spend in one draught. She was also preparing to dispose of the other in the same way, when Plancus stopped her, and saved the pearl, which was afterwards carried to Rome by Augustus, and being cut in two by his orders, it served for pendants to the Venus of the Julian family. (Pliny, l. xxxiii. cap. 3.) For a further account of the connection between Antony and Cleopatra, see the article ANTONY. This connection inspired her with the hope of becoming one day queen of Rome; for we are told by Dio Cassius and Eutropius, that her usual oath was, "as I hope to give law in the capitol." When Antony and Cleopatra separated after the disastrous battle of Actium, the former went to Libya, and the queen sailed to Alexandria. Fearing, however, that she might not be received by her subjects, if her misfortunes were known, she entered the harbour with crowns on the prows of her ships, as if she had obtained some signal victory. This artifice succeeded; and having gained admission into her capital, she put to death all who were averse to her, in order to prevent the tumults, which she apprehended they might occasion, when the true state of their affairs should be known. Antony, who arrived in Egypt soon after the queen, by whom he was infatuated, was astonished to hear of a very extraordinary undertaking in which she was engaged. As she expected Octavianus to pursue her into Egypt, in order to avoid falling into his hands, she concerted measures for the transportation of her ships from the Mediterranean into the Red Sea, over the isthmus, of 70 miles, which lay between them. These ships were to be joined to those in the Red Sea, and all her treasures on board of them, she determined to seek some place of settlement, out of the reach of the enemy. But the Arabians on the coast disconcerted her plan, by burning all her ships; and she was, therefore, forced to abandon her enterprise. After the death of Antony, Cleopatra was taken, having been prevented from dispatching herself with a dagger, which she always carried about with her for this purpose; and being introduced to Octavianus on his arrival at Alexandria, obtained the only favour she asked, which was leave to bury Antony. She afterwards made an attempt to captivate and delude Octavianus; but her efforts were ineffectual, for after she had done speaking, he returned her this laconic answer, "Woman, be of good cheer; no harm shall be done you!" Cleopatra observed his coldness and indifference, but dissembled the concern which they occasioned; and expressing her gratitude for the favour he had conferred upon her, she put into his hand an inventory of all her moveables, jewels, and revenues, which she designed for his use. When Seleucus reproached her for having concealed part of her most valuable effects, she flew at him in a violent rage, and gave him several blows in the face. Then turning to Octavianus, she said, "Is it not very hard, since you have condescended to visit me in my present condition, that one of my own servants should thus insult me in your presence? I have, it is true, reserved some jewels, not to adorn my own person, but as a present intended for your sister Octavia, and wife Livia, that by their intercession you may be induced to treat an unfortunate prisoner with more favour and kindness." Octavianus, apprehending from this conversation that she had no thoughts of destroying herself, desired her to dispose of the jewels she had reserved according to her own wishes, and assured her that she should be treated with a greater degree of kindness and generosity than she expected. Cleopatra, however, was not deceived by these professions. She had no doubt of Octavianus's intention to make her serve as an ornament to his triumph; and she determined to avoid that ignominy by a voluntary death. To prevent it she was constantly watched by Epaphroditus; but in hopes of obtaining a fit opportunity for executing her purpose, she obtained leave to pay her last tribute of respect to the tomb of Antony. She bathed it with her tears, covered it with flowers, and with many sighs and lamentations performed the ceremonies that were customary among the Egyptians on such occasions. After her return, a messenger was deputed by Cornelius Dolabella, who was the intimate friend of Octavianus, and who, nevertheless, being in love with Cleopatra, had promised to give her timely notice of his designs respecting her, in order to inform her, that, within three days, she and her children would be put on board a vessel that was in the harbour, and conveyed by sea to Rome. Upon this intimation, she ordered a splendid entertainment to be prepared, and having invited some of her friends appeared more cheerful than usual during the feast. Rising suddenly from table, she delivered to Epaphroditus a sealed letter for Octavianus, requesting that it might be immediately conveyed into his own hands. Having thus contrived to get him out of the way, she withdrew to her apartment, attended by two of her women, and having dressed herself in her royal robes, she lay down on the bed, and asked for a basket of figs, which one of her faithful servants had brought her in the disguise of a peasant. Among the figs was concealed an asp, the poison of which was such that those who were bitten by it fell immediately into a kind of lethargy, and died without any pain or uneasiness. (On this subject see the article ASP.) The purport of her letter to Octavianus was that he would permit her to be buried in the same tomb with Antony. Conceiving from this request that she meant to lay violent hands on herself, he dispatched some of his friends in haste to prevent it, if possible. Upon their entrance into the apartment of Cleopatra, they found her lying dead on a golden bed in her royal robes; one of her maids likewise being dead at her feet, and the other ready to expire. Octavianus, as soon as he heard the news, lost no time in using all possible means for her recovery; but they were altogether ineffectual. Thus deprived of the chief glory and ornament of his triumph, he, however, granted her last request, and commanded that she should be buried with all possible pomp in the same tomb with Antony.

> "Ausa et jacentem visere regiam
> Vultu sereno fortis, et asperas
> Tractare serpentes, ut atrum
> Corpore combiberet venenum,
> Deliberata morte ferocior:
> Sævis liburnis scilicet invidens,
> Privata deduci superbo
> Non humilis mulier triumpho."

Hor. Od. 37. l. 1.

"Not

C L E

"Not the dark palace of the realms below
Can awe the furious purpoſe of her ſoul;
Calmly ſhe looks from her ſuperior woe,
That can both death, and fear control:
Provokes the ſerpent's ſting, his rage diſdains,
And joys to feel the poiſon in her veins.
Invidious to the victor's fancy'd pride,
She will not from her own deſcend,
Diſgrac'd, a vulgar captive, by his ſide,
His pompous triumph to attend;
But fiercely flies to death, and bids her ſorrows end."

Thus died Cleopatra, at 39 years of age, after ſhe had reigned, from the death of her father, 22 years. She was a woman of extraordinary talents, and of boundleſs ambition. She is ſaid to have been well acquainted with Greek and Latin, and to have ſpoken with eaſe and readineſs many other languages, converſing with the Ethiopians, Troglodites, Jews, Arabians, Syrians, Medes, and Perſians, without an interpreter. In the midſt of the career of ambition and licentious pleaſure which ſhe purſued, ſhe retained a taſte for polite literature, and erected in the place where the famous library of Alexandria ſtood, a new one, not inferior to the former; enriching it with the 200,000 volumes of the library of Pergamus, with which Antony had preſented her. With her terminated the family of Ptolemy Lagus, the founder of the Egyptian monarchy, after it had ruled over Egypt, from the death of Alexander, 294 years, or as others affirm, 293 years and three months. From this time Egypt was reduced to a Roman province, and governed by a prætor ſent thither from Rome. Anc. Un. Hiſt. vol. viii. Rollin's Anc. Hiſt. vol. vii.

Cleopatra's *Needles*, in *Ancient Architecture*, are two obeliſks towards the eaſtern part of the palace of Alexandria, in Egypt; they are conſtructed of Thebaic ſtone, and covered with hieroglyphics; one is overturned, broken, and lying under the ſand; the other is on its pedeſtal. Theſe two obeliſks, each of them of a ſingle ſtone, are about 60 feet high, by 7 feet ſquare at the baſe.

CLEOPATRIS, in *Ancient Geography*, a town of Egypt, ſeated on the canal which paſſes from the Nile to the Red Sea. See Arsinoe.

CLEOPHORA, in *Botany*, (from κλεος, *ſplendor*, and φορος, *ferens*, denoting a tree with a ſplendid ſpadix), Gært. 701. (Latania, Juſſ. p. 39. Comerſ. MSS.) Nat. Ord. *Palmæ*.

Gen. Ch. Male and female flowers on different plants. *Male. Calyx common*, ſpathe many-leaved; leaves imbricated; ſpadix branched; branches ſomewhat cylindrical, digitate-cleft at the top; clefts having the form of an Amentum, covered with ſmall imbricated one-flowered ſcales. *Cal. proper* ſix-parted; outer ſegments ſmaller. *Stam.* fixteen, united at the baſe. Fem. Spatha . . . Spadix. *Calyx* ſix-leaved. *Berry* (or drupe) globular, one-celled, containing three pyrenes or ſtones.

Sp. C. *lontaroides*, Gært. tab. 120. fig. 1. "Leaves palmate-pinnatifid; petiole without prickles." *Berry* obſoletely trigonous, ſmooth; rind coriaceous, thin, brittle, and almoſt cruſtaceous when old; pulp ſucculent, fugacious, drying into membranous ſcoriæ, adhering to the pyrenes or ſtones, without any veſtige of fibres or partitions; oſſicles, or ſtones, three, cruſtaceous, thin, convex and obſoletely ſtriated on one ſide, angular, and ſmoothiſh on the other. *Seeds* one in each oſſicle, ſomewhat elliptical, thick, very finely and irregularly ſtriated, pulverulent, ſomewhat convex on one ſide, obſoletely angular on the other, ending beneath in a ſhort point, marked above a little behind the apex, with a ſmall papilla which covers the embryo. Gært. A native of the Iſle of France.

CLEOSTRATUS, in *Biography*, an ancient mathematician and aſtronomer of Tenedos, who flouriſhed about 533 years B.C. and firſt formed, as it is ſaid, the ſigns of the zodiac, and reformed the Grecian calendar.

CLEPSYDRA, in *Ancient Geography*, a fountain of Peloponneſus, in Meſſenia, placed by Pauſanias and Appian in mount Ithome.

Clepsydra, ſo called from κλεπτω, *ſurripio*, and ὕδωρ, *aqua*, was an horological inſtrument of great antiquity, among the Egyptians and other eaſtern nations, probably before ſun-dials were invented; though the name of the original inventor is not handed down to us; the conſtruction has been varied in different ages and countries, according to the variation of the different modes of reckoning time, but one principle is the baſis of all the forms it has undergone, namely, the conſtant dropping, or running of water through a ſmall aperture, out of one veſſel into another. At firſt the indication of time was effected by marks correſponding to either the diminution of the fluid in the containing veſſel, during the time of emptying, or to the increaſe of the fluid in the receiving veſſel during its time of filling; but it was ſoon found, that the eſcape of the water was much more rapid out of the containing veſſel, when it was full, than when it was nearly empty, owing to the difference of preſſures at different heights of the ſurface; this irregularity in the dropping, preſented an obſtacle which required much ingenuity to correct. In our account of the different conſtructions of clepſydræ, we will claſs them under the two heads of *ancient* and *modern*.

Ancient Clepſydræ.—According to M. Vitruvius Pollio, the firſt improver of the ancient clepſydra, or water-clock, was Cteſibius of Alexandria, the ſon of a barber, who, about 245 years before Chriſt, ſpent much time in deviſing mechanical contrivances for removing not only the obſtacle in queſtion, but alſo another equally formidable one, which aroſe from the daily inequality of the Egyptian hours. As one-twelfth part of the time elapſed from ſun-riſe to ſun-ſetting on any day, was called an hour of that day; and as one-twelfth part of the time that paſſed from ſun-ſetting to ſun-riſe, was called an hour of the night; not only did the hours of day differ from the hours of night, but from one another, at all times, except at the vernal and autumnal equinoxes; hence it became neceſſary, either to make the water fall irregularly into a receiving veſſel, with equidiſtant hour-marks, or to have varying hour-marks for a regular efflux; the firſt of theſe methods (which probably preceded that of Cteſibius) was thus effected, *viz.* 1. A conical hollow veſſel, A, was inverted, or placed like a funnel in a frame C C (*Plate* I. *fig.* 1. of *Horology*) there being a very ſmall aperture at the apex of the cone, and another ſolid cone, B, every way ſimilar as to dimenſions, was plunged into the hollow one, when filled with water to a greater or a ſmaller depth, accordingly as the efflux was wanted to be more or leſs rapid, and then adjuſting marks, correſponding to every day and night in the year, were put on a long ſtem D, inſerted into the broad end of the ſolid cone B, and kept in its poſition by the frame, as repreſented in the figure, to ſhow how much the inner cone was to be depreſſed or elevated, to accelerate or retard the iſſue of the fluid for the correſponding time; H was the ſpout which ſupplied a conſtant influx of water, and I the waſte pipe, connected with the top of the conical veſſel, which carried off the ſuperfluous water; hence the conſtant influx of water preſerved an unvarying height of the ſurface from the aperture, which aperture was varied at pleaſure, by the elevation or depreſſion of the inner cone; if if now we ſuppoſe the ſubjacent veſſel to be a cube, cylinder, or any other regular figure, and equidiſtant hour-marks to be properly made on its ſide, the ſurface of the water, or an index borne by it on a piece of cork, would, as it roſe, indicate the hours correſponding to thoſe marks.

The imperfections of this clepſydra were theſe: 1. It required two daily manual adjuſtments, one in the morning, and the other in the evening; and, 2. It made no allowance for the variation of fluidity, in different degrees of temperature, which, it is aſſerted (but perhaps without proof), greatly influenced the iſochroniſm of the drops. As an improvement, or rather appendage, to this conſtruction of the clepſydra, a bar, E E, with rack-work at the upper end, as ſhewn by the dotted lines, was made to float on the ſurface of the lower veſſel by means of an affixed piece of cork, F, ſo that as the cork and its bar roſe in the veſſel, the teeth of the bar turned a ſmall wheel, G, fixed to the upper part of the frame by a cock, on the arbor of which wheel a hand was put, which revolved and indicated the hours on a fixed dial-plate. This addition, however, did not render the inſtrument a more accurate meaſure of time, but only indicated the hours, ſuch as they were, in an improved manner. It may be worthy of remark here, that water was at once the regulator and the maintaining power of the inſtrument before us; the interval between two ſucceſſive drops was to the clepſydra what one vibration of the pendulum is to a clock, or one oſcillation of the balance is to a watch; and the floating of the indented bar was in place of a weight or ſpring to move the wheel to which the hand was attached; conſequently it might be ſaid to be an horological machine of the ſimpleſt conſtruction poſſible. The adjuſtment of the two cones was regulated by the latitude of the place, owing to the manner in which the hours were divided; at Alexandria, for inſtance, the greateſt and leaſt velocity of the drops were required to be to each other as 70 to 50, the longeſt and ſhorteſt hours in that latitude being reſpectively $1^{h}\ 10^{m}$ and 50^{m} of equable time; and in higher latitudes the diſparity is ſtill greater.

2. The next attempt to improve the clepſydra was by conſtructing it ſo that its aperture was adjuſted, as the year advanced, by the putting of an index to the ſun's place in an ecliptic circle; which attempt, of courſe, rendered the inſtrument more complex. Perrault conceives the parts to have been thus adapted, according to the deſcription given of it by M. Vitruvius Pollio, in his book "De Architecturâ" (cap. ix. lib. ix.).

Fig. 2. of *Plate* I. repreſents an ancient clepſydra with an horary circle and a variable aperture: A is a reſervoir, to the top of which is attached a water-pipe, not ſeen in the drawing, to preſerve an equal preſſure by carrying off the ſuperfluous water; B is a pipe projecting from the reſervoir into the upper part of the drum, M N, on the front of which drum the ecliptic circle is marked; O D L is a ſmaller inner drum, which revolves on a tubed arbor, F, and which is repreſented as drawn out of its place; this ſmall drum has a thorough groove, *a b*, varying in breadth all round it, like a hoop tapering throughout from the broadeſt part both ways to its oppoſite point, and is of ſuch a diameter that the middle of the groove juſt reaches to, and coincides with, a perforation under the tube, B, at the upper part of the great drum, ſo that, as the little drum, which carries the diurnal index, L, and nocturnal index, O, oppoſite to the former, is turned round by hand, the variation in the breadth of the groove occaſions a correſponding variation in the velocity of the efflux of water, by making a larger or ſmaller aperture, accordingly as the ſun's place is more or leſs advanced in the ecliptic, the largeſt aperture being when the diurnal index is at the beginning of Capricorn; a little baſon or funnel attached to the upper part of the fixed tube or hollow arbor, F, (not viſible), receives the water in its fall within the drum, and tranſmits it through the ſaid tube by G into the receiving veſſel, H, in which is floated the piece of cork, I; this floating-piece is connected, by a chain, with the counterpoiſe, K, after it is folded round the arbor, P, which carries the hour-hand of the dial-plate; conſequently, as the water riſes in the veſſel, H, the piece, I, is raiſed, and its counterpoiſe, K, at the ſame time falling gives motion to the arbor and hour-hand, and the hours are longer or ſhorter according to the breadth of the groove which is at any time under the perforation of the tube, B, *i. e.* according to the place in the ecliptic to which the proper index is put.

This clepſydra, like the preceding one, compoſed of two cones, requires two manual adjuſtments, one in the morning and the other in the evening, and makes no allowance for the (ſuppoſed) variation of fluidity occaſioned by the different ſtates of the weather; and the variation in the breadth of the groove or ſlit, it is preſumed, was more plauſible in theory, than feaſible in practice; the contrivance, however, was ingenious, and beſpoke the inventor's acquaintance with aſtronomy.

3. The next improvement in the ancient clepſydra was probably that of Cteſibius, which was an automaton, or ſelf-adjuſting machine, and is repreſented by *fig.* 3, which, according to Perrault and Ferd. Berthoud, exhibits the interior conſtruction of this machine; A is the end of a tube over which an image ſtands, which is connected with a full reſervoir, and from the eyes of which, conſidered as invariable apertures, the water continually flows or drops in a regulated manner into it; this tube conveys the water from M towards B into the top of a long regular veſſel, B C D F, which it gradually fills, and raiſes the cork, D, with its attached light pillar, C D; on the top of this pillar is ſurmounted another image holding an index which points to the diviſions on the large column above. Now, when the water riſes in the veſſel that contains the cork, it alſo riſes in the ſmall tube, F B, which conſtitutes one leg of a ſyphon, F B E, that is connected with the bottom of the cubic veſſel; conſequently, when the index has mounted to the uppermoſt diviſion on the large column of hour lines, conſiſting of twice twelve, the water flows over the bent part, B, of the ſyphon, and immediately empties the veſſel into one of the ſix troughs or diviſions of the water-wheel, K, which is thus turned one-ſixth part of a revolution, during which time the image falls with its index to the bottom of the column, to be ready for the next day. This portion of the mechaniſm would have been ſufficient to conſtitute the machine, if the hours had been conſidered as of equal length throughout the year, but the Egyptian mode of dividing and reckoning time made it requiſite that the hour lines ſhould ſlope out of an horizontal direction on the ſurface of the column, ſo as to make variable ſpaces, and alſo that the column ſhould revolve once in a year, to preſent all the variations of ſpace to the index. This annual motion of the column is ſaid to be effected by wheel-work in the following manner:—on the arbor of the water-wheel, K, is fixed the pinion, N, of ſix leaves, which impels the contrate-wheel, I, of 60 teeth in $6 \times \frac{60}{6} = 60$ days, then on the perpendicular arbor of I is another pinion, H, of ten leaves, which drives the wheel, G, of 61 teeth round in $60 \times \frac{61}{10} = 366$ days, and along with it the horary column, into which its arbor is inſerted at L. On the bottom of the column is marked an ecliptic circle; and 12 perpendicular lines drawn lengthwiſe down the column divide it

it into the respective signs, which are serviceable for ascertaining the requisite shape of the hour lines in any month. The writer of this article, however, suspects, that the above train of wheel-work is only what Perrault, the translator of Vitruvius, supposed to be that of Ctesibius; for, on referring to the original account of Vitruvius, the year in which the column revolved is stated to be 365 days, a period which might be effected thus:

Let the water-wheel have only five compartments instead of six, and let an endless screw be cut on its arbor to impel a wheel of 73 teeth, with a perpendicular arbor, to be inserted into the column of hours, which will, by such a simple construction, revolve in $5 \times \frac{73}{1} = 365$ days, agreeably to the original account.

The clepsydra, in one of its earlier forms, was used as an astronomical instrument, by the help of which the equator was divided into twelve equal parts, before the mathematical division of a circle was understood: it was deemed of more value than a sun-dial, on account of its dividing the hours of the night as well as of the day. It was introduced into Greece by Plato, and into Rome by P. Cornelius Scipio Nasica, about 157 years before Christ.

Pliny says (lib. xxxvii.) that Pompey brought a valuable one among his spoils from the Eastern nations; and Cæsar is said to have met with an instrument of this kind in England, by the help of which he observed that the summer nights of this climate are shorter than they are in Italy. The use which Pompey made of his instrument was to limit the speeches of the Roman orators; which Cicero alludes to when he says "latrare ad clepsydram."

4. Besides the ancient clepsydra, above described, F. Berthoud mentions another (Histoire de la Mesure du Temps, tom. I. p. 20.), which was called the *anaphoric*, on the dial-plate of which were projected the circles of the sphere, including the parallels of the sun's altitude, with the semi-diurnal and semi-nocturnal arcs, to which an adjustable bead, as the sun's representative, pointed as an index to shew the hours, parallels, &c. as the dial-plate revolved daily by means of wheel-work, which was impelled by water. It does not seem certain at what period this instrument was invented and used; but Berthoud thinks that tables of the sun's motion must have existed previously to its invention, and also a knowledge of projections of the sphere on a plane surface, whence he fixes the date posterior to the time of Hipparchus, who, according to Pliny, died about 125 years B.C. The name *anaphoric* is evidently derived from *anaphora*, which was the second house in the heavens, according to the doctrine of astrology, which prevailed about the time here specified.

In Athenæus, lib. iv. p. 174, we have a history and description of an ancient instrument. He tells us that it was invented in the time of the second Ptolemy Euergetes, by Ctesibius, a native of Alexandria, and by profession a barber: or rather, that it was improved by him, for Plato furnished the first idea of the hydraulic organ, by inventing a night-clock, which was a clepsydra, or water-clock, that played upon flutes the hours of the night at a time when they could not be seen on the index.

The anecdote in Athenæus concerning the mechanical amusements of the great ideal philosopher, is curious. What a condescension in the *divine* Plato to stoop to the invention of any thing useful! This musical clock must have been wholly played by mechanism.

In describing it, Athenæus says, it resembled in appearance a round altar; but was not to be ranked with stringed but wind instruments, composed of pipes; the orifices of which being towards the water, when it was agitated, produced from the pipes, by its fall, a soft and pleasing sound.

Modern Clepsydræ.—The modern method of dividing the natural day into 24 solar hours of equal length, has rendered the preceding constructions of the clepsydra useless for some centuries back; and, notwithstanding the science of hydrostatics is much better understood by the modern than it was by the ancient philosopher, so that a scale of altitudes corresponding to the variable velocities of the efflux of a fluid out of a given aperture can be ascertained by calculation for a containing vessel of any capacity or figure, yet, since the happy inventions of the balance and pendulum, as regulators of watches and clocks, horological machines, actuated by the motion of water, have become so rare, as to be considered as objects only of curiosity.

Beckmann, in his "History of Inventions," vol. i. p. 136. attributes the contrivance and introduction of a water-clock to some time between 1643 and 1663, and gives nearly the same brief account of one as we meet with in "Bion, on Mathematical Instruments," and also in "Ozanam's Recreations," edited by Dr. Hutton, the last of which authors said, in the year 1693, that the first water-clock brought to Paris about that time was from Burgundy. He also says, that father Timothy, a Barnabite, had given the machine all the excellence it was capable of, by constructing it so as to make it go a month at one winding up, and to exhibit not only the hours on a dial-plate, but also the sun's place, day of the month, and festivals throughout the year.

How these and similar particulars might be indicated, will be easily apprehended from the following description, which is agreeable to the accounts given of a water-clock of the 17th century by the authors already named.

1. In *fig.* 1, of *Plate* II. of *Horology*, A B C D is an oblong frame of wood, to the upper part of which two cords, A *a* and B *b*, are fixed at their superior extremities, and at their inferior, to the metallic arbor, *a b*, of the drum, E, which contains distilled water; this water is confined in cells so peculiarly constructed, that they regulate the velocity with which the drum shall descend by the force of gravity from the top to the bottom of the frame, and the ends of the arbor indicate the hours marked on the vertical plane of the frame during the time of descent. An observer, who knows not the nature of the interior cells of the drum, is surprised to see that its weight does not make it run down rapidly, when mounted to the top of the frame by merely folding the strings round the arbor, there being apparently no mechanical impediment to the natural action of gravity. To explain how this phenomenon is produced, we must refer to *fig.* 2, which is a section of the drum at right angles to its arbor; this circular plane we will suppose to be six inches, which is about the usual size, in diameter, and to represent the inner surface of either of the two ends of the drum, which may be made of any of the unoxidable metals; then, if we conceive seven metallic partitions, F *f*, G *g*, H *h*, I *i*, K *k*, L *l*, and M *m*, to be closely soldered to both ends of the drum, in the sloping direction indicated by the figure, where the black lines are equidistant tangents to the small dotted circle of an inch and half diameter at the points *f*, *g*, *h*, &c.; it is evident, that any small quantity of water introduced into the drum would fall into two, or at most three, of the lower compartments, and would remain there until some external force should alter the position of the drum, supposing in this case the cords tied fast to the arbor; but we have said that they are wound round the circumference of an arbor, that has a sensible diameter, suppose one-eighth of an inch; therefore, they

they are removed one-ſixteenth of an inch, or upwards, if we take their thickneſs into the account, from the centre of the drum, which would alſo be its centre of gravity, if it were empty, on which account it would, in that caſe, revolve to the left, in the direction F G H downwards, from the cord being at the remote ſide of the centre, as repreſented by N O; but conceive the water to be included now and then, it would be elevated to the right, till its weight became a counterpoiſe to the gravity of the heavier ſide of ths drum, in which ſituation all motion would ceaſe, and the drum would remain, ſuſpended, indeed, by the cords, but in a ſtate of equilibrio. Conceive again a ſmall hole perforated in the partition preſſed upon by the water near the circumference of the large circle, and alſo at the points F, G, H, I, K, L, M, and the conſequence will be, that the water will firſt force its way ſlowly through the perforation at K, from the more elevated to the lower compartment, which effect will diminiſh its power as a counterpoiſe, and give ſuch an advantage to the heavy ſide, F G H, of the drum, conſidered as empty, as will occaſion a ſmall degree of motion towards the left, and conſequently carry the water once more towards the right; but now the water paſſes through the perforation of the next partition alſo at I, and produces again the ſame effect, as has been deſcribed with reſpect to K, and will continue to do ſo, at the ſucceſſive perforations, till all the compartments have been filled and emptied by means of theſe perforations, in ſucceſſion, which kind of motion of the drum, contrary to that of the water, it is now not difficult to conceive will be pretty regular, if all the partitions are perforated exactly alike. The difference of the preſſures of the water in cells, nearly full and nearly empty, will occaſion ſome little deviation from regularity; but theſe will be periodic, and muſt be allowed for in the hour diviſions, which ought to be made by a compariſon of the ſpaces fallen through, with the time indicated by a clock or watch. About nine ounces of diſtilled water will ſuffice for a clepſydra of ſix inches diameter, and two inches depth, and the velocity of the fall may be limited, either by varying the quantity of water, or by hanging a ſmall metallic cup F, to receive weights, by a cord wound in a direction contrary to the cords of ſuſpenſion, to act as a counterpoiſe in aid of the water, if the fall be too rapid, or *vice verſâ*.

It is abſolutely neceſſary that the arbor ſhould fit the central ſquare hole ſo well as to prevent the eſcape of water from the drum, otherwiſe the inſtrument would continue to gain velocity, till at length it would no longer afford a true indication of time.

Sometimes a cord, *cd*, with a weight, P, is made to paſs round a pulley fixed to an arbor at the top of the frame, with a nooſe paſſing over the axis near *a*, as is ſeen in the ſame figure, which arbor, projecting through a dial-plate or face, turns round and carries a hand to indicate the hours like an ordinary clock; when this conſtruction is preferred, it is an indiſpenſable requiſite that the circumference of the pulley's groove be exactly of the ſame dimenſions as the fall of the drum in 12 or 24 hours, accordingly as the dial is divided.

This clepſydra, it is ſaid, goes faſter in ſummer than in winter, which is owing to the drum being relatively heavier in rarefied than in denſe air; we can hardly ſuppoſe that any alteration in the fluidity of the water, as formerly ſuppoſed, would make any difference. The minute hand and alſo the ſtriking part of a common clock might eaſily be ſuperadded to this clepſydra.

2. Another form, and that a very ſimple one, of the modern clepſydra has derived its origin from that law in hydroſtatics by which the efflux of water out of an orifice is influenced under different preſſures, or which is the ſame thing, at different depths from the ſurface, the velocity being directly as the ſquare root of the height of the ſurface from the aperture. If a glaſs veſſel, like that in *fig*. 3, therefore be taken, out of which all the water will flow in exactly 12 hours, from a ſmall aperture in its lower extremity, the whole height muſt be divided, or ſuppoſed to be divided, into the ſquare of 12 or 144 equal parts, of which parts 11 × 11, or 121 meaſured from the bottom, or 23 meaſured from the top, will give the diviſion for the hour 11, 10 × 10 or 100 from the bottom will give the line for 10, 81 for 9, 64 for 8, and ſo on down to the bottom, as repreſented in the figure; which ſcale is in the inverted proportion of that according to which heavy bodies fall in free ſpace by the ſole force of gravity.

If, inſtead of the veſſel itſelf being divided by hour-lines as above directed, the ſtem of a floating piece like an hydrometer were to have a ſimilar ſcale kept in a perpendicular direction, by paſſing through the central hole of a cap or cover of the veſſel, the indication of time would be made on the ſtem at the ſurface of the cap, which conſtruction would admit of the veſſel being of wood or metal.

3. But ſuch a figure might be given to the containing veſſel as would require the dividing marks to be equi-diſtant, which Dr. Hutton, in his recent edition of "Ozanam's Recreations," has aſſerted to be a paraboloid, or veſſel, formed by the circumvolution of a parabola of the fourth degree, the method of deſcribing which, he has given thus:

Let A B S, *Plate* II. *fig*. 4, be a common parabola, the axis of which is P S, and the ſummit S. Draw, in any manner, the line, R v T, parallel to that axis, and then draw any ordinate of the parabola A P, interſecting R T in R; make P Q a mean proportional between P R and P A, and let pq be a mean proportional alſo between pr and pa; and ſo on. The curve paſſing through all the points Q q, &c. will be the one required, which, being made the mould for a veſſel to be caſt by, will produce an inſtrument, which, when perforated at the apex, will have the ſingular property of equalizing the ſcale, ſo as to correſpond to equal times while the water is running out. Mr. Varignon has given a geometrical and general method of determining the ſcale for a clepſydra, whatever may be the ſhape and magnitude of the veſſel. (See "Memoires de l'Academié Royale des Sciences," p. 78, 1699.)

4. Another method of making a water-clock with equi-diſtant hour lines in any regular veſſel, is effected more ſimply than in the preceding one, by means of the ſyphon fixed faſt in the centre of a broad piece of cork, which is floated in any regular veſſel, as the cylindrical one at *fig*. 5, for as the power of a ſyphon to empty any veſſel filled with water depends upon the difference of atmoſpheric preſſures at the ſurface of the water and at the orifice of the longer leg, it is clear that while the ſhorter leg ſinks with the ſurface of the water in the veſſel during its time of emptying, the relative preſſures, depending on the diſtance from the ſurface of the water to the orifice of the lower leg, will continue unaltered in any ſtate of the atmoſphere; hence equal portions of water will be diſcharged in equal times; and a light cock cemented on the lower orifice would afford a means of adjuſting its aperture to the ſize of any veſſel that may be fixed upon; or otherwiſe a ſecond receiving veſſel may be divided into equal ſpaces for the hours, which would in this caſe be indicated by the ſurface of the riſing water.

Beſides the preceding methods of meaſuring time by means of water, there are others nearly ſimilar, ſuch as the double jet d'eau, which, like the ſand-glaſs that may be claſſed with theſe, requires to be inverted as ſoon as empty, and it is eaſy to conceive a variety of ways of applying any liquid to anſwer the purpoſe of meaſuring pretty nearly a given number of hours, but we do not learn that the moſt accurate of the clepſydra is comparable to an ordinary clock, though it has been aſſerted, that Amontons conſtructed one in ſo accurate a manner, that he hoped to find it uſeful in aſcertaining the longitude at ſea by means of its accuracy; we regret that it is not in our power at preſent to procure the pamphlet in which the account of it was publiſhed. "Remarques & Experiences Phyſiques ſur la Conſtruction d'une nouvelle Clepſydre," &c. Paris. Jombert. 1695.

5. We ſhall conclude our account of theſe horological inſtruments with detailing the conſtruction and action of a clepſydra, publiſhed in the 44th volume of the Philoſophical Tranſactions by the Hon. Mr. Charles Hamilton.

A B and C D are two ſimilar oblong veſſels attached to a frame of wood, which may eaſily be conceived to ſurround figure 6, which ſhews only the interior mechaniſm; *a b* and *c d* are two columns of wood ſo floating in water, that their counterpoiſes, F and G, juſt keep their ſuperior ends equal with the ſurface of the water by means of connecting chains paſſing over the pulley *f*, and another hid by the dial plate; the former of theſe pullies, *f*, has a click which puſhes the ratchet on the barrel, *i*, when the counterpoiſe, F, falls, but ſlips eaſily over the ſlopes of the teeth when the ſaid counterpoiſe riſes; the latter pulley has alſo a ſimilar click acting in like manner, with a ſecond ratchet at the oppoſite end of the barrel, *i*, which ratchet is alſo hid in the drawing, ſo that whichever of the two counterpoiſes ſhall at any time be falling, the barrel, *i*, will move forwards in the ſame direction; and carry the minute hand along with it on the dial-plate; the hour hand goes round by means of dial-work, as in an ordinary clock or watch, where a diminution of velocity is effected by two wheels and two pinions. The action is thus produced by means of five ſyphons and two balances.

The water enters with an unvaried influx, drawn from a reſervoir, by a ſyphon of ſmall bore, the longer leg of which is ſeen at J, into the middle of what may be called a horizontal trough, ſupported like a balance by a fulcrum at K, in ſuch a manner, that either end of the balance may be elevated accordingly as the long veſſels A B and C D require to be alternately filled; near the top of each of theſe veſſels is inſerted a long ſyphon or tantalus, *l* and *m*, the lower legs of which reach down to two ſmall cylindrical veſſels, *n* and *o*, which are poiſed by another balance at the fulcrum *p*; theſe cylindrical veſſels have, in like manner, each a ſmall ſyphon, *q* and *r*; laſtly, a ſilken thread tied to the upper end of the cylinder, *n*, is carried up round a ſmall pulley faſt to the frame at *s*, and is faſtened to the end of the trough under it, and a ſimilar thread is faſtened in like manner to the cylinder *o*, and end of the trough under the ſmall pulley *t*. Now it is eaſy to conceive, that when the veſſel, A B, is filled to nearly the head of the tantalus *l*, the bore of which is larger than of the feeding ſyphon J, the water will be diſcharged into the cylindrical vaſe *n*, which conſequently will preponderate, and by means of the ſilken chord elevate the end of the trough higher than the horizontal line, and make its oppoſite end under the ſmall pulley, *t*, to be depreſſed, which will therefore conduct the water into the other long veſſel C D; during this action the counterpoiſe, F, riſes, and its pulley *f*, produces no effect on the ratchet by reaſon of the click, *h*, ſliding over the ſloping ſides of its teeth, but the counterpoiſe, G, falls, and the click of its pulley (not ſeen) puſhes the ſecond ratchet forwards in the direction of the figures of the face i [illegible] &c.

When C D is nearly full, the long ſyphon, *m*, begins to diſcharge its water; makes the cylindrical vaſe, *o*, preponderate, and again elevates by means of its ſilken ſtring the end of the trough under the ſmall pulley *t*, and depreſſes the oppoſite end to fill the veſſel, A B, again, during which time the click, *h*, of the pulley, *f*, acts with its ratchet; and thus the alternate increaſe and decreaſe of the water in the two veſſels are continued without interruption, ſo long as the feeding ſyphon continues to ſupply a ſufficient quantity of pure water. We think, however, that the mechaniſm is nearly as complex as that of a clock itſelf, and conſequently ſhould prefer a water-clock, ſuch as that made by Perrault in the year 1699, where a pendulum is uſed as the regulator, and water only as the firſt mover. For the account, ſee "Machines Approuvées," tome i. p. 39.

The ſame Perrault alſo made a water-clock with a balance and ſtriking part, an account of which is given in the volume of "Machines Approuvées," which we have juſt referred to; and in the ſeventh volume of the ſame work, is a deſcription of a regulator going by water, invented by Peronnier, and improved by Le Roy, the ſon, in 1746. (See page [illegible].)

Clepsydra is alſo uſed for an hour-glaſs of ſand.

Clepsydra is alſo applied to a chemical veſſel perforated in the ſame manner.

CLERAC, in *Geography*. See Clairac.

CLERC, John Le, in *Biography*, an eminent ſcholar and critic, was born at Geneva in the month of March 1657. He was placed at a grammar ſchool when only eight years old, and ſoon diſtinguiſhed himſelf by his abilities and by his cloſe application to his ſtudies; he attracted particular notice by the ſtrength of his memory, and his great facility in Latin poetical compoſition. His talent for poetry he did not however cultivate much beyond the compoſition of ſchool exerciſes. He devoted while young a very large ſhare of attention to the principal writers of Greece and Rome, which he read with much care and critical obſervation. When ſixteen years old he ſtudied philoſophy, natural and moral, under Chouet, who was profeſſor of philoſophy at Geneva, and taught the ſyſtem of Des Cartes. After remaining under the tuition of this maſter for two years he devoted a year to the ſtudy of the Hebrew language, under the inſtruction of the reverend James Gallatin, his maternal uncle. His fondneſs for books kept pace with his improving capacity for reading them with advantage; and he ſeldom ſuffered any to eſcape peruſal that promiſed to repay his time and labour. His diligence and aſſiduity in this particular, at this period, prepared the way for that laborious application and various and extenſive reading which afterwards ſo remarkably diſtinguiſhed him in the annals of literature. At the age of nineteen he entered on a courſe of theological ſtudies, which he continued for two years, under Meſtrezat, Turretin, and Tronchin. He read much on the controverſies then agitated in that part of Europe, and carefully ſtudied the ſcriptures in the original languages, with the aſſiſtance of the beſt commentators then extant, among whom Grotius held a pre-eminent rank. Having loſt his father in 1676 he became deſirous of viſiting France, and accordingly in 1678 he went to Grenoble and there undertook the education of a ſon of M. Saraſin de la Pierre. Here he became acquainted with father Lamy the learned author of the "Apparatus Rituus," and other works of erudition, who was prieſt of the oratory. By the end of the year he returned to Geneva, where he was ordained, after having paſſed the cuſtomary examinations with great applauſe. Not having attached himſelf to any church, he availed himſelf of his liberty to reviſit Grenoble, and thence in 1680 went to Saumur. The works of Curcellæus having been

been read by him during his first residence at Grenoble, he now availed himself of an opportunity to peruse attentively the writings of Episcopius, which confirmed him in a theological system very different from that imposed upon the belief of candidates for the ministry in his native country. He here read also the Old Testament in the Polyglot Bible, making copious notes as he proceeded, which laid the foundation of the biblical annotations which he afterwards prosecuted with so much success. The change in his sentiments having determined him to quit Geneva altogether, he returned in the autumn of 1681 from Saumur to Grenoble; the following year visited Paris, and thence proceeded to London, where he arrived in the spring of 1682. One object he had in view in visiting England was to acquire a sufficient knowledge of the language to introduce him to an acquaintance with the literature of the country, which, with his usual facility, he soon accomplished. During his residence in London he preached frequently at the Walloon church, in French, and for six months regularly served the Savoy on Sundays. As the climate of England disagreed with his constitution, he passed over to Holland in 1683 with the celebrated apostate Italian monk Gregorio Leti, whose daughter he afterwards married. He took an early opportunity to pay his respects to Limborch at Amsterdam, who gave him the information he sought respecting the principles and the condition of the Remonstrants, with whom he was greatly disposed to unite. Overcome by the importunities of his family he once more visited Geneva, but on account of his religious opinions, and the freedom with which he avowed and defended them, he returned again in the course of the same year. He now resolved to make Holland his permanent residence, and associated with the Remonstrants, occasionally officiating at their churches; but his popularity exciting the jealousy of some of the Walloon ministers, they procured an order from the magistrates to forbid him any more to preach. In the following year, however, 1684, he preached before a synod of the Remonstrants at Rotterdam, and was by them appointed professor of Hebrew, Belles Lettres, and Philosophy to their college at Amsterdam, a situation which he continued to fill until incapacitated for the discharge of its arduous duties by the malady which led to his dissolution. In 1691 he married the daughter of Gregorio Leti, as noticed above, by whom he had four children, who all died in infancy. The subsequent years of his life exhibit a wonderful picture of laborious application and unabating industry, devoted to literary pursuits, which is abundantly exemplified in the number of his publications, and the depth and variety of erudition displayed in them. We shall subjoin a brief account of such of them as are most entitled to notice. His first publication appeared anonymously at Saumur in 1679, under the title of "Liberii de Sancto Amore Epistolæ Theologicæ," in which he advocated the cause of religious toleration and freedom of inquiry, and maintained some opinions respecting the doctrine of the Trinity, and other articles of faith, which must have been deemed highly heretical by the majority of divines in that age. In 1685 he published his "Sentimens de quelques Theologiens de Hollande sur l'Histoire critique du Vieux Testament, composée par M. Rich. Simon." In this work Le Clerc delivers some very free thoughts respecting the scriptures, avowing his opinion that the Pentateuch was not written by Moses, but compiled from a variety of more ancient writings, and combating the commonly received notion of the inspiration of the sacred writers as unfounded and erroneous. The freedom of his remarks having excited much prejudice against him, and given rise to misrepresentation, he published a defence of it in 1686, in which he explains himself and states his sentiments in the most clear and explicit language. This year formed a remarkable æra in his life by the commencement of his "Bibliothéques," a series of papers comprising critical analyses and reviews of the most remarkable publications of the time, interspersed with a variety of original essays and disquisitions on such topics as excited the chief attention of literary men. The first which appeared was the "Bibliothéque Universelle et Historique." It was continued to the year 1693, and completed in 26 small volumes closely printed. In this work Le Clerc was considerably indebted to the labours of M. de la Crose, and M. Bernard, who supplied him with a considerable proportion of the papers. "Le Bibliothéque Choisie" followed in 1703, and was published at intervals until the year 1713, when it was concluded in 28 volumes, corresponding in size to the former work. To this succeeded "Bibliothéque Ancienne et Moderne," which was published from 1714 to 1727 in 29 similar volumes. These works contain a great mass of very valuable materials, of critical disquisitions and bibliographical notices and memoirs, and well deserve a place in the library of every literary man. The public are indebted to them for the documents from which Dr. Jortin principally composed his life of Erasmus. In 1690 Le Clerc published a letter to Mr. Jurieu on his treatment of Episcopius in his "Picture of Socinianism," which is a species of apology for that learned divine. Two years afterwards he published his "Logica, seu Ars Ratiocinandi" and his "Ontologia et Pneumatologia"; to these he added in 1695 his "Natural Philosophy," when he published them in an uniform edition in four volumes octavo under the general title of "Opera Philosophica." This publication has been well received, and gone through five editions. In 1693 appeared his version of the book of Genesis with critical notes, which was followed in 1696 by the other books of the Pentateuch. These were afterwards enlarged by additional notes, and in the year 1735 reached a fourth edition in folio. His "Ars Critica," first appeared in 1697, in 3 volumes 12mo. and was reprinted in the same form in 1712, and 1730. This is a most useful and valuable publication to all who wish to study ancient writings with critical accuracy and profit. He published in 1695, and again in 1714 "La Vie de Cardinal du Richelieu;" and in 1696 an excellent work in octavo under the title of "Traité de l'Incredulité," designed chiefly to expose the folly of infidelity; it was reprinted in 1714. In 1698 he printed a compendium of Universal History in Latin, in one volume octavo; the same year produced his valuable translation into Latin of the New Testament, with Hammond's Annotations, in two volumes in folio. He enriched his edition with a great number of additional critical and explanatory notes. "Parrhasiana," ou Pensées diverses sur de Matieres de Critique, d'Histoire, de Morale, et de Politique," appeared anonymously in one volume in 1699, and again in two volumes in 1702. Although interspersed with many good remarks, this has been regarded as a very hasty and incorrect performance. In 1699 he published also his "Harmonia Evangelica," in Greek and Latin, with several notes and dissertations, which drew upon him the charge of favouring the opinions of Socinus. This was followed in 1703 by a translation of the New Testament into French, in two volumes 4to. with notes, which again exposed him to the attacks of the Catholic and Calvinistic clergy. In 1708 he proceeded with his Latin version of the Old Testament, and printed the Historical Books from Joshua to Esther. "Historia Literaria II. primorum a Christo sæculorum," published in 4to. 1716, and "Histoire de Provinces Unies des Pays Bas," in three volumes in folio,

from

from 1560 to 1728, the firſt volume of which appeared in 1723, and the others in 1728, are the laſt we ſhall mention of the original works of Le Clerc. But beſides his own writings, he publiſhed ſeveral other works in the capacity of editor, many of them of conſiderable ſize and extent. Among the principal of them may be mentioned Cotelerius's "Patres Apoſtolici," two volumes folio; an edition of Moreri's Dictionary, in four volumes folio; the works of Eraſmus in 10 volumes folio, 1707; "Grotius de Veritate Relig. Chriſti," which he accompanied with ſome valuable notes; the fragments of Menander and Philemon, which had to ſubmit to the formidable ordeal of Bentley; "Livii Hiſt." in 10 volumes, in octavo, 1710; and "Æſchinis Dial. III." Gr. & Latin, 8vo. 1711. This catalogue might eaſily be ſwelled out to greater length; we ſhall, however, cloſe it here. The liſt we have given will be read with aſtoniſhment, as preſenting ſuch an example of literary induſtry as occurs hardly once in an age. Le Clerc continued this laborious courſe of writing, connected alſo with regular attention to the duties of his office as a tutor, until the year 1728, when a paralytic attack ſuſpended his purſuits, by materially impairing his intellectual powers. In 1732 a ſecond attack deprived him of ſpeech and reduced him to a ſtate little better than idiocy, in which he continued to the time of his death, which took place in 1736, in the 79th year of his age. Moreri. Gen. Dict. Gen. Biog.

Clerc, Gabriel, Le, phyſician in ordinary to Lewis XIV. and author of ſeveral eſteemed medical works, publiſhed in 1684, in 12mo., "L'Ecole du Chirurgien;" and, in 1694, "La Chirurgie complette," which was dedicated to M. Fagon. This has been many times reprinted, and is an excellent manual of the art. It contains, in the opinion of Boerhaave and Haller, the completeſt and moſt correct anatomy of the bones that had at that time been publiſhed. He alſo publiſhed, in 1700, "Appareil commode de jeunes Chirurgiens, Paris, avec Figures," 12mo.; and the following year, "Catalogue des Drogues," alſo 12mo. "La Medicine aiſee, contenant pluſieurs Remedes faciles et experimentes pour toutes Sortes de Maladies," 2 vols. 12mo. This has alſo been ſeveral times reprinted. Boerhaave Meth. Studii. Haller Bib. Med.

Clerc, Nicholas, phyſician to the duke of Orleans, which poſt he quitted, on being invited to take the place of inſpector of the hoſpital at Moſcow, where he reſided ſeveral years, and was in great eſtimation. In 1754 he was elected member of the Imperial Academy at Peterſburg, and about the ſame time honorary member of the Academy of Belles Lettres and Arts at Rouen. His works are "Medicus veri Amator ad Apollineæ Artis Alumnos," Moſchæ, 1764, 8vo.; containing a valuable collection of obſervations on epidemical diſeaſes, particularly on the epidemic that raged in the greater part of the Ruſſian empire in the year 1760. "Eſſai ſur les Maladies contagieuſes du Betail, avec les moyens de les prevenir, et d'y remedier efficacement," Paris, 1766, 12mo. The only efficacious remedy was found to be ſeparating and killing ſuch animals as were perceived to have taken the infection. "Hiſtoire Naturelle de l'Homme conſideré dans l'Etat de Maladie, ou la Medicine rapellée a ſa premiere Simplicité," Paris, 1767. His next and laſt work, on contagion, was printed, in 1771, at Peterſburg, ſoon after which he quitted Ruſſia, and retired to Beſançon, where he continued to the time of his death, which happened two or three years after. Eloy. Dict. Hiſt.

Clerc, John Le, a painter and engraver who was born at Nancy, in Lorraine, in 1587; he ſtudied, however, many years in Italy, under the tuition of Carlo Saraceno; and imitated the ſtyle of his maſter with wonderful addreſs.

He made ſeveral excellent etchings from the pictures of Saraceno, and other maſters; and died at the place of his nativity in the year 1633. Felibien. Strutt. Pilkington.

Clerc, Sebastien Le, an artiſt of very conſiderable reputation and ability; well known by the prodigious number of prints (chiefly of ſmall figures), which he etched from his own deſigns. He was born at Metz, in Lorraine, in the year 1637, and was probably of the ſame family with John Le Clerc; it is ſaid that he learned the firſt principles of drawing from his father. His firſt prints were executed entirely with the graver; the earlieſt, a head of Chriſt, is dated 1655. Upon his arrival at Paris, he was much encouraged by Le Brun, and ſometime afterwards obtained a penſion from the king, and an apartment in the Gobelins; in addition to which he received the honour of knigthood from pope Clement XI. He was a member of the Academy of Painters at Paris, and there died, at the age of 77, in the year 1714.

Le Clerc had great fertility of invention, and deſigned all kinds of ſubjects, whether of hiſtory, landſcape, or animals, with equal ſpirit and facility. His manner of etching is neat and at the ſame time free, and often bears great reſemblance to the ſtyle of Callot. The number of the plates which he executed is ſaid to exceed three thouſand. Charles Ant. de Jombert has publiſhed a catalogue of them, together with his life. Strutt. Heinecken.

Clerc, Sebastien Le, ſon of of the preceding artiſt, was born in the year 1677. He ſtudied hiſtorical painting under Bon Boulogne, and became a painter of ſome note, if we can judge from the number of prints engraved from his works. There is an altar picture by him at the abbey-church at Paris, repreſenting the death of Ananias. He was made a member of the Royal Academy of Paris, in 1704, and died, aged 86, in the year 1763.

Heinecken, in his Dictionary, mentions ſeveral other inferior artiſts of the name of Le Clerc. Heinecken. M. Papillon de la Ferté.

CLERCK, Charles, a learned man, and member of the Academy of Sciences, at Upſal, who publiſhed "Icones Inſectorum variorum, &c.". Holmiae, 1750, Gr. in 4to. with 55 plates. Not having been able to find a perſon who could colour theſe inſects to his ſatisfaction, he determined to undertake the laborious taſk himſelf; but he had ſcarcely coloured ten copies of his work when he died. Heinecken.

CLE'RES, in *Geography*, a town of France, in the department of the Lower Seine, and chief place of a canton, in the diſtrict of Rouen. The place contains 455, and the canton 11,123 inhabitants: the territory includes $167\frac{1}{2}$ kilimetres and 33 communes.

CLEREVAUX, a town of France, in the department of the Aveiron, and diſtrict of Rhodez, or Rodés, 8 miles N.W. of it.

CLERFF. See Clervaux.

CLERGOUX, a town of France, in the department of the Correze, and diſtrict of Tulles, 6 miles N.E. of it.

CLERGY, Clerus, the aſſembly or body of clerks, or eccleſiaſtics; in contradiſtinction to the laity. This diſtinction of the whole Chriſtian commonwealth into clergy and laity, which gradually became univerſal, took its riſe among thoſe paſtors, who, at an early period, took care to improve the reſpect of the lower ranks, by widening the diſtance between their own order and the condition of their Chriſtian brethren. Although it had been unknown among the Greeks and Romans, it was familiar to many nations of antiquity; and

and the prieſts of India, of Perſia, of Aſſyria, of Judæa, of Ethiopia, of Egypt, and of Gaul, derived, or profeſſed to derive from a celeſtial origin, the temporal power and poſſeſſions which they had acquired. In the Chriſtian world it originated from the circumſtance above mentioned, and ſeems to have kept pace with the progreſs of eccleſiaſtical authority. Some have thought that they can diſcover traces of this diſtinction in a very early age of the Chriſtian church, and that it is ſanctioned by the authority of ſcripture. Others conceive that it had its riſe at a later period, when the deſire of ſpiritual and ſecular pre-eminence and correſponding dominion had perverted the minds of the profeſſors and teachers of Chriſtianity, and when the intereſt of the church was interwoven with that of the ſtate. The terms expreſſing this diſtinction, are derived from two Greek words, κληρος, lot or inheritance, and λαος, people; and this diſtinction of *clerus* and *laicus*, it is ſaid, was eſtabliſhed before the time of Tertullian, towards the cloſe of the ſecond century. The diſtinction itſelf was intended, as ſome have ſaid, to ſuggeſt, that the former, that is, the paſtors or clergy, for they appropriated the term κληρος to themſelves, were ſelected and contradiſtinguiſhed from the multitude, as being, in the preſent world, by way of eminence, God's "peculium", or ſpecial inheritance. In ſupport of this claim they allege, that God is, in the Old Teſtament, ſaid to be the inheritance of the Levites, becauſe a determinate ſhare of the ſacrifices and offerings made to God, was in part to ſerve them inſtead of an eſtate in land, ſuch as was given to each of the other tribes. But it has been argued, on the other hand, that the tribe of Levi is no where called God's inheritance, though that expreſſion is repeatedly uſed, with reſpect to the whole nation. Concerning the whole nation of Iſrael, Moſes, who was himſelf a Levite, ſays, in an addreſs to God, (Deut. ix. 29.) "They are thy people, and thine inheritance, which thou broughteſt out by thy mighty power." The words in the Septuagint, deſerve our particular attention. Ουτοι λαος σου και κληρος σου ὃς εξηγαγες εκ γης Αιγυπτου εν τη ισχυι σου τη μεγαλη. The ſame perſons are, in the ſame ſentence, declared to be both the λαος and the κληρος. What, ſays the canoniſt, at once laymen and clergy? That is certainly abſurd; the characters are incompatible; yet it did not then appear ſo to Moſes. Nor would it be thought reaſonable or juſt, that what was allowed to be the privilege and the glory of every Iſraelite, under the more ſervile eſtabliſhment of Moſes, ſhould, under the more liberal diſpenſation of the goſpel, be diſclaimed by all thoſe diſciples of Jeſus, who have not been admitted into the ſacred order, which they, for this reaſon, have called clerical. As to the uſe of the term in the New Teſtament, one paſſage, as the perſons to whom we now refer argue, and only one, occurs, in which it is applied to perſons. (See 1 Peter, v. 3.) The words in the original are, μηδ' ὡς κυριευοντες των κληρων, αλλα τυποι γινομενοι του ποιμνιου; thus rendered in our verſion, "Neither as being lords over God's heritage, but being enſamples to the flock." They are part of a charge given to the preſbyters, or paſtors, relating to their care of the people committed to them, who are called God's flock, which they are commanded to feed, of which they are to take the overſight, not the maſtery, and to which they are to ſerve as patterns. The ſame perſons, therefore, who both in this and in the preceding verſe, are ſtyled ποιμνιον, the flock, under the direction of God's miniſters, the ſhepherds, are alſo called κληροι, his inheritance, over whom their paſtors are commanded not to domineer. The diſtinction above-mentioned, it is ſaid, ſtands in direct contradiction both to the letter and to the ſenſe of the unerring ſtandard of ſcripture. Some expoſitors, however, render the term κληροι, in this paſſage, the church's poſſeſſions; but this explication, as others ſay, ill ſuits the context, and annihilates the contraſt between an imperious manner and an engaging pattern, and ſuppoſes an awkward ellipſis in the words themſelves. Beſides, it is aſked, what were the church's poſſeſſions in thoſe days? Was ſhe ſo early veſted with lands and hereditaments, for it is to ſuch only that the term κληρος, when denoting property or poſſeſſion, is applied? Or, have thoſe interpreters been dreaming of the truly golden age of pope Gregory VII., when the patrimonies of ſome metropolitical and patriarchal ſees were indeed like dukedoms and principalities, and the grand hierarch himſelf could diſpoſe of kingdoms and empires? In the apoſtolic times, on the contrary, the church's patrimony conſiſted moſtly, as we may ſay, in perſecution and calumny, hatred and deriſion, agreeably to the prediction of our Lord. Some have aſcribed the origin of the diſtinction we are now conſidering, to Clemens Romanus, who, in his epiſtle to the Corinthians, contradiſtinguiſhes λαικοι (the laics), among the Jews, from the high-prieſt, the prieſts, and the Levites. This, however, is introduced by him when ſpeaking of the Jewiſh prieſthood, and not of the Chriſtian miniſtry; nor does it ſtand in oppoſition to any one general term, ſuch as κληρος, or κληρικοι; but after mentioning theſe different orders, he uſes the term λαικοι, to include, under one comprehenſive name, all that were not ſpecially compriſed under any of the former; and, in this reſpect, it exactly correſponds to the application ſometimes made of the Latin word "popularis." Accordingly it may, with equal propriety, be contraſted with men in office of any kind whatever. Thus, in ſpeaking of civil government, it may be oppoſed to αρχοντες, to denote the people as diſtinguiſhed from the magiſtrates; or, in ſpeaking of an army, to στρατηγοι, to denote the ſoldiers as diſtinguiſhed from the commanders or officers. It is further added, that the way in which Clement employs the term does not imply, that he conſidered it as in itſelf excluſive of the prieſthood and Levitical tribe, to which the term λαικοι is oppoſed in that paſſage. They are here indeed excluded, becauſe ſeparately named, but not from the import of the word. Thus in Acts xv. 32, three orders are plainly mentioned and diſtinguiſhed, apoſtles or extraordinary miniſters, elders or fixed paſtors, and the church or chriſtian people. Does this mode of expreſſion imply, that the name church does not properly comprehend the paſtors as well as the people. The import of the expreſſion ſeems to be no more than this. "The apoſtles and elders, with all the Chriſtian brethren, who come not under either of theſe denominations." Thus alſo, in the paſſage cited from the epiſtle of Peter, where the πρεσβυτεροι are oppoſed to the κληροι, not as though the former conſtituted no part of God's heritage, or in modern phraſe, the clergy; they only do not conſtitute that part, of which they are here commanded to take the charge. In like manner Clement's mention of λαικοι, after ſpeaking of the ſeveral orders of the Jewiſh prieſthood, imports neither more nor leſs than if he had ſaid, "And all the Jewiſh people."

The diſtinction of the whole church into clergy and laity, whenſoever it originated, was extended much farther than the original intention of thoſe who adopted it. In the time of Cyprian, about the middle of the third century, we find, that, in general, all things relating to the government and policy of the church were performed by the joint conſent and adminiſtration of the clergy and laity. Thus Cyprian ſays (Epiſt. 6. § 5. cited by the author of the Enquiry into the Conſtitution, &c. of the Primitive Church, p. 106.), "he did nothing without the knowledge and conſent of his people."

people." Again (Epist. 55. § 21.), "when any letters came from foreign churches, they were received and read before the whole church, and (Epist. 58. § 2.) the whole church agreed upon common letters to be sent to other churches." In later ages, after the church had been in some degree incorporated with the state, or an alliance had been formed between them, with a view to their mutual advantage and support, the distinction of clergy and laity became an object of much greater importance; and it has been said, that the former availed themselves of it, without always consulting the benefit of the latter. Instances to this purpose might easily be adduced from the church of Rome, in the period of its full splendour and power. The laity were not always treated with due attention and respect by those of the other denomination. The schoolmen, and they belonged to the clerical body, thought it was doing the laymen too much honour to derive the name from λαος, *populus*. It suited their notions better to deduce it from λααs, *lapis*, *a stone*. The following specimen of the mode of reasoning adopted by some celebrated doctors, and cited by Altensaig in his "Lexicon Theologicum," may possibly amuse some of our readers. "Capitur clericus pro viro docto, scientifico, perito, scientia pleno, repleto et experto. E contra, laicus capitur pro viro indocto, imperito, insipiente, et lapideo. Unde laicus dicetur a λααs Græcè, quod est lapis Latinè. Et sic omnis clericus, in quantum clericus, est laudabilis; laicus vero, in quantum laicus, est vituperandus. Clerici quoque a toto genere de jure proponuntur, et debent præponi laicis." Cardinal Bona also delivers his sentiments in relation to the care that ought to be taken by the clergy, that laymen may not be allowed to do themselves harm by studying the profounder parts of scripture, which their stupidity is utterly incapable of comprehending: and though he does not absolutely prohibit their reading some of the plainer books of scripture, he indulges them more freely in the use of books containing the histories, lives, and legends of the saints, and holy meditations. See on this subject Campbell's Ecclesiastical History, vol. i.

In more modern times, and more especially in countries where the reformation has contributed to enlighten the minds and to meliorate the dispositions both of the clergy and the laity, the distinction that still subsists, for the convenient arrangement and distribution of the people, is not likely to produce any of the disadvantages that resulted from it in the darker ages.

The clergy in the first century were distinguished by the title of presbyters or bishops; and some maintain that they are of equal rank and authority. But towards the close of the second century, a notion prevailing, that the ministers of the Christian church succeeded to the character, rights, and privileges of the Jewish priesthood, this produced a subordination of rank among them. The bishops assumed a rank and character similar to those of the Jewish high-priest, the presbyters represented the priests, and the deacons the Levites. This distinction was still farther promoted towards the end of the third century, and a new set of ecclesiastical officers was established, such as sub-deacons, acolythi, door-keepers, readers, exorcists, &c. The powers of the clergy were considerably extended under the patronage of Constantine the Great, about the close of the fourth century.

The clergy were anciently divided into three orders; *viz.* priests, deacons, and inferior clerks; and each order had its chief: the arch-priest was the head of the first order, the arch-deacon of the second, and the dean of the third.

Under the name of clergy, were also formerly comprised all the officers of justice; as being supposed to be men of letters.

In the Romish church there are two kinds of clergy; the one *regular*, comprehending all the religious of both sexes, as abbots, monks, priors, &c.; the other *secular*, comprehending all the ecclesiastics that do not make the monastic vows. Among the reformed, there are none but those of the latter. The Roman clergy forms a monarchical state, under the pope, as its supreme head.

In England, the term clergy comprehends all persons in holy orders, and also in ecclesiastical offices; *viz.* archbishops, bishops, deans and chapters, arch-deacons, rural deans, parsons, who are either rectors or vicars, and curates; to which number we may also add, parish clerks, who formerly frequently were, and still sometimes are, in orders. See each of the articles above enumerated.

This venerable body of men, being separated and set apart from the rest of the people, in order to attend the more closely to the service of Almighty God, have several privileges allowed them by our municipal laws, and those privileges were formerly much greater than they have been since the reformation, at which time they were abridged on account of the ill use which the popish clergy had endeavoured to make of them. For as the laws exempted them from almost every personal duty, they attempted to obtain for themselves a total exemption from every secular tie; and as it has happened in other cases, by extending their claims too far, they either lost or ceased to enjoy those liberties which of right belonged to them. The personal exemptions, however, for the most part are still continued. A clergyman cannot be compelled to serve on a jury, nor to appear at a court-leet or view of frank-pledge; which almost every other person is obliged to do. 2 Inst 4. But if a layman is summoned on a jury, and before the trial takes orders, he shall, notwithstanding, appear and be sworn. 4 Leon. Neither can he be chosen to any temporal office, as bailiff, reeve, constable, or the like, in regard of his own continual attendance on the sacred functions. Finch. L. 88. During his attendance on divine service, he is privileged from arrests in civil suits. Stat. 50 Edw. III. c. 5. 1 Ric. II. c. 26. In cases also of felony, a clerk in orders shall have the benefit of his clergy, without being branded in the hand; and may likewise have it more than once; in both which particulars he is distinguished from a layman. 2 Inst. 637. Stat. 4 Hen. VII. c. 13. and 1 Edw. VI. c. 12. As they have their peculiar privileges, they have also their disabilities, on account of their spiritual avocations. Clergymen, as some have maintained, are incapable of sitting in the House of Commons, (see PARLIAMENT); and by stat. 21 Hen. VIII. c. 13. they are not (in general) allowed to take any lands or tenements to farm, on pain of 10*l.* per month, and total avoidance of the lease; unless where they have not sufficient glebe; and the land is taken for the necessary expences of their household. Stat. §. 8.; nor, on the like penalty, are they allowed to keep any tan-house or brew-house; nor to engage in any manner of trade, nor to sell any merchandize, under forfeiture of the treble value, which prohibition is consonant to the canon law. By the statute called "Articuli Cleri," 9 Ed. II. st. 1. c. 3., if any person lay violent hands on a clerk, the amends for the peace broken (1) shall be before the king (that is by indictment), and the assailant may (2) also be sued before the bishop, that excommunication or bodily penance may be imposed; which if the offender will redeem by money, it may (3) be sued for before the bishop. See ARTICLES *of the Clergy* and BATTERY.

Though the clergy formerly claimed an exemption from all secular jurisdiction, yet Matt. Paris tells us, that William the Conqueror subjected the bishops and abbeys who held *per baronium*, and who, till then, had been exempt from all secular service; and ordered they should be no longer free

from

from military services. To this purpose he prescribed arbitrarily what number of soldiers every abbey and bishopric should provide, to serve him and his successors in time of war, and laid up the registers of ecclesiastical servitude in his treasury. But, in effect, the clergy were not exempt from all secular service till then; as being bound by the laws of king Edgar to obey the secular magistrate in some things; *viz.* upon an expedition to the wars, and in contributing to the building and repairing of bridges, &c. See TRINODA *necessitas.*

The privileges of the English clergy, confirmed to them by Magna Charta, and by the ancient statutes, are very considerable: their goods are to pay no toll in fairs or markets; they are exempt from all offices but their own; from the king's carriages, posts, &c. from appearing at sheriffs' tourns or frank-pledges; and are not to be fined or amerced, according to their spiritual, but their temporal means. A clergyman acknowledging a statute, his body is not to be imprisoned; if he be convicted of a crime for which the benefit of clergy is allowed, he shall not, as we have before observed, be burnt in the hand. See *Benefit of* CLERGY.

The clergy, by common law, are not to be burdened in the general charges with the laity; nor to be troubled or incumbered, unless expressly named, and charged by the statute; for general words do not affect them. Thus, if a hundred be sued for a robbery, the minister shall not contribute; though the words are *gentes demorantes:* neither are they assessed to the highway, to the watch, &c. But these privileges are in a great measure lost; the clergy being included under general words in later statutes: so that they are liable to all public charges imposed by act of parliament, where they are not particularly excepted. Besides the exemptions and privileges above stated, their bodies are not to be taken on statutes-merchant, or staple, &c.; for the writ to take the body of the conusor is "Si laicus sit;" and if the sheriff, or any other officer, arrest a clergyman upon any such process, it is said that an action of false imprisonment lies against him that does it; or the clergyman arrested may have a "superfedeas" out of Chancery. 2 Inst. 4. In action of trespass, account, &c. against a person in holy orders, wherein process of "capias" lies, if the sheriff return that the defendant is "Clericus beneficiatus nullum habens laicum feodum ubi summoneri potest:" in this case the plaintiff cannot have a "capias" to arrest his body; but a writ should be addressed to the bishop, compelling him to appear: nevertheless, when execution is obtained, a sequestration of the profits of his benefice may be had.

The revenues of the clergy were anciently more considerable than at present. Ethelwolph, in 855, gave them the tythe of all goods, and the tenth of all the lands in England; free from all secular services, taxes, &c. The charter whereby this was given them, was confirmed by several of his successors; Edmund, Edgar, Ethelred, Alfred, and William the Conqueror; the last of whom, finding the bishoprics so rich, erected them all into baronies; each barony containing thirteen knights' fees at least. But since the Reformation, the bishoprics are much impaired. See BISHOP.

The revenues of the inferior clergy, in the general, are small; a third part of the best benefices being anciently, by the pope's grant, appropriated to monasteries; upon the dissolution whereof they became lay-fees. Indeed, an addition was made, 2 Anne; the whole revenue of first-fruits and tenths being then granted, to raise a fund for the augmentation of the maintenance of the poor clergy: pursuant to which, a corporation was formed, by the name of governors of the bounty of queen Anne, for the augmentation of the maintenance of the poor clergy; to whom the said revenues were conveyed in trust, &c. See AUGMENTATION. For a statement of the number and revenues of the clergy of the established churches of England and Scotland; see CHURCH *of England*, and CHURCH *of Scotland.*

CLERGY, *articles of the.* See ARTICLES.

CLERGY, *proctors of the.* See PROCTORS.

CLERGY, *Privilegium Clericale,* or *Benefit of Clergy,* denotes an ancient privilege of the church, consisting in this, that places consecrated to religious duties were exempted from criminal arrests, whence proceeded sanctuaries; and that the persons of clergymen were exempted from criminal process before the secular judges in particular cases. This, at first, was an indulgence granted by the civil government, or Christian princes, from a pious regard to the church in its infant state; but as the clergy increased in wealth, power, honour, number, and interest, that which was first obtained by favour, was afterwards claimed as an inherent, indefeasible, and *jure divino* right: and the clergy endeavoured to extend the exemption not only to almost all kinds of crimes, but to a variety of persons, besides those who were properly of their own order. In England, though this privilege was allowed in some capital cases, it was not universally admitted. The method of granting it was settled in the reign of Henry VI. which required, that the prisoner should first be arraigned, and then claim his benefit of clergy, by way of declinatory plea, or, after conviction, by way of arrest of judgment; which latter mode is most usually practised. This privilege was originally confined to those who had the *habitum & tonsuram clericalem:* but in process of time every one was accounted a clerk, and admitted to this benefit, who could read, though neither initiated in holy orders, nor trimmed with the clerical tonsure; so that, after the invention of printing, and the dissemination of learning, this became a very comprehensive test, including laymen as well as divines; and, therefore, the stat. 4 Hen. VII. cap. 13, distinguishes between lay scholars, and clerks in holy orders; and directs that the former should not claim this privilege more than once, and, in order to their being afterwards known, that they should be burnt with a hot iron in the brawn of the left thumb. This distinction between learned laymen, and real clerks in orders, was abolished, for a time, by 28 Hen. VIII. cap. 1. and 32 Hen. VIII. cap. 3, but is held (Hob. 294. 2 Hal. P. C. 375.) to have been virtually restored by 1 Ed. VI. cap. 12, in consequence of which statute, peers of the realm, and lords of parliament, having place and voice in parliament, were entitled to the benefit of their peerage, equivalent to that of clergy, for the first offence, though they could not read, and for all offences then clergyable to commoners, and also for the crimes of house-breaking, highway robbery, horse-stealing, and robbing of churches. When those, admitted to the privilege of their clergy, the laity after burning, and before it, the real clergy, were thus discharged from the sentence of the law in the king's court, they were delivered over to the ordinary for canonical purgation. But this purgation having given occasion to a scandalous prostitution of oaths, and other abuses, it became necessary, when the reformation was thoroughly established, to abolish a ceremony so vain and impious. Accordingly, it was enacted by stat. 18 Eliz. cap. 7, that all such persons, instead of being committed to the ordinary, should be delivered out of prison, provided the judge does not think fit to continue them in goal for a limited time, not exceeding a year. Further alterations were made in the law respecting this privilege, by 21 Jac. I. cap. 6, which allowed, that women convicted

convicted of ſimple larcenies under the value of 10*s.* ſhould not properly have the benefit of clergy, for they were not called upon to read; but be burned in the hand, and whipped, ſtocked, or impriſoned for any time not exceeding a year. See Branding. And a ſimilar indulgence by 3 and 4 W. and M. cap. 9, and 4 and 5 W. and M. cap. 24, was extended to all women guilty of any clergyable felony; who were allowed once to claim the benefit of the *ſtatute*, in like manner as men might claim the benefit of *clergy*, and to be diſcharged upon being burned in the hand, and impriſoned for any time not exceeding a year. The puniſhment of burning in the hand being found ineffectual, was alſo changed by ſtatute 10 and 11 W. III. c. 23, into burning in the moſt viſible part of the left cheek, neareſt the noſe; but ſuch an indelible ſtigma being found by experience to render offenders deſperate, this proviſion was repealed about ſeven years afterwards, by ſtat. 5 Ann. c. 6.; and till that period, all women, all peers of parliament, and peereſſes, and all male commoners who could read, were diſcharged in all clergyable felonies; the males abſolutely, if clerks in orders; and other commoners, both male and female, upon branding, and peers and peereſſes without branding, for the firſt offence; all, however, except peers and peereſſes, liable to impriſonment, as before mentioned; and thoſe men who could not read, if under the degree of peerage, were hanged. By 5 Anne, cap. 6, the benefit of clergy was indiſcriminately granted to all who had a right to aſk it, without the condition of reading. It was further enacted by the ſame ſtatute, that when any perſon is convicted of any theft or larceny, and burned in the hand for the ſame, according to the ancient law, he ſhall alſo, at the diſcretion of the judge, be committed to the houſe of correction, or public workhouſe, to be there kept to hard labour for any time not leſs than ſix months, and not exceeding two years; with a power of inflicting a double confinement in caſe of the party's eſcape from the firſt. Again, by 4 Geo. I. cap. 11, and 6 Geo. I. cap. 23, it is enacted, that when any perſons ſhall be convicted of larceny, either grand or petit, or any felonious ſtealing or taking of money, or goods and chattels, either from the perſon or the houſe of another, or in any other manner, and who by the law ſhall be entitled to the benefit of clergy, and liable only to the penalties of branding or whipping, the court in their diſcretion may direct ſuch offenders, inſtead of burning or whipping, to be tranſported to America, (or, by ſtat. 19 Geo. III. c. 74, to any other parts beyond the ſeas), for ſeven years; and if they return within that time, it ſhall be felony without benefit of clergy. For other particulars, ſee Branding, and Transportation.

It appears, from the above account, that the perſons to whom this privilege now extends, are clerks in orders, without branding, and of courſe without any tranſportation, fine, or whipping; lords of parliament and peers of the realm, and alſo peereſſes, for the firſt offence; and all commoners, not in orders, whether male or female, for clergyable felonies, upon being burnt in the hand, whipped, or fined, or impriſoned, at the diſcretion of the judge, in the common gaol, the houſe of correction, one of the penitentiary houſes, or in the places of labour for the benefit of ſome navigation; and in caſe of larceny, on being tranſported for ſeven years, or ſuffering the puniſhment more lately ſubſtituted in the room of tranſportation.

It is a privilege peculiar only to the clergy, that ſentence of death can never be paſſed upon them for any number of man-ſlaughters, bigamies, ſimple larcenies, or other clergyable offences; but a layman, even a peer, may be ouſted of clergy, and will be ſubject to the judgment of death, upon a ſecond conviction of a clergyable offence. Thus, if a layman has been once convicted of man-ſlaughter, upon production of the conviction, he may ſuffer death for bigamy, or any other clergyable felony; which would not therefore be a capital crime to another perſon not ſo circumſtanced.

It hath been ſaid, that Jews, and other infidels and heretics, were not capable of the benefit of clergy, till after the ſtatute 5 Ann. c. 6., as being under a legal incapacity for orders. 2 Hal. P. C. 373. 2 Hawk. P. C. 33. §. 5. Forſt. 306. But judge Blackſtone much queſtions, whether this was ever ruled for law, ſince the re-introduction of the Jews into England, in the time of Oliver Cromwell. For, if that were the caſe, the Jews are ſtill in the ſame predicament, which every day's experience will contradict; the ſtatute of queen Anne having certainly made no alteration in this reſpect; it only diſpenſing with the neceſſity of reading in thoſe perſons, who, in caſe they could read, were before the act entitled to the benefit of their clergy.

A perſon, having once had benefit of clergy, ſhall not be ouſted of his clergy, by the bare mark in his hand, or by a parol averment, without the record teſtifying it, or a tranſcript thereof, according to the following ſtatutes: 2 H.H. 373. By ſtat. 34 and 35 Hen. VIII. cap. 14. the clerk of the crown, or of the peace, or of the aſſiſe, ſhall certify a tranſcript briefly of the tenor of the indictment, outlawry, or conviction, and attainder, into the King's Bench in 40 days; and the clerk of the crown, when the judges of aſſiſe, or juſtices of the peace, write to him for the names of ſuch perſons, ſhall certify the ſame, with the cauſes of the conviction or attainder. Another method is given by the ſtat. 3 W. and M. cap. 9. §. 7.; which enacts, that the clerk of the crown, clerk of the peace, or clerk of aſſiſe, where a perſon admitted to clergy under that act ſhall be convicted, ſhall at the requeſt of the proſecutor, or any other on the king's behalf, certify a tranſcript briefly and in few words, containing the effect and tenor of the indictment and conviction, of his having the benefit of clergy, and the addition of the party, and the certainty of the felony and conviction, to the judges where ſuch perſon ſhall be indicted for any ſubſequent offence. It ſeems alſo, that if the party deny that he is the ſame perſon, iſſue muſt be joined upon it, and it muſt be found upon trial that he is the ſame perſon, before he can be ouſted of clergy. 2 H. H. 373. Againſt the defendant's prayer of clergy, the proſecutor may file a "counter-plea;" alleging ſome fact, which in law deprives the defendant of the privilege he claims. It is a good counter-plea to the prayer of clergy, that the offender is not entitled to the benefit of the ſtatute, becauſe he was before convicted of an offence, and thereupon prayed the benefit of the ſtatute, which was allowed to him; alleging the truth of the fact and praying the judgment of the court, that he may die according to law; which fact is to be tried by the record in purſuance of the ſtatute 34 and 35 Hen. VIII. c. 14. Staunf. 135. Divers other counter-pleas, by which an offender may be deprived of clergy, may alſo be framed from a conſideration of the *perſons* to whom it is allowed or denied by the common law; and of the *circumſtances* under which that allowance or denial of it has been placed by divers ſtatutes. Ib. 138. The uſe of this counter-plea has, however, long become obſolete, and out of uſe. But the daring practices of ſome money-coiners occaſioned its revival; and in 1783, on occaſion of the conviction of money-coiners, a counter-plea of record was filed on the part of the proſecution; alleging that the convicts had been before allowed

lowed the benefit of the ſtatute, &c.; and they were thereby ouſted of their clergy. Leach's Hawk. P. C. ii. c. 33. §. 19. *n.*

The privilege of clergy was not indulged at the common law, either in high treaſon, or petit larceny, or in any mere miſdemeanors; and therefore it may be laid down as a rule, that it was allowable only in petit treaſon, and in capital felonies; which, for the moſt part, became legally entitled to this indulgence by the ſtatute "de clero," 25 Edw. III. ſt. 3. c. 4., which provides, that clerks convicted for treaſons or felonies, touching other perſons than the king himſelf or his royal majeſty, ſhall have the privilege of holy church. But it was not allowed in all felonies; in ſome of which it was denied even by the common law, *viz.* "inſidiatio viarum," or lying in wait for one on the high-way; "depopulatio agrorum," or deſtroying and ravaging a country (2 Hal. P. C. 333.); and "combuſtio domorum," or arſon, that is, the burning of houſes; all which are a kind of hoſtile acts, and in ſome degree border upon treaſon. Moreover, all theſe crimes, together with petit treaſon, and many other acts of felony, are ouſted of clergy by particular acts of parliament. All the ſtatutes for excluding clergy are merely the reſtoration of the law to the ſame rigour of capital puniſhment in the firſt offence, that was exerted before the "privilegium clericale" was at all indulged; and which it ſtill exerts upon a ſecond offence in almoſt all kinds of felonies, unleſs committed by clerks in actual orders. But ſo tender is the law of inflicting capital puniſhment in the firſt inſtance for any inferior felony, that notwithſtanding by the marine law, declared in ſtatute 28 Hen. VIII. c. 15. the benefit of clergy is not allowed in any caſe whatſoever; yet, when offences are committed within the admiralty-juriſdiction, which would be clergyable if committed by land, the conſtant courſe is to acquit and diſcharge the priſoner. Moor. 756. Foſt. 288. It is not neceſſary, that the ordinary ſhould demand the benefit of the clergy for a clerk; nor is there any neceſſity that the priſoner himſelf ſhould demand it, where it ſufficiently appears to the court, that he hath a right to it, in reſpect of his being in orders, &c. In which caſe, if the priſoner does not demand it, it is left to the diſcretion of the judge, either to allow, or not allow it to him. 2 Hawk. P. C. c. 33. §. 112. Clergy may be demanded after judgment given againſt a perſon, whether of death, &c. and even under the gallows, if a proper judge be there, who has power to allow it. 2 Hawk. P. C. c. 33. §. 111.

Upon the whole we may obſerve in relation to this ſubject: 1. That in all felonies, whether newly created or by common law, clergy is now allowable, unleſs taken away by expreſs words of an act of parliament. 2 Hal. P. C. 330. 2. That, where clergy is taken away from the principal, it is not of courſe taken away from the acceſſory, unleſs he be alſo particularly included in the words of the ſtatute. 2 Hawk. P. C. 342. 3. That, when the benefit of clergy is taken away from the *offence*, (as in caſe of murder, buggery, robbery, rape, and burglary), a principal in the ſecond degree, being preſent, aiding and abetting the crime, is as well excluded from his clergy as he that is principal in the firſt degree: but, 4. That, where it is only taken away from the *perſon committing* the offence, (as in the caſe of ſtabbing, or committing larceny in a dwelling-houſe, or privately from the perſon), his aiders and abettors are not excluded; through the tenderneſs of the law, which hath determined that ſuch ſtatutes ſhall be taken literally. 1 Hal. P.C. 529. Foſter, 356, 357.

As to the conſequences to the party of allowing him this benefit of clergy, they are ſuch as affect his preſent intereſt and future credit and capacity; as having been once a felon, but now purged from that guilt by the privilege of clergy; which operates as a kind of ſtatute-pardon. It may be obſerved, 1. That, by his conviction, he forfeits all his goods to the king; which, being once veſted in the crown, ſhall not afterwards be reſtored to the offender. 2 Hal. P. C. 388. 2. That, after conviction, and till he receives the judgment of the law, by branding or ſome of its ſubſtitutes, or elſe is pardoned by the king, he is to all intents and purpoſes a felon, and ſubject to all the diſabilities and other incidents of a felon. 3 P. Wms. 487. 3. That, after burning, or its ſubſtitute, or pardon, he is diſcharged for ever of that, and all other felonies before committed, within the benefit of clergy; but not of felonies from which ſuch benefit is excluded; and this by ſtatutes 8 Eliz. c. 4. and 18 Eliz. c. 7. 4. That by the burning, or its ſubſtitute, or the pardon of it, he is reſtored to all capacities and credits, and the poſſeſſion of his lands, as if he had never been convicted. 2 Hal. P. C. 389. 5 Rep. 110. 5. That what is ſaid with regard to the advantages of commoners and laymen, ſubſequent to the burning in the hand, is equally applicable to all peers and clergymen, although never branded at all, or ſubjected to other puniſhment in its ſtead. For they have the ſame privileges, without any burning or any ſubſtitute for it, which others are entitled to after it. 2 Hal. P.C. 389, 390. Blackſt. Comm. vol. iv.

Clergy, *Corporation of the Sons of the*, a benevolent inſtitution, which ſeems to have originated in the time of the Uſurpation, when a ſermon was preached at St. Paul's, Nov. 8, 1658, to the ſons of miniſters ſolemnly aſſembled; the deſign of which was to promote charitable contributions in favour of the ſons of the clergy. Whether or not ſermons of this kind were annual before the Reſtoration, we are not able to aſcertain; however, afterwards, a charter was granted, bearing date July 1, 1678, by which a body politic and corporate was conſtituted, under the name of "The Governors of the Charity for the Relief of the poor Widows and Children of Clergymen," with licence to poſſeſs any eſtate, not exceeding the yearly value of 2000 *l.* Upon the acceſſion of a gift by Dr. Thomas Turner, amounting to about 18,000 *l.* the governors obtained, Dec. 16, 1714, an augmentation of the ſaid grant, by a licence to poſſeſs the yearly value of 3000 *l.* over and above all charges and repriſes, as alſo over and above the ſaid 2000 *l. per annum.* To promote the uſeful and laudable purpoſe of this inſtitution, a ſermon was preached at the anniverſary meeting of the ſons of clergymen in the church of St. Mary le Bow, Nov. 7, 1678, by Dr. T. Sprat, afterwards biſhop of Rocheſter, in which it appears, that thoſe ſervices had been cuſtomary before they were encouraged by a royal eſtabliſhment. Theſe ſermons continued to be preached at Bow church till the year 1697, when Dr. George Stanhope preached his ſermon for the benefit of this charity at the cathedral church of St. Paul, at which time it is ſuppoſed the thought was firſt ſuggeſted of a grand muſical performance in aid of the charity. The annual feaſt of the ſons of the clergy appears to be prior to their incorporation; for in the London Gazette of Nov. 22, 1677, the annual feaſt of the ſons of the clergy was advertiſed to be held at Merchant Taylors Hall, on Thurſday the 29th of November following. Since the year 1697, there has been conſtantly an annual ſermon, and alſo a grand muſical ſervice at the cathedral church of St. Paul, for promoting the ends of this charity. The moſt eminent divines of the church have preached on theſe occaſions, and the muſical performance has acquired celebrity from the concurrence of eminent perſons of the profeſſion. For many years paſt it has been the practice of the ſtewards of the corporation, to have at St. Paul's on the Tueſday

 preceding

preceding the day of the sermon, what is called a rehearsal of the performance, and also a collection for the charity. The corporation is under the management of a president (the archbishop of Canterbury), a vice-president, three treasurers, and a numerous court of assistants.

The society for maintaining, educating, and apprenticing poor orphan children of clergymen, was instituted in 1749, and is under the direction of a president (bishop of London), a vice president, a treasurer, and secretary.

CLERI, in *Ancient Geography* a people of Asia Minor, in the Lesser Asia, mentioned by Diodorus Siculus.

CLERICAL *Crown*. See CROWN.

CLERICAL *Title*. See TITLE.

CLERICI, TOMMASO, in *Biography*, an historical painter of Genoa. He was born in 1637, and became the disciple of Francisco Merano, called il Paggio; and, though he died of the plague in the 21st year of his age, *anno* 1657, yet the progress he had made in the art was so great, that the four altar pictures remaining of his hand, in the church and sacristy of the Nunziata del Guastato, at Genoa, have at all times been much admired. One of these represents the three archangels, Michael, Gabriel, and Raphael; the second, the Virgin Mary, with the image of St. Dominick; the third, a martyrdom of saints; and the last, a number of Franciscan friars following Christ, who is bearing his cross. Soprani. Orlandi.

CLERICI *non eligantur in officio*. See QUOD *Clerici*.

CLERICIS *regis, non-residentia pro*. See NON-*residentia*.

CLERICO *admittendo*. See ADMITTENDO *Clerico*.

CLERICO *capto per statutum mercatorum*, is a writ for the delivery of a clerk out of prison, who is imprisoned upon the breach of a statute-merchant. Reg. Orig. 147.

CLERICO *convicto commisso gaolæ in defectu ordinarii deliberando*, is a writ for the delivery of a clerk to his ordinary, that was formerly convicted of felony; by reason his ordinary did not challenge him according to the privilege of clerks. Reg. Orig. 69.

CLERICO *intra sacros ordinis constituto non eligendo in officium*, is a writ directed to the bailiffs, &c. that have thrust a bailiwick or beadleship upon one in holy orders, charging them to release him. Reg. Orig. 143.

CLERIEUX, in *Geography*, a town of France, in the department of the Drome, and district of Valence, 5 miles N.W. of Romans.

CLERINCE, a town of Poland, in the palatinate of Braclaw; 44 miles S.S.W. of Braclaw.

CLERISSEAU, CHARLES LOUIS, in *Biography*, an artist who was born at Paris 1718, and is well known by his beautiful pictures in water colours, representing the ruins and picturesque views of Italy, where he long studied. He was, upon his return, made a member of the Royal Academy at Paris, and, some time after, he received a similar honour in England, the Royal Academy of London being just then instituted.

Several prints have been engraved from his works, and, amongst others, an excellent set of thirteen large views of ancient buildings, by Domenico Cunego of Rome. Heinecken.

CLERK, DANIEL LE, a celebrated physician, and learned writer on the history and practice of medicine, was born at Geneva, Feb. the 4th, 1652. He was the son of Stephen le Clerk, professor in the Greek language, and from him received the rudiments of his knowledge, as well as his taste for research into antiquity, by which he became in time so famous. Having completed his school education, he went, in succession to Montpellier, Paris, and Valence, where he took his degree of doctor in medicine, in 1672. He now returned to Geneva, and soon found himself in considerable practice, which he attended to with zeal, until the year 1704, when, being appointed one of the members of the council of state, he entirely renounced practice, that he might have leisure to fill the honourable post to which he had been raised, and to correct and complete the various works in which he had been engaged, and which had given him a distinguished rank among the principal literary characters of his age. He died June 8th, 1728, leaving two sons, James, who had been educated to medicine, and James Theodore, who was minister of the gospel, and professor of the Oriental Languages. He had published, in conjunction with James Mangets, "Biblioth. Anatomica," 2 vols. folio, in 1685; but the work for which he is principally celebrated, is his "Histoire de la Medicine, ou l'on voit l'Origine et le Progres de cette art de Siecle, en Siecle:" A work of immense erudition, in which are depicted the opinions, or theories of medicine, which have prevailed from the earliest period to the time of Galen. The first part, which brought the history of medicine only to the time of Hippocrates, was published in one volume, 8vo. 1696. Finding this approved, he produced the work completed in one volume, 4to. in 1702. This was reprinted in 1723; and again, with additions, and much improved, in 1729. To this edition he added a plan of a continuation of the history, to the middle of the 17th century, but which his age and avocations prevented his completing. Friend, who pays the author the highest compliments on the completion of the work, which it amply deserves, is very severe in his censure of this plan. But he would surely have spared his reproof, if he had attended to the apology made by the author, who was well acquainted with its defects. Friend wrote a continuation of the history, and in so excellent a manner, as to leave little reason to regret that it had not been finished by Le Clerk. "Historia naturalis et medica latorum Lumbricorum intra Hominem et Animalia nascentium," Genevæ, 1715, 4to. which contains all that is known on the subject of those pernicious reptiles. A little before he died, he translated, Senebier says, the first "Satyr of Persius" into the French language; but this has not been printed. Haller, Bib. Med. Senebier, Histoire Literaire de Geneve.

CLERK, CLERICUS, a word formerly used to signify a learned man, or man of letters. For the etymology of the term, see CLERGY.

Thus, Pasquier observes, the officers of the counts (*comites*) were anciently created under the title of *clerks of accompts*; and secretaries of state were called *clerks of the secrets*. So, *Clericus domini regis*, in the time of Edward I. was rendered in English, the *king's secretary*, or *clerk of his council*.

The term was applied indifferently to all who made any profession of learning, or who knew how to manage the pen; though, originally, it was appropriated to ecclesiastics.

As the nobility and gentry were usually brought up to the exercise of arms; there were none but the clergy left to cultivate the sciences; hence, as the clergy alone made any profession of letters, a very learned man came to be called a *great clerk*, and a stupid ignorant man, a *bad clerk*.

Ronsard, in his old language, uses the word femininely, *clergesse*, for a learned woman. "*Mais trop plus est à craindre une feme clergesse.*"

CLERK (in general), is used as synonymous with *clergyman* for all those of the ecclesiastical state, who are in holy orders, of any degree, or kind, from the deacon, to the prelate.

Yet, in its utmost latitude, the word clerk also includes

CHANTORS,

CHANTORS, ACOLYTHI, EXORCISTÆ, and OSTIARII. The word, however, has been anciently ufed for a fecular prieft, in oppofition to a religious or regular. Paroch. Antiq. 171. The canons excommunicate all thofe who lay hands on a clerk. A council held in Africa prohibited the appointing any clerk to be a tutor, guardian, or curator, by teftament. The council of Elvira enjoins continence on all clerks, bifhops, priefts, or deacons, on pain of being ftripped of their clericature.

CLERK, *acephalous*, in the fixth century, was a name given to thofe clerks who feparated from the bifhop, and chofe not to live any longer in community with him; in contradiftinction to

CLERKS, *canonic*, who continue to live with the bifhop, according to the canons.

CLERK, in the way of trade and bufinefs, is one who exercifes any function with the pen.

The Clergy, in the early ages, engroffed almoft every kind of learning to themfelves; and they were peculiarly remarkable for their proficiency in the ftudy of the law. Thus William of Malmfbury characterifes them foon after the conqueft, "Nullus clericus nifi caufidicus." The judges, therefore, were ufually created out of the facred order; and all the inferior offices were fupplied by the lower clergy, which has occafioned their fucceffors to be denominated clerks to this day. Accordingly, this title is given to feveral officers of this kind in the royal palace, the courts of juftice, revenue, army, navy, &c. The principal of thefe are as follow:

CLERK *of the Acts*, is an officer of the navy, who receives and enters the commiffions, contracts, warrants, &c. of the lord high admiral; and regifters the acts and ordinances of the lords commiffioners of the admiralty, and commiffioners of the navy. Stat. 22 & 23 Car. II. c. 11.

CLERK *of Affidavits*, in the court of chancery, an offirec who files all affidavits made ufe of in court.

CLERK *of Affife*, is he that writeth all things judicially done by the juftices of affife, in their circuits.

This office is affociated to the judge in commiffions of affife, to take affifes, &c. He fhall not be counfel with any perfon in the circuit. Stat. 33 Hen. VIII. c. 24. § 5. He certifies the names of felons convict. See *Benefit of* CLERGY. He is punifhable for concealing, &c. any indictment, recognizance, fine, or forfeiture. See ftat. 22 & 23 Car. II. c. 22. § 9. 3 Geo. I. c. 15. §. 12. He is to take only 2*s*. for drawing an indictment, and nothing if defective. 10 & 11 W. III. c. 23. §. 7, 8. The clerk of affife is fineable for falfely recording appearances of perfons returned on a jury. 3 Geo. II. c. 25. §. 3.

CLERK of *the Bails*. See BAILS. *clerk of the*.

CLERK of *the Check* or *Cheque*. See CHECK.

CLERK *of the Clofet*, is a divine, otherwife called *confeffor to his Majefty*; whofe office is to attend at the king's right hand during divine fervice, to refolve all doubts concerning fpiritual matters, to wait on the king in his private oratory, &c.

CLERK *controller of the king's houfe*, an officer in the king's court, that hath authority to allow or difallow charges and demands of purfuivants, meffengers of the green-cloth, &c. He hath likewife the overfight of all defects and mifcarriages of any of the inferior officers; and he hath a right to fit in the counting-houfe with the fuperior officers, *viz*. the lord-fteward, treafurer, controller, and cofferer of the houfhold, for correcting any diforders. There are two officers of this kind. See ftat. 33 Hen. VIII. c. 12.

CLERK *of the Crown*, in the king's bench court, an officer whofe bufinefs is to frame, read, and record all indictments againft traitors, felons, and other offenders there arraigned or indicted of any public crime.

When divers perfons are jointly indicted, the clerk of the crown fhall take for them all but one fee, *viz* 2*s*. Stat. 2 Hen. IV. c. 10. He is otherwife denominated *clerk of the crown-office*, and exhibits informations, by order of the court, for divers offences. See INFORMATION.

CLERK *of the Crown*, in chancery, is an officer, who, by himfelf, or deputy, is continually to attend the lord-chancellor, or lord-keeper, to write or propofe fpecial matters of ftate by commiffion, or the like, either immediately from his majefty's orders, or by order of his council; as well ordinary as extraordinary, *viz*. commiffions of lieutenancy, of juftices of affife, oyer and terminer, gaol-delivery, and of the peace, with their writs of affociation, &c. All general pardons, upon grants of them at the king's coronation, or in parliament, where he fits in the lords' houfe in parliament time; the writs of parliament, with the names of the knights, citizens, and burgeffes, are alfo returned into his office, and filed; befides which, he has the making of fpecial pardons, and writs of execution upon bonds of ftatute ftaple forfeited, which was annexed to this office in the reign of queen Mary, in confideration of his chargeable attendance.

CLERK *of the Declarations*, an officer in the court of king's bench, that files all declarations in caufes there depending, after they are engroffed, &c.

CLERK *of the Deliveries*, is an officer in the Tower of London, who takes indentures for all ftores iffued thence.

CLERK *of the Errors*, in the court of common pleas, tranfcribes, and certifies into the king's bench, the tenor of the records of the caufe, or action, upon which the writ of error, made by the curfitor, is brought there, to be heard and determined.

CLERK *of the Errors*, in the king's bench, tranfcribes and certifies the records of fuch caufes in that court into the exchequer; if the caufe, or action, is by bill: if by original, the lord chief juftice certifies the record into the houfe of peers in parliament, by taking the tranfcript from the clerk of errors, and delivering it to the lord chancellor, there to be determined, according to the ftats. 27 Eliz. c. 8. and 31 Eliz. c. 1.

CLERK *of the Errors*, in the exchequer, tranfcribes the records certified thither out of the king's bench; and prepares them for judgment in the court of exchequer, to be given by the juftices of the common-pleas, and barons, there. Stats. 16 Car. II. c. 2. 20 Car. II. c. 4.

CLERK *of the Effoins*, in the court of common pleas, keeps the effoin-rolls, or enters effoins. He alfo provides parchment, cuts it into rolls, marks the number on them; delivers out all the rolls to every officer, and receives them again when written, binds and makes up the bundles of every term, which he does as fervant of the chief juftice. The chief juftice of C. B. is at the charge of the parchment of all the rolls, for which he is allowed: as is alfo the chief juftice of B. R. befides the penny for the feal of every writ of privilege and outlawry, the feventh penny taken for the feal of every writ in court under the green wax, or petit feal: the faid lord chief juftices having annexed to their offices or places the cuftody of the faid feals belonging to each court. See ESSOIN.

CLERK *of the Eftreats*, belongs to the exchequer; and, every term, receives the eftreats out of the lord-treafurer's remembrancer's office, and writeth them out to be levied for the king. He alfo maketh fchedules of fuch fums eftreated as are to be difcharged. See ESTREAT.

CLERKS *of the Green Cloth*. See GREEN-CLOTH.

CLERK *of the Hamper*, or *Hanaper*, is an officer in chancery,

cery, whose business is to receive all money due to the king for the seals of charters, patents, commissions, and writs: as also fees due to the officers for inrolling and examining the same. He is obliged to attend on the lord-chancellor, or lord-keeper, daily, in term-time; and at all times of sealing; having with him leather bags, wherein are put all charters, &c. After they are sealed, those bags, being sealed with the lord-chancellor's private seal, are delivered to the controller of the hanaper, who, upon receipt of them, enters the effect of them in a book, &c. This hanaper represents what the Romans called "fiscum," which contained the emperor's treasure; and the exchequer was anciently so called, because "in eo reconderentur hanapi et scutræ cæteraque vasa quæ in censum et tributum persolvi solebant;" or perhaps, because the yearly tribute which princes received was in hampers or large vessels full of money. There being an arrear of 10,590*l.* 12*s.* 11*d.* of several ancient fees and salaries, &c. payable out of this office: and there being a remainder of 13,698*l.* 1*s.* 11*d.* of the six-penny stamp duty on writs granted for the relief of the suitors of the court of chancery; it was enacted by the stat. 23 Geo. II. c. 25. that thereout the 10,590*l.* 12*s.* 11*d.* should be paid to the creditors of this office:—that the said duty should be made perpetual; and out of it 3000*l.* *per annum* should be paid to the "clerk of the hanaper:"—that the residue of the 13,698*l.* 1*s.* 11*d.* should be laid out in government securities, and the interest paid to the "clerk of the hanaper," who should pay 1,200*l.* to the master of the rolls:—and that in case the revenue of this office so augmented, should be more than sufficient to pay all fees, salaries, &c. the clerk should account for the surplus.

CLERK *of the Inrollments of Fines and Recoveries*, in the court of common pleas, is an officer under the three elder judges of that court, and removeable at their pleasure, who inrols and exemplifies all fines and recoveries, and returns writs of entry, &c. See INROLLMENT.

CLERK *of the Juries*, is an officer belonging to the court of common-pleas, who makes out the writs called *habeas corpus*, and *distringas*, for the appearance of juries, either in that court or at the assises; after the panel is returned upon the *venire facias*. He also enters into the rolls the awarding of these writs; and makes all the continuances, from the going out of the *habeas corpora* until the verdict is given. See JURY.

CLERK *of the Market*, is an officer of the king's house, whose duty is to take charge of the king's measures; and to keep standards of them, that is, examples of all the measures that ought to be used through the land; as of ells, yards, quarts, gallons, &c.; and of weights, bushels, &c.; and to see that all weights and measures in every place be answerable to the said standard. With regard to this officer's duty there are divers statutes, as 13 Ric. II. cap. 4, and 16 Ric. II. cap. 3, by which every clerk of the market is to have weights and measures with him when he makes assay of weights, &c. marked according to the standard; and to seal weights and measures, under penalties. The stat. 16 Car. I. c. 19, enacts, that clerks of the market of the king's or prince's household shall only execute their offices within the verge; and head-officers are to act in corporations, &c. The clerks of markets have generally power to hold a court, for which purpose they may issue out process to sheriffs and bailiffs to bring a jury before them; and give a charge, take presentments of such as keep or use false weights and measures; and may set a fine upon the offenders, &c. 4 Inst. 274. But if they take any other fee or reward than what is allowed by statute, &c. or impose any fines without legal trial; or otherwise misdemean themselves; they shall forfeit 5*l.* for the first offence; 10*l.* for the second; and 20*l.* for the third offence; on conviction before a justice of peace, &c. The "Court of the clerk of the market" is incident to every fair and market in the kingdom, to punish misdemeanours therein; as a court of "pie-powdre" is to determine all disputes relating to private or civil property. It is the most inferior court of criminal jurisdiction in the kingdom. Blackst. Com. vol. iv. See stats. 22 Car. II. c. 8. 23 Car. II. c. 12, and WEIGHTS and MEASURES.

CLERK *Marshal* of the king's house, seems to be an officer who attends the marshal in his court, and records all his proceedings. See MARSHAL.

CLERK *of the Nichils*, or *Nihils*, is an officer in the exchequer, who makes a roll of all such sums as are *nihilled* by the sheriffs upon their estreats of green-wax; and delivers the same into the lord treasurer's remembrancer's office, to have execution done upon them for the king. Stat. 5 Ric. II. c. 13. See NIHIL.

CLERK *of the Ordnance*, is an officer in the Tower, who registers all orders relating to the king's ordnance. See ORDNANCE.

CLERK *of the Outlawries*, is an officer belonging to the court of common-pleas; being a deputy to the king's attorney-general, for making out the writs of *capias utlagatum*, after outlawry; and the king's attorney's name is to every one of those writs.

CLERK *of the Paper-Office*, is an officer of the king's bench, who makes up the paper-books of special pleadings and demurrers in that court.

CLERK *of the Papers*, an officer in the court of common-pleas, who keeps the papers of the warden of the Fleet, enters commitments and discharges of prisoners, delivers out day-rules, &c.

CLERK *of the Parcels*, an officer of the exchequer. See PARCEL-*Makers*.

CLERK *of a Parish*. See PARISH *Clerk*.

CLERK *of the Parliament Rolls*, is an officer who records all things done in parliament; and engrosses them fairly into parchment rolls for the better preservation of them to posterity. Of these there are two; one of the house of lords, and the other of the house of commons.

CLERK *of the Patents*, or letters patent under the great seal; an office created 18 Jac. I. See PATENT.

CLERK *of the Peace*, is an officer belonging to the session of the peace, whose duty is at the session to read the indictments, to inrol the acts, and draw the processes; to inrol proclamations of rates for servants' wages; to inrol the discharge of apprentices; to keep the counterpart of the indenture of armour, to preserve the register-book of licences given to badgers of corn, of persons licensed to kill game, to register the estates of papists and of others not taking the oaths, &c. He also certifies into the king's bench transcripts of indictments, outlawries, attainders, and convictions, had before the justices of the peace within the time limited by statute. He is appointed by the *custos rotulorum* of the county, and liable to be discharged for misdemeanour by the justices of peace in quarter-sessions. See stats. 37 Hen. VIII. c. 1. 1 W. & M. c. 21. The following is the form of the oath prescribed by the latter statute, to be taken by the clerk of the peace, in open sessions, before he enters on his office:

"I C. P. do swear, that I have not (paid) nor will pay any sum or sums of money, or other reward whatsoever, nor given any bond or other assurance to pay any money, fee, or profit, directly or indirectly, to any person or persons whomsoever for (my) nomination or appointment.

So help me God."

He

He is also to take the oaths of allegiance, supremacy, and abjuration, and perform such requisites as other persons who qualify for offices. By stat. 22 Geo. II. c. 46. § 14, No clerk of the peace, or his deputy, shall act as solicitor, attorney, or agent at the sessions where he acts as clerk or deputy, on penalty of 50*l.* with treble costs. If the justices of the peace should discharge this officer for misconduct, the custos rotulorum is to chuse another, resident in the county, or on his default the sessions may appoint one:—the place is not to be sold, on pain of forfeiting double the value of the sum given by each party, and disability to enjoy their respective offices, &c. Stat. 1 W. & M. Sess. 1. c. 21.

Clerk *of the Pells*, belongs to the exchequer; his business is, to enter every teller's bill into a parchment roll, called *pellis receptorum;* and also to make another roll of payments, called *pellis exituum*, wherein he sets down by what warrant the money was paid. 22 and 33 Car. II. c. 22. This officer is appointed for life, by a constitution under the hands and seals of the commissioners of the Treasury, to exercise his office either by himself or his deputy. In consequence of this privilege, it has not been usual, for many years, for the clerk of the pells to execute any part of the business himself; the deputy transacts the whole, and receives and accounts with his principal for all the profits that belong to him.

Clerk *of the Petty Bag*, is an officer in chancery, whereof there are three; the master of the rolls being the chief. Their office is to record the return of all inquisitions out of every county, all liveries granted in the court of wards, all oster les mains; to make all patents of customers, gaugers, comptrollers, and aulnagers; congé d'elires for the creations of bishops; summonses of the nobility and burgesses to parliament; commissions directed to the knights and others, of every shire, for assessing of subsidies and taxes; writs for nomination of collectors for the fifteenths; and all traverses upon any office, bill, or otherwise; and to receive the money due to the king for the same. See Petty-*Bag*.

Clerk *of the Pipe*, an officer in the exchequer, who having the accounts of debts due to the king, delivered and drawn out of the remembrancer's offices, charges them down in the great roll, and is called "Clerk of the Pipe," from the shape of that roll, which is put together like a pipe; he also writes out warrants to the sheriffs to levy the said debts upon the goods and chattels of the debtors; and if they have no goods, then he draws them down to the lord treasurer's remembrancer, to write estreats against their lands The ancient revenue of the crown stands in charge to him, and he sees the same answered by the farmers and sheriffs; he makes a charge to all sheriffs of their summons of the pipe, and green wax, and takes care it be answered in their accounts. He hath also the drawing and engrossing of all leases of the king's lands; having a secondary and several clerks under him. In the reign of king Hen. VI. this officer was called "Ingrossator magni rotuli." See stat. 33 Hen. VIII. c. 22. See Pipe-*Office*.

Clerk *of the Pleas*, is an officer in the exchequer, in whose office the officers of the court, upon special privilege belonging to them, ought to sue, and be sued, in any action.

The clerk of the pleas has under him many clerks, who are attornies in all suits commenced or depending in the court of exchequer.

Clerks *of the Privy-seal*, are four officers who attend the lord-keeper of the privy-seal, or, if there be none such, the principal secretary of state; and write, or make out, all things sent by warrant from the signet to the privy-seal, and to be passed to the great seal; as also to make out privy-seals upon any special occasion of the king's affairs; as for loan of money or the like.

He that is now called "Lord Privy-Seal," seems to have been in ancient times called "Clerk of the Privy-Seal," and yet to have been reckoned in the number of the great officers of the realm. Stats. 12 R. II. c. 11. 27 Hen. VIII. c. 11.

Clerk *of the Remembrance*, an officer in the exchequer, who is to sit against the clerk of the pipe, to see the discharges made in the pipe, &c. Stat. 37 Ed. III. c. 4. The clerk of the pipe and remembrancer shall be sworn to make a schedule of persons discharged in their offices. Stat. 5 Ric. II. st. 1. c. 15.

Clerk *of the Rolls*, in chancery, an officer who searches for, and copies deeds, offices, &c.

Clerk *of the Rules*, in the court of king's bench, an officer who draws up and enters all the rules and orders made in court, and gives rules of course in divers writs. This officer is mentioned in stat. 22 and 23 Car. II. c. 22.

Clerk *of the Sewers*, is an officer belonging to the commissioners of the sewers, who writes down all things they do by virtue of their commission, and the authority given them by 13 El. cap. 9. See Sewers.

Clerk *of a ship*, is an officer appointed to take care that nothing be squandered or spent needlessly.

He is obliged to keep a register, or journal, containing an exact inventory of every thing in the loading of the vessel; as the rigging, apparel, arms, provisions, ammunition, merchandizes; as also the names of the passengers, if there be any; the freight agreed on; a list of the crew, their age, quality, wages; the bargains, purchases, sales, or exchanges the ship makes from its departure; the consumption of provision; and, in short, every thing relating to the expence of the voyage. He also registers the consultations of the captains, pilots, &c. He also does the office of a register in all criminal processes; and of a notary, to make and keep the wills of those who die in the voyage; takes inventories of their effects, &c. The clerk is not allowed to quit the vessel during the voyage, on forfeiture of all his wages, &c. In small vessels, the master, or pilot, does the office of clerk.

Clerk *of the Signet*, is an officer continually attending on the king's principal secretary; who has custody of the privy-signet, as well for sealing the king's private letters, as for such grants as pass his majesty's hands by bills signed. Of these there are four, who attend in their turn, and have their diet at the secretary's table.

The fees of the clerk of the signet and privy-seal are limited particularly by statute, with a penalty annexed for taking any thing more. 27 Hen. VIII. c. 11.

Clerk *of the King's Silver*, is an officer belonging to the common-pleas; to whom every fine is brought, after it has passed the office of the *custos brevium;* and by whom the effect of the writ of covenant is entered into a paper-book; according to which note, all the fines of that term are also recorded in the rolls of the court. After the king's silver is entered, it is accounted a fine in law, and not before. See Fine. See also Queen *Gold*.

Clerk *of the Supersedeas*, is an officer in the court of common-pleas, who makes out writs of *supersedeas* (upon the defendant's appearing to the exigent on an outlawry) whereby the sheriff is forbidden to return the exigent.

Clerk *of the Treasury*, an officer of the common-pleas who has charge of the records of the court, and makes out all the records of *nisi prius*, and has the fees due for all searches and the certifying of records into the king's bench, when a writ of error is brought. He also makes out all writs of *supersedeas de non molestanda*, which are granted for the defendants

fendants while the writ of error is depending: and all exemplifications of records, being in the treasury.

He is the servant of the chief justice, and removeable at pleasure; whereas all other officers of the court are for life. There is a secondary, or under-clerk of the treasury, for assistance; who hath some fees and allowances; and likewise an under-keeper, that always keeps one key of the treasury door, and the chief clerk of the secondary, another; so that the one cannot come in without the other.

Clerk *of the King's great Wardrobe*, keeps an account or inventory, in writing, of all things belonging to the king's wardrobe. Stat. 1 Ed. IV. c. 1. See Wardrobe.

Clerk *of the Warrants*, is an officer belonging to the court of common-pleas, who enters all warrants of attorney for plantiff and defendant in suits; and inrolls all deeds in indentures of bargain and sale, which are acknowledged in the court, or before any judges out of the court; and it is his office to estreat into the exchequer all issues, fines, and amerciaments, which grow due to the king in that court, for which he has a standing fee or allowance.

Clerks, *Regular*, a general denomination, comprehending several distinct religious orders, and assumed to denote a reformation attempted to be introduced among them. See Theatins and Fathers

Clerks, *Regular, of the Company of Jesus*. See Jesuits.

Clerks, *Regular, of St. Maieul*. See Fathers *of Somasquo*.

Clerks, *Regular, of St. Paul*. See Barnabites.

Clerks, *Misprision of*. See Misprision.

Clerk, *riding*. See Riding.

Clerks, *Six*. See Six.

Clerks, *Apostolic*, in *Ecclesiastical History*. See Jesuates.

CLERKE, Charles, in *Biography*, a celebrated English navigator, was bred up to the navy from his youth, and during the war which began in 1756 served in various actions; particularly in that between the Bellona and Courageux, where, being stationed in the mizen-top, he was carried over board with the mast, but was taken up without having received any hurt. He accompanied commodore Byron in his first voyage round the world in the station of a midshipman; and in the year 1768 he again circumnavigated the globe as master's mate and lieutenant on board the Endeavour. Soon after his return in 1775, he was appointed master and commander. In captain Cook's last voyage, Mr. Clerke was captain of the Discovery, and upon the disastrous death of that celebrated officer he succeeded to the chief command; but did not long enjoy that new dignity. Having manifested symptoms of a consumption before he left England, the disease not only continued during his whole voyage, but was aggravated by long residence in cold northern climates. Such, however, was the ardour of his mind in the prosecution of the service to which he was devoted, that declining to avail himself of the only chance for prolonging life by returning to a warmer climate, he persisted in his endeavours to explore a passage between the Asiatic and American continents, until all his officers were unanimous in their opinion that it was impracticable. Retaining his spirits and manifesting singular firmness and equanimity during the progress of his disease, his life was at length prematurely terminated on the 22d of Aug. 1779, in the 38th year of his age, within view of the coast of Kamschatka. Cook's Third Voyage, vol. iii. p. 281.

Clerke's *Harbour*, otherwise called *Port Clerke*, in *Geography*, lies to the S. of Pickersgill's cove, in Christmas sound (which see), and is much larger than the cove. On the N. of some low rocks lying off a point on Shag island is the entrance into Port Clerke at W. by S. $1\frac{1}{2}$ mile, with from 12 to 24 fathoms. Here may be procured both wood and fresh water, which are two very essential articles in such a climate. To the southward of this port about a mile, a large island appears to cover another bay from S. and S.E. winds.

Clerke's *islands*, are two islands, situated in the north Pacific ocean, on the western side of the American continent. At a distance they appear to be of considerable extent, and to contain several hills connected by land, but seeming to form a group of islands. Near the east point is a small island, having upon it 3 elevated rocks. N. lat. 63° 15'. W. long. 190° 30'.

Clerke's *rocks*, are situated on the coast of south Georgia, in about 55° 5'. S. lat. and 34° 4' W. long. 12 leagues S. 75° E. from Cooper's island.

CLERMONT, a county of America, in the state of Ohio, bounded N. on Warren county, S. on the Ohio, E. on Adams, and W. on Hamilton county. Its extent from N. to S. is 30 miles, and from E. to W. 23 miles. By the census of 1803 it contained 755 inhabitants; it has one senator in the state legislature and one representative.

Clermont, a post-town of America, in Columbia county, and the state of New York; 117 miles N. of New York, and 212 from Philadelphia. The township contains 867 inhabitants, including 113 slaves.

Clermont, a town of America, in New Hampshire, on the east bank of the river Connecticut, between Dartmouth and Charleston.

Clermont, or Clermont *en Beauvaisis*, a town of France, and principal place of a district in the department of the Oise, seated on an eminence near the Bresche; $7\frac{1}{2}$ posts N. of Paris. The place contains 1995, and the canton 10,465 inhabitants: the territory includes 145 kiliometres and 18 communes.

Clermont, a city of France, and capital of the department of Puy-de-Dôme; before the revolution the capital of Auvergne, and the see of a bishop, suffragan of Bourges: seated on a small eminence at the foot of a lofty mountain. The place, comprehending the N. S. and S. E. cantons, contains 24,478, and the 3 cantons 38,485 inhabitants: the territory of the first canton includes $52\frac{1}{2}$ kiliometres and 5 communes; that of the second $67\frac{1}{2}$ kiliometres and 2 communes: and that of the third 120 kiliometres and 3 communes. The commerce of this city consists in corn, wine, wool, woollen stuffs, tammies serges, linen, lace, &c.

Near this place are some mineral springs, and the water of a brook, which passes through one of the fauxbourgs, petrified a wooden bridge to perfect stone, so that carriages can pass over it. A council was held here in the year 1095, to determine on the crusade against the infidels in the Holy Land, during the pontificate of Urban II. It is called Clermont-Ferrand from the town of Montferrand being united to it, and forming one of its fauxbourgs; distant $23\frac{1}{4}$ posts W. from Lyons, and $46\frac{3}{4}$ S. from Paris. N. lat. 45° 46' 44". E. long. 3° 5' 2".

Clermont, a town of France, in the department of the Hérault, and chief place of a canton, in the district of Lodève, 20 miles W. of Montpellier. The place contains 5430, and the canton 11,440 inhabitants: the territory includes $167\frac{1}{2}$ kiliometres and 15 communes. The chief trade consists in wool and cattle, with manufactures of cloth and hats for exportation.

Clermont, a town of France, in the department of the Meuse, and chief place of a canton in the district of Verdun; seated on an eminence surrounded with woods and pastures; 4 leagues W.S.W. of Verdun. The place contains 1598, and the canton 9660 inhabitants: the territory

tory includes 207½ kilometres and 17 communes. N. lat. 49° 7'. E. long. 4°.

CLERMONT, a town of France, in the department of the Lot and Garonne; 3 leagues W. of Agen.

CLERMONT, a town of France, in the department of the Sarthe, 1 league N.E. of La Flèche.

CLERMONT *Manufcript, Codex Claromontanus* or *Regius* 2245, in *Biblical Literature,* is a Greek-Latin copy of St. Paul's Epiftles, found in the monaftery of Clermont en Beauvaifis in France, and ufed by Beza, together with the Cambridge MS. in preparing his edition of the New Teftament.

Wetftein charges Beza with a miftake in regard to its having been preferved at Clermont, and fays that he confounded it with the Cambrige MS. He conjectures that it was brought into Switzerland from the monaftery of Cluny which the Swifs plundered, and that Beza defignedly concealed the manner in which it came into his poffeffion. But this reflection on the part of Wetftein is thought to be partial and unjuft; as Beza, who had procured it either by purchafe or gift, and thus refcued it from deftruction, might have openly avowed the fact, without incurring the charge of a literary theft, or being in danger of having it redemanded. From the hands of Beza it came into the Putean library, a library which derived its name from the family of Du Puy; the proprietor being Jacques du Puy, who was librarian to the king of France, and died in 1656. Du Puy bequeathed it with all his other MSS. to the Royal Library at Paris, where it is now preferved and marked Cod. Græc. 107; and it is noted D in the fecond part of Wetftein's New Teftament. This copy is written on vellum in Greek and Latin, with fome mutilations. According to the accounts of Wetftein and Sabatier, thirty-fix leaves were cut out of it, in the beginning of the laft century, probably by John Aymon, a noted literary thief, who robbed both the royal and private libraries; and thefe leaves were fold in England; but they were fent back by lord Oxford in 1729. The MS. is therefore again complete, as there fails only the covering, in which the ftolen fheets had been inclofed, which is kept in the Britifh Mufeum, and filled with the letters that paffed on the occafion, as a monument of this infamous theft.

This manufcript, like other codices Græco-Latini, has been accufed of having a Greek text that has been altered from the Latin. Wetftein has produced feveral examples, of unequal weight, in fupport of this charge. Neverthelefs, though perhaps the charge is not wholly unfounded, it harmonizes with other ancient verfions, more efpecially the Syriac; and as no one can fuppofe, that this MS. has been corrupted from them all, no other caufe of coincidence can be affigned befides its high antiquity. From feveral examples, produced by Michaelis in confequence of having examined only a few chapters, it may be concluded, that the fufpicion of its having been altered throughout from the Latin is ungrounded. Mill contended that the Codex Claromontanus was the fecond part of the Cantabrigienfis: but Wetftein has fufficiently confuted this opinion, and fhewn that the former is by no means connected with the latter, as appears from the difference of their form, their orthography, and the nature of the vellum on which they are written. This has likewife been confirmed by Griefbach in his " Symbolæ Criticæ," who has examined both MSS

Beza was the firft who made ufe of the Clermont MS.; it was afterwards collated by Morinus, with a view of difcovering readings in fupport of the Vulgate; more copious extracts were given in the London Polyglot, which Mill transferred to his Greek Teftament; and Wetftein has twice collated it himfelf in 1715 and 1716. The Latin verfion publifhed by Sabatier was taken from this manufcript and the Sangermanenfis.

With regard to the antiquity of this MS. Sabatier eftimates it at 1200 years; and it is fuppofed by Montfaucon to have been written in the 7th century. He has defcribed it in his "Palæographia Græca," p. 217), and in the plate fronting this page he has given a fac-fimile of its characters. Though written in Uncial letters, it has accents and marks of afpiration, of which Montfaucon says; "fecundâ manu, ut videtur, nec diu, ut creditur, poft defcriptum codicem adjecti funt." The marks of afpiration, however, are not of the modern femicircular form. This MS. was probably written in the weft of Europe, not only becaufe it has a Latin tranflation, but becaufe the epiftle to the Hebrews is written at the end; and in the catalogue of the books of the New Teftament placed after the epiftle to Philemon, no mention is made of the epiftle to the Hebrews. To this may be added, that neither Simon nor Wetftein has noted that this epiftle is written even by a later hand, and was therefore wholly excluded from the canon by the original writer of the manufcript. Confequently, as the epiftle to the Hebrews was, during a confiderable time, rejected by the Church of Rome, but not by the Greek Church, it is certain, that the Codex Claromontanus was written in a country, that was under the dominion of the former. Michaelis's Introd. to the New Teftament by Marfh, vols. ii. and iii. See CAMBRIDGE *Manufcript.*

In the above-mentioned catalogue the Latin order of the gofpels is likewife obferved, *viz.* Matthew, John, Mark, Luke, which furnifhes additional evidence that it was written by a member of the Latin church.

CLERODENDRUM, in *Botany,* (from κλῆρος, *lot* or *fortune,* and δένδρον, *a tree;* fortunate tree). Linn. Gen. 789. Schreb. 1057. Willd. 1202. Gært. 340. Juff. 106. Vent. 2. 316. (Peragu, Encyc. Meth.) Clafs and order, *didynamia angiofpermæ.* Nat. ord. *Perfonatæ,* Linn. *Vitices,* Juff. *Pyrenaceæ,* Vent.

Gen. Ch. *Cal.* Perianth one-leafed, campanulate; fegments five, ovate-acute, broader than the tube of the corolla, permanent. *Cor.* monopetalous, irregular; tube long, flender; border regularly cleft, upper fegments more deeply divided. Filaments four, filiform, much longer than the corolla, afcending and widely fpreading through its two upper fiffures; anthers fimple. *Pift.* Germ roundifh; ftyle the length of the filaments; ftigma fimple. *Peric.* Berry, or rather drupe, enclofed by the inflated calyx, one-celled, with four ftones, (pyrenes, Gært.) often feparating into four parts in the ftate of maturity; ftones or pyrenes one-celled, each containing a fingle kernel or feed.

Eff. Ch. Calyx five cleft, campanulate. Tube of the corolla flender; border five-cleft, equal. Stamens very long, projecting through the two upper fiffures of the corolla, widely fpreading. Berry or drupe one-celled; ftones four, each with a fingle feed.

Obf. There is a great refemblance in the general habit and feveral prominent characters between the fpecies of this genus and thofe of volkameria. It differs from the latter in having a fimple, not a bifid ftigma, and one-feeded, not two-feeded ftones. The number of kernels or feeds is, however, in both genera exactly the fame.

Sp. 1. C. *infortunatum,* Linn. Sp. Pl. 1. Mart. 1. Poir. 1. Willd. 1. Gært. tab. 57, fig. 1. Lam. Ill. tab. 544. Lour. 387. (Peragu, Rheed. Hort. Mal. 2. tab. 25.) "Leaves heart-fhaped, tomentous." A fhrub about three feet high, (feven feet, Lour.) *Roots* fibrous, yellow or red-

difh

diſh. *Stems* cylindrical near the bottom, quadrangular above with a deep groove on each of the ſides, cloathed with a ruſſet down. *Leaves* oppoſite, without ſtipules, cordate acute, entire, nerved; their upper ſurface deep green, with a few very ſhort, fine, ſcattered hairs; their under ſurface cloathed with a thick, cloſe, ruſſet down. *Flowers* yellowiſh white, (bright ſcarlet, Lour.) in a terminal pyramidal panicle; each peduncle terminated by one or two pedicelled flowers. *Fruit* blackiſh when ripe. A native of ſandy places on the coaſt of Malabar and other parts of the Eaſt Indies. 2. C. *fortunatum*, Linn. Sp. Pl. 2. Mart. 2. Poir. 2. Willd. 2. Oſbeck. It. tab. 11. "Leaves lanceolate, quite entire." A ſhrub. Stems cylindrical, ſlightly hoary. *Leaves* two or three inches long, more than an inch broad, oppoſite, petioled, naked, nerved, a little decurrent along the petioles; petioles a third of the length of the leaves, rather cylindrical near the baſe, ſtriated and almoſt flat above. *Flowers* yellowiſh white, axillary, in ſmall corymbs; common peduncles an inch long, narrow, ſcarcely pubeſcent, dividing into ſhort branched bifurcations, each ſupporting a ſingle flower; calyx much expanding, deeply divided; ſegments ovate, acute, ſmooth, permanent; tube of the corolla ſcarcely longer than the calyx; filaments nearly twice the length of the corolla, capillary; anthers oval, very ſmall; piſtil ſhorter than the ſtamens. A native of the iſland of Java and other parts of the Eaſt Indies. 3. C. *calamitoſum*, Linn. Mant. 90. Mart. 4. Poir. 3. Willd. 3. (Volkameria alternifolium, Burm. Ind. tab. 44??) "Leaves oval, ſomewhat toothed, naked." *Stem* erect, woody. *Leaves* oppoſite, petioled; petioles one-third of their length. *Flowers* ſmaller than thoſe of the preceding ſpecies, axillary, in a ſpreading panicle. A native of Java. 4. C. *phlomoides*, Linn. jun. Suppl. 292. Mart. 3. Poir. 4. Willd. 4. Vahl. Symb. 2. (Volkameria multiflora, Burm. tab. 45. fig. 1). "Leaves egg ſhaped, entire, toothed and angular; peduncles axillary, with about three flowers." A hoary ſhrub. *Stems* woody, whitiſh, pubeſcent, nearly cylindrical. *Leaves* oppoſite, petioled, acute, thick, tomentous, yellowiſh white on both ſides, entire near the baſe, toothed and almoſt angular from the middle to the ſummit, nearly as broad as long; petioles about half an inch long, a little ſhorter than the leaves. *Flowers* white, forming altogether a ſpreading panicle; branches axillary, from the upper leaves; peduncles tomentous, white, nearly the length of the leaves; bractes ovate, acute, entire, tomentous, white; calyx campanulate, divided nearly to the middle; ſegments open, lanceolate, very acute; tube of the corolla at leaſt three times longer than the corolla, ſlender, enlarged near its orifice; diviſions of the border five, ſhort, ovate, a little reflexed; ſtamens half as long again as the corolla, leſs ſpreading than in the other ſpecies. A native of the Eaſt Indies; found by Koenig and Sonnerat. 5. C. *umbellatum*, Poir. 5. "Leaves coriaceous, egg-ſhaped, ſhining, quite entire; flowers ſomewhat umbelled." A ſhrub. *Stems* tetragonous, quite ſmooth, ſtriated, reddiſh or purple. *Leaves* oppoſite, petioled, quite ſmooth, very acute, about three inches long, one inch broad; petioles very ſhort. *Flowers* reddiſh, in a terminal four-rayed umbel; peduncles twice bichotomous or trichotomous, with one flower at the ends of the laſt diviſions; calyx pubeſcent, tubular, cleft to the middle; ſegments narrow, linear; tube of the corolla more than an inch long, ſlender; lobes of the border rather large; filaments twice the length of the corolla, purple. A native of Africa; found by Smeathman; deſcribed from a ſingle branch in the herbarium of La Marck. 6. C. *ſquamatum*, Mart. 7. Poir. 6. Willd. 5. Vahl. Symb. 2. p. 74. "Leaves heart-ſhaped, obſcurely angular; branches of the panicle dichotomous, ſmooth." *Stems* fruteſcent erect; branches ſmooth, tetragonous, with a groove on each ſide. *Leaves* from three to five inches long, from two to four broad, with a deep ſinus at their baſe, oppoſite, acute, entire, or ſometimes obſcurely toothed, three or five-nerved, tender, ſmooth; pale green underneath, and covered with minute, roundiſh, umbilicated ſcales; deeper green above, and cloathed with a few ſmall very ſhort hairs; petioles at firſt villous, afterwards ſmooth, at leaſt as long as the leaves. *Flowers* in a large, terminal, ſpreading, ſmooth, panicle; peduncles deeply furrowed, thrice dichotomous, ſometimes trichotomous at the ſecond diviſion; pedicels one-flowered, filiform; lower bractes oppoſite, petioled, oppoſite, heart-ſhaped, ſlightly villous; upper ones ſeſſile, narrow, awl-ſhaped; calyx deeply divided; ſegments quite ſmooth, a little coloured, oval, acute, permanent; tube of the corolla ſlender, three times the length of the calyx; diviſions of the border lanceolate, acute; ſtamens projecting two inches out of the corolla; piſtil of the ſame length. A native of the Eaſt Indies. Specimens ſent by Sonnerat are preſerved in the Herbarium of La Marck, from which Vahl formed his ſpecific character and deſcription. Poiret, who examined the ſame ſpecimens, was induced by appearances to ſuſpect that the ſuppoſed ſcales on the under ſurface of the leaves are really either a kermes, or ſome kind of paraſitic fungus, allied to æcidium. If this ſuſpicion be well founded, the plant is miſnamed, and loſes the moſt prominent part of its ſpecific character. 7. C. *trichotomum*, Mart. 6. Poir. 7. Willd. 6. Thunb. Jap. 256. (Seo kuſits, vulgo kuſaggi, Kæmpf. Amœn. 827. Ic. Select. tab. 22.) "Leaves lobed and undivided, broad-egg-ſhaped, quite entire; panicle trichotomous." *Stems* fruteſcent; branches ſmooth, tetragonous, with a deep furrow on each ſide. *Leaves* oppoſite, petioled; lower ones larger, three-lobed; upper ones undivided; uppermoſt very ſmall; all acuminate, ſmooth, entire, nerved, deep green above, paler underneath; petioles ſlightly pubeſcent, ſhorter than the leaves. *Flowers* white, in a very large panicle, without bractes; peduncles and pedicels ſmooth, compreſſed at the diviſion; calyx inflated, contracted above, with five angles, ſhrivelling but permanent, much wider and ſhorter than the corolla, ſmooth; ſegments keeled, acute, erect; tube of the corolla an inch long, filiform, a little bent; diviſions of the border oblong, obtuſe, ſpreading; filaments inſerted into the tube of the corolla within the throat, whitiſh, divaricated at the bottom; anthers cordate-ovate; germ ſuperior, tetragonous, ſmooth; ſtyle longer than the ſtamens; ſtigma ſimple, truncated. *Fruit* an almoſt globular capſule, ſmooth, with four furrows, four-celled, four-valved. *Seeds* ſmooth, one in each cell. A native of Japan. The leaves have a ſtrong poiſonous ſmell like mandragora. *Obſ.* The fruit of this ſpecies, as deſcribed by Thunberg, is altogether at variance with the eſſential generic character. 8. C. *diverſifolium*, Mart. 8. Poir. 8. Willd. 7. Vahl. Symb. 2 75. "Leaves entire and three-lobed, egg-ſhaped; branches of the panicle dichotomous, villous; pedicels racemed." *Stems* woody; branches tetragonous, with a furrow on each ſide, villous at the top. *Leaves* from ſix to eight inches long, five or ſix broad, oppoſite, petioled, ſmooth, deep green above, covered underneath with ſcales ſimilar to thoſe of C. ſquamatum; lower leaves very large, five-lobed, enlarged at the baſe; lobes acute, middle one much longer, acuminate; upper leaves ſmaller, narrowed at the baſe, three-lobed; two lateral lobes ſhort, rather acute; terminal leaves ſmall, entire, lanceolate, ſeſſile, or narrowed into a petiole. *Flowers* in a large terminal panicle

cle eight or ten inches long, villous in all its ramifications; common peduncles opposite, expanding, once or twice dichotomous, terminated by simple racemes; calyx pubescent, with oblong acute segments; tube of the corolla about an inch long, slightly pubescent, two-lipped; upper lip bifid, with erect linear divisions; lower one three-lobed, the two lateral lobes shorter than that in the middle; filaments nearly twice the length of the corolla. A native of the East Indies. Description formed by Vahl from specimens communicated to La Marck by Sonnerat. 9. C. *paniculatum*, Linn. Mant. 90. Mart. 5. Poir. 9. Willd. 8. Vahl. Symb. 2. 74. "Leaves lobed, serrated; panicles very large." Linn. "Leaves five-lobed, toothed, smooth; panicle brachiate; axils woolly." Vahl. *Stems* frutescent; branches smooth, tetragonous, deeply furrowed on each side, purple. *Leaves* five or six inches long, opposite, petioled, heart-shaped; lobes unequal, lanceolate, acute, edged with remote small teeth; petioles cylindrical, striated, about the size of a pigeon's quill; axils garnished with long curling whitish hairs. *Flowers* in a vast, much branched, expanding panicle, which is about six inches long; peduncles opposite, smooth, many times dichotomous; pedicels capillary, one-flowered; segments of the calyx lanceolate, smooth; corolla about an inch long; tube filiform, divisions of the border oblong. A native of the East Indies.

Clerodendrum *fruticosum spinosum*, Brown. Jam. See Volkameria *aculeata*.

CLEROMANCY, derived from κληρος, *lot*, and μαντεια, *divination*, a kind of divination performed by the throwing of dice, or little bones; and observing the points or marks turned up.

At Bura, a city of Achaia, was a temple, and a celebrated oracle of Hercules; where such as consulted the oracle, after praying to the idol, threw four dies, the points whereof being well scanned by the priest, he was supposed to draw an answer from them.

Something of this kind seems to have been practised with regard to Jonah. See Jonah, i. 7.

CLERORUM, in *Ancient Geography*, an episcopal see of Asia, in Phrygia Salutaris.

CLEROTI, among the Athenians, a kind of public arbitrators. See Diætetæ.

CLERVAL, in *Geography*, a town of France, in the department of the Doubs, and chief place of a canton, in the district of Baume; 7 leagues N.E. of Besançon. The place contains 1118, and the canton 9005 inhabitants: the territory includes 217½ kiliometres, and 25 communes.

CLERVAUT, a town of France, in the department of the Vienne; 5 miles N. of Chatellerault.

CLERVAUX, a town of France, in the department of the Forêts, and chief place of a canton, in the district of Dieckirch; the place contains 528, and the canton 6763 inhabitants: the territory includes 262½ kiliometres, and 10 communes.

CLERY, a town of France, in the department of the Somme, and district of Pèrone; 1 league N.W. of it.

Clery, *Notre-Dame de*, a town of France, in the department of the Loiret, and chief place of a canton in the district of Orleans; 7 miles S.W. of Orleans. The place contains 2224, and the canton 4473 inhabitants: the territory includes 125 kiliometres, and 4 communes.

CLESSIDES, in *Biography*, an ancient painter, who, imagining himself slighted by Stratonice, painted a satyrical representation of that queen, in the arms of a fisherman, with whom, it was whispered, she was enamoured; hung it up to public view in the port of Ephesus, and then took to his oars and got away. The picture was admirable; and Stratonice, valuing the art more than her own reputation, would not suffer it to be removed. Orlandi. Della Valle, Vite dei Pitt. Ant.

CLETÆBENI, in *Ancient Geography*, a people of Arabia Felix, situated near the Red Sea, between the Sabæans and Minæans.

CLETCH, in *Rural Economy*, a term signifying a young brood, as of chickens, &c.

CLETHARRO, in *Ancient Geography*, a town placed by Ptolemy in Arabia Petræa.

CLETHRA, in *Botany*, (κληθρα, Theoph. lib. i. cap. 10, which Gaza translates *alnus*, alder. H. Stephens derives it from κλειω, *claudo*, to close or shut up, referring probably to the situation of the seeds in the female catkin of the alder.) Linn. Gen. 553. Schreb. 751. Willd. 872. Gært. 383. Juss. 160. Vent. ii. 462. Class and order, *decandria monogynia*. Nat. ord. *Bicornes*, Linn. Vent. *Ericæ*, Juss.

Gen. Ch. *Cal.* Perianth one-leafed, five-cleft, (five-leaved, Gært.); segments concave, egg-shaped, erect, permanent. *Cor.* Petals five, longer than the calyx, oblong, enlarged towards the summit, half-expanding, obtuse. *Stam.* Filaments ten, a little longer than the petals, awl-shaped; anthers forked. *Pist.* Germ superior, roundish; style permanent; stigma trifid. *Peric.* Capsule roundish, enclosed in the calyx, three-celled, three-valved; partitions contrary to the valves. *Seeds* six or eight in each cell, attached to an angular receptacle, which is finally deciduous.

Eff. Ch. Calyx five-cleft. Petals five. Stigma trifid. Capsule three celled, three-valved.

Sp. 1. C. *alnifolia*, alder-leaved clethra, Linn. Sp. Pl. 1. Mart. 1. Lam. 1. Willd. 1. Gært. i. tab. 63. Lam. Ill. Pl. 369. fig. 1. (Alnifolia americana, Pluk. Alm. tab. 115. fig. 1, 2. Catesb. Car. i. tab. 66.) "Shrubby; leaves obovate-lanceolate, serrated, smooth on both sides; racemes simple, in form of spikes." *Roots* spreading. *Stems* from eight to ten feet high; branches diffuse, cylindrical, pubescent near the summit. *Leaves* about three inches long, an inch and quarter broad in the middle, alternate; on short petioles, nerved. *Flowers* white, numerous, in terminal racemes; bractes linear, shorter than the flowers, caducous. A native of Virginia and Carolina, in moist ground, and on the banks of rivulets. 2. C. *tomentosa*, Lam. 2. (C. alnifolia, β. Hort. Kew.) "Leaves tomentous, hoary underneath." Smaller than the preceding species. Peduncles, calyxes, and bractes very villous. *Flowers* white. A native of Virginia and Carolina. 3. C. *paniculata*, Hort. Kew. ii. p. 73. Mart. 2. Willd. 2. "Shrubby; leaves lanceolate, naked on both sides; flowers panicled, bracteate." Panicle not composed of racemes, narrow, elongated; peduncles pubescent, white. A native of North America, flowering from August to October. 4. C. *arborea*. "Leaves oblong, acuminate, serrated, smooth; racemes panicled; flowers without bractes; peduncles hirsute." A tree. *Calyxes* obtuse. *Receptacles* of the seeds not solitary at the base of each cell, as in C. alnifolia, but fixed laterally at the top of a short three-sided central column, with which the partitions are in contact. A native of Madeira: introduced by Masson in 1784. 5. C. *tinifolia*, Mart. 4. Willd. 4. Poir. Sub. Tinier. Swartz. Prod. 74. Ind. Occid ii p. 845. (Tinus occidentalis, Linn. Sp. Pl. p. 530. Volkameria arborea, Brown. Jam. 214. tab. 21. fig. 1. Baccifera arbor calyculata, Sloan. Jam. ii. tab. 198. fig. 2, but not the description.) "Leaves oblong, quite entire, hoary underneath; racemes panicled; flowers without bractes, peduncles tomentous." A shrub, with the habit of the other species fpecies of clethra, twelve or fourteen feet high; branches fpreading. *Leaves* alternate, petioled, fmooth, and green on their upper furface, acute, narrowed at the bafe. *Flowers* in axillary and terminal racemes; calyx a little pubefcent, with five equal fegments; petals five, a little enlarged, connivent at the bafe; ftamens ten; filaments free, not projecting; ftigma trifid. *Fruit* a capfule refembling a berry, or rather a drupe, fmooth, roundifh, three-celled, three-valved. A native of Jamaica.

Obf. Linnæus, who was imperfectly acquainted with the fructification, made it a diftinct genus, and placed it in his clafs Enneandria. Juffieu, without venturing to alter this difpofition, conjectured that its fuppofed berry would prove a capfule, and that the plant muft be affociated with clethra. Subfequent obfervations have confirmed his opinion.

Clethra, in *Gardening*, contains a plant of the hardy deciduous flowering fhrubby kind; of which the fpecies is alder-leaved clethra (C. *alnifolia*), which is a fhrub that has the roots fpreading far on every fide, and fending up many ftems, from eight or ten to fourteen feet high, which are covered with a greyifh bark, and divide into many round alternate branches. The leaves are about three inches long, and an inch and a quarter broad in the middle; of a deep green on their upper fide, and a whitifh green underneath, alternate, and on very fhort petioles. The flowers are on loofe fpikes from four or five inches to a fpan long; the petals are white. They appear in July, and, when the feafon is mild, fome fpikes are produced in October. It is a native of North America.

Method of Culture. It is capable of being increafed by feeds, layers, and fuckers.

The feeds procured from America fhould be fown in pots of light mould, and removed into the fhade during fummer, and fheltered in winter, as fometimes the plants do not come up till the fecond fpring after they have been fown.

And the layers fhould be made from the young fhoots in autumn, and water given them the following fummer; and in the autumn after, or when well rooted, they fhould be taken off and planted out in feparate pots, or in the places where they are to remain.

In the laft mode, the fuckers from the roots may be removed in the autumn, or early fpring months, fibres being preferved to them as much as poffible, and be planted out in pots, or other places where they are to remain.

This is a very ornamental fhrub, particularly during the time of its bloom, but fhould have a rather moift fituation.

CLETHRITES *lapis*, a name given by the ancients to fuch pieces of foffile wood as fhewed a grain refembling that of the wood of the alder.

CLETHY, in *Geography*, a river of South Wales, which rifes in Pembrokefhire, about 5 miles S.E. of Newport, and joins the Dungledy, 4 miles N. of Pembroke.

CLETON, a river of Wales, which runs into the Dee, two miles below Bala, in Merionethfhire.

CLETTER, a river of Wales, in Cardiganfhire, which runs into the Dovy, a few miles below Machynlleth.

CLEVELAND, a diftrict of England, in the county of York, on the borders of Durham.

Cleveland, a pleafant fmall town of America, in the ftate of Ohio, and county of Trumbull, favourably fituated on the borders of lake Erie, at the mouth of Cayahoga river.

CLEVES, a town of Germany, in the circle of Weftphalia, and capital of a duchy to which it gives name; but fince the French revolution, the principal place of a diftrict in the department of the Roer; the place contains 4243, and the canton 8353 inhabitants; and the territory includes 16 communes. It is fituated on the river Kermifdal, about two miles from the Rhine, on the brow of a hill, furrounded with walls, but not much fortified, and confifts of feveral irregular ftreets. The land about the town is very well cultivated, which is owing to the abolition of the great land-holders. About half a mile from the town is a very pleafant park, with a clofe avenue of noble plane trees; and near this agreeable fpot is a mineral fpring, which in fummer is much frequented. The Dutch language and coins are current here, as well as the High German. The Roman Catholics, the Lutherans, the Calvinifts, and the Mennonites, have their refpective churches, and the Jews have a fynagogue. In the fame department, in the diftrict of Cleves, and about the diftance of five miles from the Rhine, is the town of Calcar: the place containing 1304, and the canton 9345 inhabitants, and the territory including 22 communes. See Calcar.

Cleves is about 10 miles E.S.E. of Nimmeguen. N. lat. 51° 50′. E. long. 5° 50′.

Cleves, *Duchy of*, forming, fince the revolution, a part of the French department of Roer, is a principality of Germany, which belonged to the king of Pruffia, and is bounded on the north by Overyffel and the bifhoprick of Munfter, on the eaft by the former and the county of Rechlinghaufen, on the fouth by the county of Mark and duchy of Berg, and on the weft by Guelderland and Brabant. It is about 50 miles in length, and 13 in breadth; the air is very healthy, but the foil is unequal. On the eminence are feen fields, woods, and extenfive forefts, bordered by towns and villages; and on the banks of the Rhine, which runs through this country, are extenfive fine paftures, which feed a great number of cattle. The produce is corn, tobacco, and all forts of vegetables. Game is plentiful, and the rivers abound with all forts of fifh. The manufactures of filk, cloth, linen, lace, pipes, &c. are very confiderable. The whole country contains 22 towns, the principal of which are Cleves, Calcar, Nieder-Wefel, Duifburg, Xanton, Rees, and Emmerich, in which perfons of all religious fects are allowed freedom of worfhip. The population, according to the eftimate of Hoeck (edit. 1801), amounts to 100,000 perfons. The principal rivers are the Rhine, Meufe, Ruhr, Emfer, Lippe, and the Iffel. The revenues of Cleves and Mark are faid to have amounted to a million of crowns; and the king of Pruffia, as duke of Cleves, was accuftomed to pay towards the charges of the empire 1208 florins, and to the Imperial chamber 676 crowns. See Roer.

Cleves, a town of America, in the ftate of Virginia; two miles north of Port Royal.

CLEUSIS, in *Ancient Geography*, a river which ran from north to fouth, between Mela and the lake Benacus.

CLEVUM, or Glevum, a town of Great Britain, which, according to the Itinerary of Antonine, lay on the route from Ifca or Caerleon to Calleva or Silchefter, between Ariconium near Rofs, and Duroconovium or Cirencefter. It was the prefent city of Gloucefter.

CLEVVY, in *Agriculture*, a term fometimes provincially applied to a fort of draft-iron of a plough.

CLEW-*bay*, in *Geography*, a large bay on the weft coaft of Ireland, in the county of Mayo, which has been fometimes called Newport bay. It is twelve miles from eaft to weft, and from five to feven miles from north to fouth. At the bottom it is crowded with fmall iflands, between fome of which there is deep and fafe anchorage. It is fheltered on the north and fouth by the mountains of Burrifhoole and Morifk, and defended from weftern ftorms by the high and rocky ifland of Clare. There are two fmall ports on this bay, Newport Prat and Weftport, which will be mentioned in their proper places. The entrance S. of Clare Ifland is in about 53° 46′. N. lat. and the whole bay is between 9° 27′ and 9° 46′ long. W. from Greenwich. Beaufort. M'Kenzie.

CLEW, or CLUE, *of the fail of a fhip*, is the lower corner of it which reaches down to that earing where the tacks and fheets are faftened; fo that when a fail is made goring, or floping by degrees, fhe is faid to have a *great clew:* and a fhip is faid to have a great clew, when fhe has a very long yard, and fo has much canvas in her fails.

CLEW *garnet*, a rope faftened to the clew of the fail, and from thence running in a block feized to the middle of the main and fore-yard. Its ufe is to haul up the clew of the fail clofe to the middle of the yard, in order to its being furled. Hence to *clew*, or *clue up*, is to haul up the clews of a fail to its yard by means of the clew-lines.

CLEW-*line* is the fame to the top-fails, top-gallant-fails, and fprit-fails, that the clew-garnet is to the main-fail and fore-fail, and has the very fame ufe. In a guft of wind, when a top-fail is to be taken in, they firft haul home the lee clew-line, and by that means the fail is taken in much eafier.

CLEYER, ANDREW, M.D., in *Biography*, was born at Caffel, near the Rhine, the beginning of the 17th century. His difpofition leading him to the ftudy of medicine, and natural hiftory, after being initiated in the knowledge of pharmacy and furgery, he accepted the office of phyfician to the Dutch fettlement at Batavia, in the ifland of Java, where he appears to have refided feveral years. He had been previoufly elected a member of the Imperial Academy, whofe Tranfactions he enriched with numerons curious and interefting communications, the titles of which follow: "An Account of Hydatids, found in a Human Stomach," "Of the Cuftom of the Indians, of taking Opium," "ut ad venerem fe excitent." They think opium, taken in the quantity of a drachm in the day, has the power of prolonging life. In Java, he fays, the elephantiafis made its firft appearance about twenty years before he arrived in the ifland; from his defcription of the difeafe, it appears to have been the yaws. He defcribes 289 plants growing in the ifland, with the ufes they are put to by the natives; particularly the moxa, ginfeng, and the tea-plant; of the greater part of which there are engravings, elegantly, Haller fays, but not very accurately, drawn. His publications are, "Specimen Medicinæ Sinicæ, five Opufcula Medica ad Mentem Sinenfium." Francof. 1680, 4to. It confifts of feveral treatifes on the pulfe, as defcribed by the Chinefe; of the indications of difeafe, taken from the pulfe, colour of the tongue, &c. The obfervations on the medicine of the Chinefe, in part tranflated from their books, was the work of William Ten Rhyne, who was alfo refident in Java, and who complains that they were publifhed without his knowledge. Haller Bib. Med. Anat. Chir. Bot.

CLEYERA, in *Botany*, Thunb. See TERNSTRŒMIA.

CLEYN, or CLENN, FRANCIS DE, in *Biography*, was a native of Roftock, in Germany; having an inclination towards the fine arts, he went to Rome, where he ftudied four years. He afterwards came to England, and was employed by James I. to make defigns for ornamental tapeftries. His talent lay chiefly in painting friezes, and other grotefque decorations, in which he introduced fea-nymphs, tritons, and cupids; with fufficient grace of defign and freedom of execution. Several paintings by him of this defcription ftill exift at Holland houfe; and feveral of them were engraved by himfelf and others. He died in London, in the year 1658. Pilkington. Strutt.

CLIBADIUM, in *Botany*, (κλιβαδιον, Diofcor.) Linn. Gen. 1329. Schreb. 1430. Willd. 1670. Juff. 191. Clafs and order, *monœcia pentandria*. Nat. Ord. *Corymbiferæ*, Juff.

Gen. Ch. *Cal. common* imbricated; fcales egg-fhaped, acute. *Cor.* Florets tubular, funnel-fhaped, five-cleft; male florets in the difk, numerous, pedicelled; female ones in the ray, three or four. *Stam.* in the males; filaments five, very fhort, capillary; anthers oblong, approximating, but not united. *Pift.* in the males abortive; germ very fmall, fuperior; ftyle filiform; ftigma fimple; in the females, germ roundifh, inferior; ftyle filiform; ftigma bifid. *Peric. common* none, except the permanent, coloured calyx; *proper*, to the males, none; to the females, a roundifh, umbilicated drupe, with a yellow vifcid juice. *Seeds* one in each drupe, heart-fhaped, compreffed.

Eff. Ch. Common calyx imbricated. Anthers of the male florets approximating, not united; female florets three or four. Drupe umbilicated.

Sp. C. *furinamenfe*, Linn. Mant. p. 294. Mart. Poir. Willd. (C. fœtidum; Allemand MSS.) *Leaves* oppofite, petioled, egg-fhaped, acuminate, acutely crenate, fcabrous. *Flowers* white; peduncles oppofite; common calyx violet-coloured, when ripe. *Drupe* green. A native of Surinam.

CLIBANARII. See CATAPHRACTI or CATAPHRACTARII.

CLIBANUS, in *Ancient Geography*, a town of Afia Minor, in the interior of Ifauria, according to Pliny.—Alfo a mountain of Italy, in Magna Græcia, in the vicinity of the Lacinian promontory. Pliny.

CLICH, a fabre in ufe among the Turks. It is curved and very large. They have another fabre, which cuts with one fide or edge only, and has folid iron along the back of it. This is called *gadara*, and is lefs curved than the *clich*. They have alfo a third kind of fabre, which is ftraight, rounded, and fharp at the end, and cuts with both edges. It is called *palas*.

CLICHY *la Garenne*, in *Geography*, a town of France, in the department of Paris; one league W.N.W. of Paris.

CLIDE or IAUCLIDE, in *Ancient Military Language*, a long piece of wood or ftrong plank, held in its pofition by a counter-weight, which, when loofened from the fame, lets fly a great weight of ftones into befieged fortreffes. Thefe machines were in ufe under Charlemagne.

CLIDES *infulæ*. See CLEIDES.

CLIDOMANCY, from κλεις, a *key*, and μαντεια, *divination*, a fpecies of divination performed by means of keys. See DATYLIOMANCY.

CLIE, LE, in *Geography*, a lake of Upper Canada, about 38 miles long, and 30 broad; the waters of which communicate with thofe of lake Huron. N. lat. 44° 20′. W. long. 80°.

CLIENT, CLIENS, among the Romans, a citizen who put himfelf under the protection of fome great man, who, in that relation, was called his patron, *patronus*.

The patron affifted his client with his protection, intereft, and eftate, advifed him in points of law, managed his fuits, took care of him as of his own child, and to the utmoft of his power, contributed to fecure his peace and happinefs: and the client gave his vote for his patron, when he fought any office for himfelf, or his friends. Clients owed refpect to their patrons, as thefe reciprocally owed them their protection.

This right of patronage was appointed by Romulus, to unite the rich and poor together, in fuch manner, as that one might live without contempt, and the other without envy. This patronage was a tie as effectual as any confanguinity or alliance, and had a wonderful effect towards maintaining union and concord among the people for an interval of 600 years; during which time we find no dissensions or jealousies between the patrons and their clients, even in the times of the republic, when the populace frequently mutinied against those who were the most powerful in the city. But the condition of a client, in course of time, became little else but a moderate kind of slavery.

By degrees, the custom extended itself beyond Rome; and not only families, but cities, and entire provinces, even out of Italy, followed the example. Thus Sicily, *v. gr.* put itself under the clientela, or protection of Marcellus.

Lazius and Budæus refer the origin of fiefs and tenures to the patrons and clients of ancient Rome: but the difference is pretty considerable between the relation of vassals and their lords, and that of clients and their patrons. See Vassal.

The clients, beside the respect they bore their patrons, and the vote they gave them, were obliged to assist them in all affairs: and even to pay their ransom, if they should be taken prisoners in war, in case they were not able to do it of themselves; to contribute to the portions of their daughters, and to defray, in part, the charges of their public employments. They were never to accuse each other, or take contrary sides; and if either of them was convicted of having violated this law, the crime was equal to that of treason, and any one was allowed to kill the offender with impunity.

Client is now used for a party in a law-suit, who has turned over his cause into the hands of a counsellor, or solicitor, and who puts himself under their protection and defence. Clients are so called from their resemblance to those above-mentioned, who were dependant upon the ancient Roman orators. Those, indeed, practised *gratis*, for honour merely, or at most for the sake of gaining influence: and so likewise it is established with us (Davis, pref. 22. 1 Chan. Rep. 38), that a counsel can maintain no action for his fees; which are given, not as *locatio vel conductio*, but as *quiddam honorarium*; not as a salary or hire, but as a mere gratuity, which a counsellor cannot demand without doing wrong to his reputation: (Davis, 23); as is also laid down with regard to advocates in the civil law, (Ff. 11. 6. 1.), whose *honorarium* was directed by a decree of the senate not to exceed in any case 10,000 sesterces, or about 80*l.* of English money. (Tac. Ann. l. 11.) And, in order to encourage due freedom of speech in the lawful defence of their clients, and at the same time to give a check to the unseemly licentiousness of prostitute and illiberal men, (a few of whom may sometimes insinuate themselves even into the most honourable professions), it hath been holden that a counsel is not answerable for any matter by him spoken, relative to the cause in hand, and suggested in his client's instructions; although it should reflect upon the reputation of another, and even prove absolutely groundless: but if he mentions an untruth of his own invention, or even upon instructions, if it be impertinent to the cause in hand, he is then liable to an action from the party injured. (Cro. Jac. 90.) And counsel guilty of deceit or collusion are punishable by the statute Westm. 1 (3 Edw. I. c. 28.) with imprisonment for a year and a day, and perpetual silence in the courts:—a punishment still sometimes inflicted for gross misdemeanors in practice. (Raym. 376.) Blackst. Com. B. 111.

Clients. Gentlemen, who served in the French armies under the pennon of a chevalier, under the banner of a banneret, or under that of the advowée of some abbey.

CLIFF, Cliff-Regis, or King's-Cliff, in *Geography*, a town of England, in the county of Northampton, with a weekly market on Tuesdays; 8 miles S. of Stamford, and 88 N. of London.

Cliff, a village in Kent, in the lath of Aylesford, situate at the edge of the marshes which border on the Thames river, near the top of the chalk strata. The situation of the steeple of its church was determined in the government trigonometrical survey in 1799, by an observation from Gad's-hill station distant 19,967 feet; and another from Gravesend station distant 50,549 feet, and bearing 70° 49′ 7″ S.W. from the parallel to the meridian of Greenwich observatory: whence is deduced its latitude 51° 27′ 43″ N. and its longitude 29′ 50″ E.

CLIFFORD, George, in *Biography*, the third earl of Cumberland, a nobleman distinguished for his skill and enterprize in naval expeditions, was born at Brougham castle in Westmoreland in the year 1558. He received his college education at Peterhouse, Cambridge, under Whitgift, who was afterwards archbishop of Canterbury. The bent of his pursuits at this period was the study of mathematics, by which he was afterwards eminently qualified for the several great expeditions in which he engaged. He was likewise much addicted to athletic exercises, and is said to have excelled all his contemporaries in tilts, tournaments, and field sports. The first public business in which we find him engaged, was in 1586, when as a peer of the realm he sat in judgment upon Mary queen of Scots. In the same year he fitted out a small fleet, consisting of four vessels, for the South-sea, with a view either to maritime discoveries, or more probably that he might distinguish himself in injuring the enemies of his sovereign: his operations were, however, in this instance, chiefly confined to the eastern coast of South America, and he returned with little success. In the year 1588, the earl of Cumberland was among the number of those who signalized themselves by the destruction of the famous armada intended for the ruin of this country. The valour which he exhibited on this highly interesting and important occasion so far recommended him to the queen, that as a reward she gave him a commission to proceed to the South-seas, and lent him a vessel of her own for his admiral ship. In this and some subsequent expeditions during three following years, he was generally unfortunate. Not discouraged, however, by the want of that success which he had anticipated, he undertook, in 1592, another expedition with a fleet of his own: he first proceeded to the Azores, where, in conjunction with some other English ships, they attacked the Santa Cruz, a rich carrack, which the Spaniards set on fire, after they had put the most valuable part of its cargo on shore; but the English landed, and made themselves masters of it and of the town. The share of the prize-money which should have fallen to the earl of Cumberland, in this expedition, would have been very considerable, but from a series of unfortunate occurrences it was reduced to 36,000*l.* In 1593, he made another cruize, and took many valuable prizes: and in 1595 he built a vessel of 900 tons burden, which was the largest that had been sent to sea by any English subject; he at the same time fitted out three small ones, with a view of undertaking another expedition in which he was disappointed by the queen's mandate: his ships, however, pursued their voyage under a different commander, and were successful in capturing a number of vessels, some of which were richly laden. His last and most considerable expedition was in 1598, when he commanded nineteen ships; of these the principal one was his own great ship, to which the queen had given the name of "The Scourge of Malice." With this fleet he proceeded to the West Indies: he first touched at the Canaries, and then, after mustering all his force at the Virgin isles, he sailed to Porto Rico, the capital of which he attacked and captured, with its strong fort of Mora. This town being reckoned the key of the West-India

India islands, and a paffage to all the wealth on the continent of America, the noble earl refolved to keep poffeffion of it. For this purpofe he fent away the inhabitants to Carthagena, though he afferts that he was offered property to the amount of half a million fterling, to abandon this ftep. This expedition, though in many refpects highly fuccefsful, proved in the end very difaftrous. Before his return he loft more than 700 men, either by difeafe or the fword, befides feveral of his veffels by fhipwreck. The character of the earl of Cumberland's expeditions, of which he made eleven, will not bear to be feverely fcrutinized; they were rather of a predatory nature than calculated to improve the noble fcience of navigation. No difcoveries are recorded to render his name illuftrious as a philofopher, and no very important victories that could give him juft pretenfions to the title of hero, by which he was, in his own, and fome fucceeding ages, defignated. His adventures were neverthelefs of confiderable importance to the nation, as well by exciting and fupporting a fpirit of maritime enterprize, as by injuring and reducing the power of Spain. By thefe eleven voyages, and by building fhips, horfe-racing, tilting, and other expenfive exercifes, this nobleman is faid to have wafted more of his eftate than any of his anceftors. It ought not to be omitted that in the year 1592, he was elected knight of the garter: and in 1601, he was one of thofe who were fent with forces to reduce the earl of Effex to obedience. It appears alfo that he fat upon the earl's trial and made a feeble oppofition to the fentence paffed on him: faying, "that if he thought it would have availed, he would have demanded more time to deliberate on the fubject; that he deemed it fomewhat too fevere, and that any commander in chief might eafily incur a fimilar penalty." "But, however," added he, "in confidence of her majefty's mercy, I agree with the reft." The earl of Cumberland died at the Savoy in October 1605, and was buried at Skipton, Yorkfhire, where a fine monument was afterwards erected to his memory. He married Margaret, the third daughter of the earl of Bedford, by whom he had two fons, who died young, and a daughter, who was the celebrated countefs of Dorfet, Pembroke, and Montgomery. Biog. Brit. Hume's Hift.

CLIFFORTIA, in *Botany*, (named by Eichrodt in honour of George Clifford, a merchant at Amfterdam, the friend and patron of Linnæus, a catalogue of whofe garden was publifhed by him at Amfterdam in 1737, in a fplendid folio, under the title of "Hortus Cliffortianus"). Linn. Gen. 1133. Schreb. 1550. Juff. 337. Vent. 3. 334. Clafs and order, *diœcia polyandria*. Nat. Ord. *Tricoccæ*, Linn. *Rofaceæ*, Juff. Vent.

Gen. Ch. *Male. Cal.* Perianth three-leaved (three-cleft, Juff. Vent.) leaves egg-fhaped, acute, coriaceous, fpreading, deciduous. *Cor.* none. *Stam.* Filaments about thirty, capillary, erect, the length of the calyx; anthers didymous, oblong, obtufe, erect, compreffed. *Female. Cal.* Perianth three-leaved, equal, erect, fuperior, permanent; leaves acute, lanceolate. *Cor.* none. *Pift.* Germ oblong, inferior; ftyles two, filiform, long, plumofe; ftigmas fimple. *Peric.* Capfule oblong, nearly cylindrical, crowned with the calyx, two-celled. *Seeds* linear, one in each cell.

Eff. Ch. *Male.* Calyx three-leaved. Cor. none. Stamens about thirty. *Fem.* Calyx three-leaved, fuperior. Cor. none. Capfule two-celled. Seeds one in each cell.

All the known fpecies are perennial fhrubs from the Cape of Good Hope, and have either ternate or fimple leaves.

* *Leaves fimple.*

Sp. 1. C. *odorata*, Linn. jun. Supp. 431. Mart. 1. Lam. 8. "Leaves egg-fhaped, ferrated, ribbed, villous underneath." A fhrub, about three feet high, erect, but little branched; branches fimple, fomewhat pubefcent. *Leaves* alternate, on fhort petioles, obtufe, refembling thofe of mint; nearly an inch and half long, an inch broad; ftipules at the bafe of the leaf, membranous, femibifid, acute; villous as well as the petioles, withering. *Flowers* axillary, feffile. The younger Linnæus had feen only a plant with male flowers, which agreed with the other fpecies, though the habit of the plant is different. Found by Thunberg. 2. C. *ilicifolia*, Linn. Sp. Pl. 1. Mart. 2. Lam. 1. Ill. Pl. 827. fig. 1. Dill. Elth. tab. 31. fig. 35. "Leaves fomewhat heart-fhaped, toothed." A fhrub, two or three feet high, quite fmooth; branches alternate, diffufe, covered with fhort, fheathing, two-pointed ftipules. *Leaves* fmall, alternate, biennial, continuing green all the year, cartilaginous about the edge, placed near together, truncate-heart-fhaped, or roundifh, a little embracing the ftem, jointed on the hinder edge of the fheathing ftipule, fmooth, nerved, edged with rather diftant fpinous teeth. *Flowers* green, lateral, axillary, folitary, feffile. Cultivated in Chelfea garden, 1714, flowering in June, July, and Auguft. 3. C. *cordifolia*, Lam. 2. "Leaves heart-fhaped, quite entire, embracing the ftem; upper ones toothed." Nearly allied to the preceding; communicated to La Marck by Sonnerat. 4. C. *rufcifolia*, Linn. Sp. Pl. 2. Mart. 3. Lam. 3. Ill. Pl. 827. fig. 2. (Frutex æthiopicus, &c. Pluk. Alm. 159. tab. 297. fig. 2.) "Leaves lanceolate, quite entire." A fhrub, about two feet high, thickly branched; branches alternate, compound, afcending, afh-coloured, and fmooth near the bottom, brown and tomentous above; little branches fhort, covered with lanceolate, acuminate, fheathing ftipules, leafy only at the end. *Leaves* fmall, numerous, growing clofe together, feffile, terminated by a fharp, and fometimes bifid fpine, fmooth and fhining above, nerved and villous underneath. *Flowers* at the ends of the little branches, in roundifh fpikes, intrenched in the leaves; bractes fmaller than the leaves, involving each flower, trifid, hirfute on the outfide, fpinous, with a fharp membranous hairy leaflet near the bafe, on each fide; germ egg-fhaped, obtufe, alternated at the bafe, rather gibbous, ftreaked and angular. Introduced by Maffon in 1786; communicated alfo to La Marck by Maffon. 5. C. *graminea*, Linn. jun. Supp. 429. Mart. 5. Lam. 0. "Leaves enfiform, flightly ferrated; petioles dilated, terminated by two ftipule-fhaped awns." A fhrub. *Stems* feveral, two feet high, fcarcely branching, ftriated, covered with leaves. *Leaves* growing near together, erect, convolute, fmooth, ftriated, acute; petioles broad, connected with the leaves by a joint; the edges elongated into awl-fhaped, erect divifions. Found by Thunberg. 6. C. *ferruginea*, Linn. jun. Supp. 429. Mart. 4. (C. berberidifolia, Lam. 9.) "Leaves lanceolate, fetaceous-ferrated," Linn. jun. "Stem fmooth; branches alternate, very fhort, leafy; leaves fomewhat lanceolate, fetaceous-ferrated, crowded," Lam. *Stems* like thofe of knot-grafs, filiform, ufually proftrate, even furface, and branching; branches fhort, ferruginous, herbaceous. *Leaves* alternate, on fhort petioles, ftriated, acute, naked; ferratures fetaceous, unarmed; ftipules two-cleft, ferruginous, fcarious. *Flowers* axillary, feffile, trifid; filaments capillary, long; anthers egg-fhaped. La Marck doubts whether this be the fame plant with his berberidifolia, as there is no mention of the crowded leaves, and the abundant hairs on the ftipulary fheaths, which appear in his fpecimens. Found by Sparman. 7. C. *polygonifolia*, Linn. Sp. Pl. 3. Mart. 6. Lam. 4. "Leaves linear, hairy." An under-fhrub, about a foot high, much branched, villous; branches flender, cylindrical, pubefcent, leafy. *Leaves* very fmall, linear, acute, quite entire, but undulated, apparently in alternate fafcicles, but really growing three together

together upon each small sheath. *Capsules* of an even surface, smaller than grains of wheat. 8. C. *filifolia*, Linn. jun. 430. Mart. 7. Lam. 17. "Leaves filiform, triquetrous, smooth, quite entire." Found by Thunberg. 9. C. *teretifolia*, Linn. jun. Supp. 430. Mart. 17. Lam. 18. "Leaves fascicled, cylindrical, incurved, smooth, entire." 10. C. *ericæfolia*, Linn. jun. Supp. 430. Mart. 18. Lam. 19. "Leaves fascicled, cylindrical, furrowed, smooth." The last three species greatly resemble each other. They were all found by Thunberg, and were introduced into England by Masson, 1787. 11. C. *cuneata*, Hort. Kew. 3. 413. Mart. 19. "Leaves wedge-shaped, serrated at the end." Introduced by Masson, 1787.

** *Leaves compound.*

12. C. *crenata*, Linn. jun. 430. Mart. 8. Lam. 12. "Leaves binate, orbicular, crenulate." *Leaves* alternate, sessile, smooth, the size of a finger-nail. *Flowers* axillary, solitary, trifid. Found by Thunberg. 13. C. *pulchella*, Linn. jun. Supp. 430. Mart. 19. Lam. 13. "Leaves binate, orbicular, quite entire." *Leaves* connivent, forming a cavity which protects the flowers, beautifully adorned on the outside with radiating nerves. Found by Thunberg. 14. C. *trifoliata*, Linn. Sp. Pl. 4. Mart. 10. Lam. 5. (myrica. Hort. Cliff. 456. 6. Thymelææ forte affinis; Pluk. Alm. 367. tab. 319. fig. 4.) "Leaves ternate; intermediate leaflet three-toothed." *Stems* slender, woody, procumbent, silky, with hairs, sending out slender branches on every side. *Leaves* sessile, hairy; side leaflets lanceolate; middle one broader. *Flowers* axillary, on short peduncles. There is a variety with smaller, linear-lanceolate leaflets. Cultivated by Miller before 1759; flowering in July and August. 15. C. *sarmentosa*, Linn. Mant. 299. Mart. 11. Lam. 6. "Leaves ternate, linear, villous." *Stem* four feet high, shrubby, filiform, sarmentous; branches alternate, short, simple, cylindrical, pubescent. *Leaves* alternate, almost sessile, nearly equal, very narrow, unarmed; petiole short, stipular, membranous, dilated, emarginate, naked. *Flowers* white, axillary, solitary, sessile. 16. C. *strobilifera*, Murray, Syst. 893. (cedrus conifera; Pluk. Alm. 91. tab. 275. fig. 2.) "Leaves ternate, linear, acute, even-surfaced." A shrub. *Branches* slender, cylindrical, smooth. *Leaves* sessile, carinated, on a short sheathing petiole; stipular sheaths permanent, after the leaves have fallen, nearly egg-shaped, scarious, with two teeth, smooth. The sessile, lateral, scaly, egg-shaped cones which occur on the branches, are supposed by Linnæus to be gals, and not fruit. Jussieu doubts, whether it be really a cliffortia. La Marck's specimens are beset with cones of different sizes, without any appearance of fructification. 17. C. *obcordata*, Linn. jun. Supp. 429. Mart. 13. Lam. 11. "Leaves ternate; leaflets roundish, middle one inversely heart-shaped." An erect, low shrub, with distich branches. *Leaves* small, sessile, inversely egg-shaped, nerveless, very obtuse, quite entire, smooth, resembling those of purslane (peplis), often binate. *Flowers* axillary, sessile, not longer than the leaves. 18. C. *ternata*, Linn. Supp. 430. Mart. 14. Lam. 16. "Leaves ternate; leaflets entire, hairy." A shrub, very distinct from the other species. *Leaflets* small, ovate-lanceolate. Found by Thunberg. 19. C. *juniperina*, Linn. jun. 430. Mart. 15. Lam. 15. "Leaves ternate, triquetrous, awl-shaped, crowded." A shrub, with the habit of a juniper, three feet high, much branched. *Leaves* on a broadish, very short, scarcely perceptible peduncle; leaflets acerose, linear, channelled, mucronate, somewhat serrated. *Flowers* axillary, sessile. 20. C. *falcata*, Linn. jun. Supp. 431. Mart. 16. Lam. 14. "Leaves ternate, linear, falcate, smooth." A shrub, about a foot high, erect, branched, stiff and straight. *Leaves* resembling those of C. sarmentosa, but smooth, often three from each bud; leaflets rather acute, incurved. Found by Thunberg.

Propagation and culture. C. ilicifolia is easily propagated by cuttings in any of the summer months. These should be planted in small pots, filled with light earth; when they have taken root, they should be gradually exposed to the open air, and when they have gained some strength, may be transplanted separately into small pots, and placed with other hardy kinds of exotic plants, in a sheltered situation, till October; they should then be placed under a common hot-bed frame, or removed into the green-house, but should enjoy the free air, whenever the season is mild. When the plants advance in height, their stem and branches will require support, they will then thrive with the same treatment as myrtles, and other hardy green-house plants, but must have little water in winter. C. trifoliata is equally hardy. C. ruscifolia is more tender, and more difficult to propagate.

CLIFT, in the *Manege*, a deficiency in the new, soft, and rough uneven hoof that grows in horses feet, upon the hoof cast. It is also called *chink*, *crack*, or *chop*, and by the French *avalure*. See CLEFT.

CLIFTS, in timber. See TIMBER.

CLIFTON, FRANCIS, in *Biography*, doctor in medicine, received his education in the university of Oxford, which completed, he came to London, and about the year 1730, he was admitted a fellow of the College of Physicians, and soon after of the Royal Society. In 1732 he published "The State of Physic, ancient and modern, briefly considered, with a Plan for improving it," 8vo. The first part of the volume contains a compendium of the history of physic, written in the manner of Friend's history, but not equally correct. He shews a marked partiality for empirics, amongst whom he places Hippocrates, and censures Galen, for attempting to found his practice on ratiocination. He proposes a law, obliging physicians and surgeons to keep registers of the cases they attend, which are to be sent to an institution, to be formed for the purpose. The accounts are to contain simply descriptions of the diseases with the remedies employed in their cure. He had before, *viz.* in 1731, published, "A plain and sure Way of practising Physic," 8vo. He recommends the use of the warm-bath in the small-pox, and condemns the practice of giving purges in that complaint, which had been recommended by Dr. Friend. He also translated "Hippocrates de Aere, Aquis et Locis," with the title of Hippocrates on air, water, and situations, upon epidemical diseases, and upon prognostics in acute cases, illustrated with notes, and added a translation from Thucydides, of the account of the plague at Athens, 8vo. 1734. Boerhaave Methodus Studii Medici.

CLIFTON, in *Geography*, a village of Gloucestershire, famous for its medicinal springs, called "Bristol hot-wells," supposed to be one of the pleasantest villages in the kingdom; 1 mile from Bristol. See BRISTOL.

The situation of a wind-mill in a conspicuous place in this parish, sometimes called Clifden wind-mill, was determined it the government trigonometrical survey in 1797, by an observation from Dundry station, distant 12,860 feet, and bearing 9° 52′ 50″ S.W. from the parallel to the meridian of Black-down station; and another from Lansdown station, distant 51,725 feet; whence is deduced its latitude 51° 25′ 53″ N. and its longitude from Greenwich 2° 37′ 26″ W. or 10^m 29ˢ.7 in time.

CLIFTON, a village near the south-eastern extremity of the west-riding of Yorkshire, in the hundred of Strafford; which parish will probably be hereafter often noted, on account of a remarkable eminence therein, called Beacon Hill, on on which a station was chosen in 1801, in the government trigonometrical survey, and where, in 1802, the curious *zenith-sector*, (see that article), the last work of that celebrated artist Mr. Jesse Ramsden, was used for determining the latitude of this station, as the northernmost point in the terrestrial arc of the meridian, of whose measurement a detailed account has been published by major William Mudge in the Philosophical Transactions for 1803; being the first attempt at the measurement of an arc of the meridian in Britain of any considerable length, since the days of our countryman Norwood, about the year 1635. Clifton station was chosen, on account of its falling almost exactly on the meridian of the station at Dunnose, in the Isle of Wight, which had been fixed on, as the south end of the British meridional arc to be measured; and also on account of the fen called the Isle of Axholme, in Lincolnshire, lying within full view of this station, and presenting an eligible situation for measuring a base of verification; and whereon, in the part called Misterton-carr, a line 26342.7 feet in length, terminated by points called Misterton north and south stations, was measured in June and July, 1801, on the level surface of the fen, by means of the curious steel chains and apparatus of Ramsden's construction, which were used in the re-measurement of the first base on Hounslow-heath in 1791; this Misterton base being situate about 35 feet above the level of half tide in the ocean, at the mouth of the Humber river.

In August 1801, one of Ramsden's great *theodolites* (see that article) was erected on Clifton station, the horizontal angles between Misterton north and Misterton south stations, Gringley station and Heathersedge, or Lords'-seat station, respectively, were repeatedly observed; and thirteen observations of the pole-star, when at its greatest elongations from the meridian, were carefully made; whence, Gringley station was found to bear 76° 17′ 25″ S.E. from the meridian of Clifton station, distant by calculation 75,068 feet; Misterton north and south stations, and Heathersedge station being 64,462, 73,322, and 92,227 feet respectively distant. The spire of Loughton en le Morthen church being found to bear only 1° 56′ 8″ W. of the south meridian of Clifton station, the spindle of its weathercock was made use of as a meridian mark, for adjusting the zenith-sector, when the same was erected on the 19th of July, 1802, on a spot $3\frac{1}{2}$ feet south of the station at Clifton, by setting off that arc on the azimuth circle of the instrument; between the above date and the 19th of August, the following zenith distances of stars were carefully observed as they passed the meridian, *viz.* 15 of β Draconis, the mean of which gave 1° 0′ 17″.84 S.; 15 of γ Draconis, which gave 1° 56′ 26″.64 S.; 9 of 45 *d* Draconis, which gave 3° 26′ 22″.92 N.; 11 of 46 *c* Draconis, which gave 1° 53′ 6″.24 N.; 9 of 51 Draconis, which gave 0° 21′ 38″.12 N.; 6 of μ Draconis, which gave 1° 16′ 38″.20 N.; 3 of 16 Draconis, wich gave 0° 7′ 51″.25 S.; 14 of 1 κ Cygni, which gave 0° 27′ 0″.32 S.; 12 of 10 ι Cygni, which gave 2° 8′ 42″.22 S.; one of γ Ursæ, which gave 1° 20′ 13″.53 N.; 5 of η Ursæ, which gave 3° 9′ 6″.98 S.; 5 of ζ Ursæ, which gave 2° 30′ 10″.37 N.; 8 of 85 ι Herculis, which gave 7° 20′ 24″.98 S.; 4 of 52 Herculis, which gave 7° 7′ 25″.52 S.; 6 of τ Herculis, which gave 6° 40′ 1″.29 S.; 5 of α Persei, which gave 4° 18′ 36″.02 S.; and 5 of Capella, which gave 7° 40′ 25″.66 S.

Comparing these, with 10 of these stars' zenith distances, observed by help of this zenith-sector at Greenwich royal observatory (for the remaining star, 15 ι Herculis, seems either to have been mistaken in the observation for some other small star, or its z.d. to have been wrong observed near 1′) we get 1° 58′ 52″ for the difference of latitude between Greenwich and Clifton; whence, the latitude of Clifton station is found 53° 27′ 32″, and its longitude appears to be 1° 12′ 23″.6 W. of Greenwich. The elevation of Clifton station above the level of the sea is not given, but we are told that from thence the apparent depression of Gringley station was 18′ 47″, and the apparent elevation of Heathersedge station 29′ 12″. The singular result of the measurement of the different parts of the arc between Dunnose and Clifton, wherein the lengths of degrees decrease instead of increasing, as they ought to do on a flattened ellipsoid, presents matter of curious investigation, and may, perhaps, furnish some data for ascertaining the arrangement of the gravitating masses of which the earth is composed. We wish that the zenith-sector were used at more of the intermediate stations, in order to discover more exactly the law of decrease in the British degrees.

CLIKAPOTIN, a town of Poland, in the palatinate of Volhynia; 72 miles E. of Lucko.

CLIMA, in *Ancient Geography*, a term used under the Lower Empire for a division of provinces.

CLIMA *Anatolicum*, an episcopal see of Asia, in Phœnicia, near mount Libanus, under the metropolis of Edessa. —— *Anatolis*, an episcopal see of Asia, in Arabia. —— *Anzitines*, a place of Asia, in the Fourth Armenia. —— *Asianicæ*, a place of Asia in the same province. —— *Bilabitensis*, a place of the same province. —— *Digesenes*, a place in the same province. —— *Gablanim*, or *Galanis*, an episcopal see of Asia, under the metropolis of Scythopolis. —— *Garenes*, an episcopal see of Asia, in the 4th Armenia. —— *Imbrudorum*, an episcopal see of Asia, in the Phœnicia of Libanus, under the metropolis of Edessa. —— *Magludorum*, an episcopal place in Asia, in the Phœnicia of Libanus, under the metropolis of Edessa. —— *Mamuzurarum*, an episcopal see of Asia, in the 4th Armenia. —— *Mesticon*, one of the five towns of the prefecture of Thrace. —— *Orientalium* et *Occidentalium*, an episcopal see of Arabia. —— *Orzianices*, an episcopal see of Asia, in the 4th Armenia. —— *Sophenes*, an episcopal place of Asia, in the same province.

CLIMACÆ, a place in the island of Eubœa, mentioned by Hesychius.

CLIMACIDES, among the Greeks, were women servants who assisted their mistresses to get on horseback, by serving as steps for them to ascend by.

CLIMACTERIC, *Annus* CLIMACTERICUS, a critical year, or period, in a man's age, wherein, according to astrologers, there is some very notable alteration to happen in the body; and a person is exposed to great danger of death. The word comes from κλιμακτηρ, or κλιμακτηρικος, of κλιμαξ, κλιμακος, *scala*; q. d. *by a scale*, or *ladder*.

The first climacteric is, according to some, the seventh year of a man's life; the rest are multiples of the first, as 14, 21, 49, 56, 63, and 84; which two last are called the *grand climacterics*, and the dangers here are supposed more imminent.

The opinion has a great deal of antiquity on its side. Aulus Gellius says, it was borrowed from the Chaldeans; who might probably receive it from Pythagoras, whose philosophy turned much on numbers; and who imagined an extraordinary virtue in the number 7.

Marc. Ficinus gives us the foundation of the opinion: he tells us, there is a year assigned for each planet to rule over the body of man, each in his turn: now Saturn being the most maleficent planet of all, every seventh year, which falls to his lot, becomes very dangerous; especially those of 63 and 84, when the person is already advanced in years.

Some

Some hold, according to this doctrine, every ſeventh year an eſtabliſhed climacteric; but others only allow the title to thoſe produced by the multiplication of the climacterical ſpace by an odd number, 3, 5, 7, 9, &c. Others obſerve every ninth year as a climacteric.

Hevelius has a volume under the title of Annus Climactericus, deſcribing the loſs he ſuſtained in the burning of his obſervatory, &c. which it ſeems happened in his firſt *grand climacteric*.

Suetonius ſays, Auguſtus congratulated his nephew upon his having paſſed his firſt grand climacteric, whereof he was very apprehenſive.

Some pretend that the climacteric years are alſo fatal to political bodies; which perhaps may be granted, when it is proved that they are ſo to natural ones.

Authors on this ſubject, are Plato, Cicero, Macrobius, Aulus Gellius, among the ancients; Argol, Magirus, and Salmaſius, among the moderns. And St. Auguſtine, St. Ambroſe, Beda, and Boetius, countenance the opinion.

CLIMATARCHÆ, Κλιματαρχαι, were governors of provinces to the Greek emperors.

CLIMATE, Clima, or Clime, in *Geography*, a part of the ſurface of the earth, bounded by two circles parallel to the equator, and of ſuch a breadth, as that the longeſt day in the parallel near the pole exceeds the longeſt day in that next the equator by ſome certain ſpace; *viz.* half an hour, an hour, or a month.

The word comes from κλιμα, *inclinamentum*, an *inclination;* becauſe the difference of climates ariſes from the different inclination or obliquity of the ſphere.

The beginning of the climate is the parallel circle wherein the day is the ſhorteſt; and the end of it is that wherein the day is the longeſt. The climates therefore are reckoned from the equator to the pole; and are ſo many bands, or zones, terminated by lines parallel to the equator: though, in ſtrictneſs, there are ſeveral climates in the breadth of one zone. Each climate only differs from its contiguous ones, in that the longeſt day in ſummer is longer or ſhorter, *e. g.* by half an hour, in the one place than in the other.

As the climates commence at the equator, the firſt climate, at its beginning, has its longeſt day preciſely twelve hours long; at its end, twelve hours and an half; the ſecond, which begins where the firſt ends, *viz.* at twelve hours and an half, ends at thirteen hours; and ſo of the reſt, as far as the polar circles, where thoſe, which the geographers call *hour-climates* terminate, and *month climates* commence.

As an *hour-climate* is a ſpace compriſed between two parallels of the equator, in the firſt of which the longeſt day exceeds that in the latter by half an hour; ſo the *month climate* is a ſpace terminated between two circles parallel to the polar circles, whoſe longeſt day is longer or ſhorter than that of its contiguous one by a month, or thirty days.

The ancients, who confined the climates to what they imagined the habitable parts of the earth, only allowed of ſeven. The middle of the firſt northern climate they made to paſs through Meroe; the ſecond through Syene; the third through Alexandria; the fourth through Rhodes; the fifth through Rome; or, according to others, through the Helleſpont; the ſixth through the mouth of the Boryſthenes; and the ſeventh through the Riphæan mountains. The ſouthern part of the earth being then very little known; the ſouthern climates received their names from the northern ones, to which they did in ſuch a manner correſpond, that they were as far diſtant from the equator ſouthward as the others were northward. The moderns, who have failed farther toward the poles, make thirty climates on each ſide: and in regard the obliquity of the ſphere makes a little difference in the length of the longeſt day; inſtead of half an hour, ſome of them only make the difference of climates a quarter.

A parallel is ſaid to paſs through the middle of a climate, when the longeſt day in that parallel differs a quarter of an hour from the longeſt day in either of the extreme parallels that bound the climate; this parallel does not divide the climate into two equal parts, but the part neareſt to the equator is larger than the other; becauſe the farther we go from the equator, the leſs increaſe of latitude will be ſufficient to increaſe the length of the longeſt day, a quarter of an hour; in the middle parallel of the firſt climate the longeſt day is 13 hours; in the middle of the ſecond climate, 13 hours and a half; in the middle of the third, 14 hours, &c. We may obſerve that every climate has three parallels, which mark the beginning, the middle, and the end of it; and that the parallel which marks the end of every preceding climate is the beginning of that which is immediately ſubſequent. Some of the ancients divide the earth by theſe parallels, and ſometimes by a parallel, they do not mean a mere linear circle, but a ſpace of ſome breadth; in which ſenſe a parallel is the ſame as half a climate, and ſhews the difference of a quarter of an hour in the length of the longeſt day.

In fixing the climates, there ordinarily is no regard had to the refraction.

Varenius gives us a table of thirty climates; but without any regard to the refraction. Ricciolus furniſhes a more accurate one, wherein the refractions are allowed for: an abſtract of which follows:

A Table of Climates.

Middle of Climate.	Longest Day.		Latitude.		Climates.	Longest Day.		Latitude.		Middle of Climate.	Latitude.		N. Lat. Continual Day.	N. Lat. Continual Night.	S. Lat. Continual Day.	S. Lat. Continual Night.
I	12h	30	7	18	VIII	16	0	45	1	XV	66	33	31d	27d	30d	28d
II	13	0	15	36	IX	17	0	53	46	XVI	69	30	62	58	60	59
III	13	30	23	8	X	18	0	57	44	XVII	73	0	93	87	89	88
IV	14	0	29	49	XI	19	0	60	39	XVIII	78	6	124	117	120	118
V	14	30	35	35	XII	20	0	62	4	XIX	84	0	156	148	150	149
VI	15	0	40	32	XIII	22	0	63	10	XX	90	0	188	180	178	177
VII	15	30	44	42	XIV	24	0	65	54							

Vulgarly,

Vulgarly, the term climate is beftowed on any country or region differing from another, either in refpect of the feafons, the quality of the foil, or even the manners of the inhabitants; without any regard to the length of the longeft day.

Abulfeda, an Arabic author, diftinguifhes the firft kind of climates by the term *real climates;* and the latter by that of *apparent climates*.

The temperature of any climate, although it fhould feem to depend principally on latitude, or diftance from the equator, and the confequent more vertical or more oblique incidence of the rays of the fun, is, neverthelefs, very materially affected by a variety of collateral circumftances; fuch as the fituation, whether it be high or low, the nature of the foil, the extent of the continent, the vicinity of mountains, forefts, marfhes, lakes, and feas, and the direction of the winds. The influence of thefe is, however, on various accounts lefs confiderable in the greater part of the ancient continent than in that of America, where the rigour of the frigid zone extends over half of that which fhould be temperate by its pofition; and where lands, fituated in the fame parallel with the moft fertile and beft cultivated provinces in Europe, are chilled with perpetual frofts, which almoft deftroy the power of vegetation. Thus, Newfoundland, part of Nova Scotia, and Canada, lie in the fame parallel with France; and yet, in every part of thefe the water of the rivers is frozen during winter to the thicknefs of feveral feet; the earth is covered with fnow as deep; almoft all the birds fly during that feafon, from a climate where they could not live. The country of the Efquimaux, part of Labrador, and the countries on the fouth of Hudfon's bay, are in the fame parallel with Great Britain; and yet, in all thefe the cold is fo intenfe, that even the induftry of the Europeans has not attempted cultivation. As we proceed to thofe parts of America, which lie in the fame parallel with provinces of Afia and Africa, poffeffing genial warmth, eminently favourable to life and vegetation, the dominion of cold prevails, and winter, during its fhort period, often reigns with extreme feverity. In advancing along the American continent into the torrid zone, the excefs of its fervour will be found in a confiderable degree mitigated by the cold of this continent. While the negro on the coaft of Africa is fcorched with unremitting heat, the inhabitant of Peru breathes a mild and temperate air, and is fhaded under a canopy of grey clouds, which intercepts the fierce beams of the fun, without obftructing his friendly influence. Along the eaftern coaft of America, the climate, though more fimilar to that of the torrid zone in other parts of the earth, is, neverthelefs, confiderably milder than in thofe countries of Afia and Africa which lie in the fame latitude. If, from the fouthern tropic, we continue our progrefs to the extremity of the American continent, we meet with frozen feas, and countries that are barren and fcarcely habitable for cold, fooner than in the north. M. de Paw, in his "Recherches Philofophiques fur les Americains," cited by Dr. Robertfon, (Hift. Amer. vol. ii. p. 472.) fuppofes, that the difference in heat between America and the old continent is equal to 12 degrees, and that a place 30° from the equator, in the latter, is as warm as one fituated 18° from it in the former. Dr. Mitchell alfo, after obfervations carried on during 30 years, contends, that the difference is equal to 14 or 15 degrees of latitude; or that it is as hot in the countries of the old continent at 29 or 30 degrees, as in the countries of the new continent, which are at 15 degrees. The abbé Clavigero, in his "Hiftory of Mexico," (p. 263.) difputes thefe facts; and he fays, that as there are many countries in America more cold than others of the old continent equi-diftant from the equator, there are alfo others more hot. Agra, the capital of Mogul, and the port of Loretto in California, are nearly in the fame latitude, and ftill the heat of that Afiatic city is not comparable to that of the American port. Hüe, the capital of Cochin-China, and Acapulco, are almoft equidiftant from the equator, and yet the air of Hue is cool, in comparifon of that of Acapulco. M. de Paw has alfo affirmed, that in the centre of the torrid zone the liquor of the thermometer does not rife to fo great a height as it does in Paris in the greateft heat of fummer; to which Clavigero replies, that if that were true, the difference between the American and European climates would not be only 12°, as M. de Paw would make it, but 49°, that is, as much as the difference of latitude between the centre of the torrid zone and Paris. It is true, fays the abbé, that according to the obfervations made in Quito, compared with thofe made in Paris, the heat of that equinoctial city never equals that of Paris in the fummer; but it is equally certain that, according to the obfervations made by the fame academicians with the fame thermometers, in the city of Carthagena, which is not the centre of the torrid zone, but ten degrees from it, the ufual heat of this city is equal to the greateft heat of Paris, agreeably to the teftimony of Ulloa, one of the obfervers. We fhall here add, as the refults of obfervations of M. de Paw, that the climate of America is not fo various as that of Europe; and, of courfe, that the inhabitants of the New World are not, like thofe of the greater part of Europe, obliged to endure the alternate extremes of exceffive cold and intolerable heat.

Thofe who maintain that the climate of America is extremely different from that of the ancient continent enumerate a variety of caufes that have combined to produce this difference. Although the utmoft extent of America towards the north be not yet difcovered, it is allowed that it advances much nearer to the pole than either Europe or Afia. The latter have large feas to the north, which are open during part of the year; and even when covered with ice, the wind that blows over them is lefs intenfely cold than that which blows over land in the fame high latitudes. But in America the land ftretches from the river St. Lawrence towards the pole, and fpreads out immenfely to the weft. A chain of enormous mountains, covered with fnow and ice, runs through all this dreary region. The wind, in paffing over fuch an extent of high and frozen land, acquires a piercing keennefs, which it retains in its progrefs through warmer climates, and is not entirely mitigated until it reach the gulf of Mexico. Over all the continent of North America, a north-wefterly wind and exceffive cold are fynonymous terms. Even in the moft fultry weather, the moment that the wind veers to that quarter, its penetrating influence is felt in a tranfition from heat to cold, no lefs violent than fudden. To this powerful caufe we may afcribe the extraordinary dominion of cold, and its violent inroads into the fouthern provinces in that part of the globe. Befides, in that portion of the American continent which lies between the tropics, the wind blows in an invariable direction from eaft to weft. As this wind holds its courfe acrofs the ancient continent, it arrives at the countries which ftretch along the weftern fhore of Africa, inflamed with all the fiery particles which it hath collected from the fultry plains of Afia, and the burning fands in the African deferts. Accordingly, the coaft of Africa is the region of the earth which feels the moft fervent heat, and is expofed to the unmitigated ardour of the torrid zone. But this fame wind which brings fuch an acceffion of warmth to the countries lying between the river of Senegal and Cafraria, traverfes the Atlantic ocean, before it reaches the American fhore. In its paffage over this vaft body of water it is cooled, and is felt as a refrefhing gale along the coaft of

Brasil and Guiana, rendering these countries, which are reckoned among the warmest in America, temperate, when compared with those which lie opposite to them in Africa. As this wind advances in its course across America, it meets with immense plains, covered with impenetrable forests, or occupied by large rivers, marshes, and stagnating waters, where it can recover no considerable degree of heat. At length it arrives at the Andes, which run from north to south through the whole continent. In passing over these elevated and frozen summits, it is so thoroughly cooled, that the greater part of the countries beyond them scarcely feels the ardour to which they seem exposed by their situation. Acosta appears to have been the first philosopher, who endeavoured to account for the different degrees of heat in the old and new continents, by the agency of the winds which blow in each. M. de Buffon has adopted this theory and embellished it by his descriptive eloquence; it has also been illustrated by later writers, in their inquiries concerning the temperature of various climates, as we shall find in the sequel of this article. Professor Robison furnished the elegant and popular historian of America with a variety of observations, elucidating this theory. To this purpose he observes, that, when a cold wind blows over-land, it must in its passage rob the surface of some of its heat; and thus the coldness of the wind is abated. But continuing to blow in the same direction, it will, by degrees, pass over a surface already cooled, and lose no degree of its keenness; and advancing over a large tract of land, it will occasion the severity of intense frost. If the same wind be supposed to blow over an extensive and deep sea, the superficial water must be immediately cooled to a certain degree, and the wind proportionably warmed. But the superficial and colder water becoming specifically heavier than the warmer water below it, descends; the warmer supplies its place, which, being cooled in its turn, continues to warm the air which passes over it, or to diminish its cold. This change of the superficial water, (and successive ascent of that which is warmer, and consequent successive abatement of coldness in the air,) is aided by the agitation caused in the sea by the mechanical action of the wind, and also by the motion of the tides. By this process, the rigour of the wind will continue to decrease until the whole water is so far cooled, that the water on the surface is no longer removed from the action of the wind, fast enough to hinder it from being arrested by frost. Whenever the surface freezes, the wind is no longer warmed by the water from below, and it goes on with undiminished cold. These principles serve to explain the severity of winter frosts in extensive continents; their mildness in small islands; and the superior rigour of winter in those parts of North America, with which we are best acquainted. In the N.W. parts of Europe, the severity of winter is mitigated by the west winds, which usually blow in the months of November, December, and part of January. On the other hand, when a warm wind blows over land, it heats the surface, which must therefore cease to abate the fervour of the wind. But, the same wind, blowing over water, agitates it, brings up the colder water from below, and thus is continually losing some of its own heat. After all, the great power of the sea to mitigate the heat of the wind or air passing over it, proceeds from the following circumstance; that on account of the transparency of the sea its surface cannot be heated to a great degree by the sun's rays; whereas the ground, subjected to their influence, very soon acquires great heat. When, therefore, the wind blows over a torrid continent, it is soon raised to a heat almost intolerable; but during its passage over an extensive ocean, it is gradually cooled; so that on its arrival at the farthest shore, it is again fit for respiration. These principles will account for the sultry heat of large continents in the torrid zone; for the mild climates of islands in the same latitude; and for the superior warmth in summer which large continents, situated in the temperate or colder zones of the earth enjoy, when compared with that of islands. The heat of a climate depends not only upon the immediate effect of the sun's rays, but on their continued operation, on the effect which they have formerly produced, and which remains for some time in the ground. Thus the day is warmest about two in the afternoon, the summer warmest about the middle of July, and the winter coldest about the middle of January.

The temperate climate in the equatorial parts of America is greatly owing to the forests which cover the country, and hinder the sun-beams from heating the ground; the ground, not being heated, cannot heat the air; and the leaves, which receive the rays intercepted from the ground, have not a mass of matter sufficient to absorb heat enough for the purpose. Besides, it is a known fact, that the vegetative power of a plant occasions a perspiration from the leaves, in proportion to the heat to which they are exposed; and from the nature of evaporation, this perspiration produces a cold in the leaf proportional to the perspiration. Thus the effect of the leaf in heating the air in contact with it is prodigiously diminished. See also Dr. Williamson's Observations on the effects of the agency of winds in reference to the temperature of different climates, in the first volume of the "Transactions of the American Philosophical Society," p. 272, &c. For a further account of the causes that produce a change in the temperature of the air; see the article *Temperature of the* ATMOSPHERE.

But to return from this digression on the effect of winds: We may observe that in the other provinces of America, from Terra Firma westward to the Mexican empire, the heat of the climate is tempered, in some places, by the elevation of the land above the sea; in others, by their extraordinary humidity; and in all, by the enormous mountains scattered over this part. The islands of America, in the torrid zone, are either small or mountainous, and are fanned alternately by refreshing sea and land breezes.

The causes of the extraordinary cold that prevails towards the southern limits of America, and in the seas beyond it, cannot be ascertained in a manner equally satisfactory. It was long supposed, that a vast continent, distinguished by the name of "Terra Australis Incognita," lay between the southern extremity of America and the Antarctic pole. The same principles which account for the extraordinary degree of cold in the northern regions of America were adopted in order to explain that which is felt at Cape Horn, and the adjacent countries. The immense extent of the southern continent, and the large rivers which it poured into the the ocean, were admitted by philosophers as causes sufficient to occasion the unusual sensation of cold, and the still more uncommon appearances of frozen seas in that region of the globe. But as such a continent is imaginary, and the space supposed to be occupied by it is an open sea, new conjectures must be formed with respect to the causes of a temperature of climate, so extremely different from that which we experience in countries removed at the same distance from the opposite pole. Of the extraordinary degree of cold, that occurs in southern latitudes, many instances are recorded. In lat. 48° some French voyagers, in 1739, found islands of floating ice; and a considerable degree of cold was experienced in lat. 44°. Dr. Halley found ice in lat. 59°. Commodore Byron, in lat. 50° 33′ S. of the coast of Patagonia, on the 15th of December, nearly midsummer in that part of the globe, compares the climate to that of England in the middle of winter.

When

When Mr. (fir Jofeph) Banks and his companions landed on Terra del Fuego, in the bay of Good Succefs, lat. 55°, Jan. 16 correfponding to July in our hemifphere, two of his attendants died in one night of extreme cold, and the whole party was in great danger of perifhing. On the 14th of March the mountains were covered with fnow. Capt. Cook, in his voyage towards the S. pole, expreffes his furprife, that an ifland of no greater extent than 70 leagues in circuit, between the latitudes of 54° and 55°, fhould in the very height of fummer be in a manner wholly covered many fathoms deep with frozen fnow; but more efpecially the S. W. coaft. The very fummits, he fays, of the lofty mountains were cafed with fnow and ice; but the quantity that lay in the vallies is incredible; and at the bottom of the bays, the coaft was terminated by a wall of ice of confiderable height. The moft obvious and probable caufe of the fuperior degree of cold, towards the fouthern extremity of America, feems to be the form of the continent there. Its breadth gradually decreafes as it ftretches from St. Antonio fouthwards, and from the bay of St. Julian to the ftraits of Magellan its dimenfions are much contracted. On the eaft and weft fides, it is wafhed by the Atlantic and Pacific oceans. From its fouthern point an open fea probably extends to the Antarctic pole. In whichever of thefe directions the wind blows, it is cooled before it approaches the Magellanic regions, in paffing over a great body of water; nor is the land there of fuch extent that it can recover any confiderable degree of heat in its progrefs over it. Thefe circumftances concur in rendering the temperature of the air in this diftrict of America more fimilar to that of an infular than to that of a continental climate, and hinders it from acquiring the fame degree of fummer heat, with places in Europe and Afia, in a correfponding northern latitude. The north wind is the only one that reaches this part of America, after blowing over a great continent; and this wind, though it blows over land, does not bring to the fouthern extremity of America, which is properly the termination of the immenfe ridge of the Andes, an increafe of heat, collected in its paffage over torrid regions; but before it arrives there, it muft have fwept along the fummits of the Andes, and comes impregnated with the cold of that frozen region. Befides, though the idea of a fouthern continent in that region of the globe which it was fuppofed to occupy is abandoned, it neverthelefs appears from Capt. Cook's difcoveries, that there is a large tract of land near the fouth pole, which is the fource of moft of the ice fpread over the vaft fouthern ocean. Whether, fays Dr. Robertfon, the influence of this remote frozen continent may reach the fouthern extremity of America, and affect its climate, is an inquiry not unworthy of attention. See ICE *iflands*.

Having confidered the variety of temperature to which different climates are fubject, we fhall next proceed to evince the change to which they have been fubject in different intervals of time, and to fpecify the moft obvious caufes of this change. This is a fubject to which various authors, both ancient and modern, have directed their attention; among thefe we may mention M. de Buffon, Hume, the Abbé du Bos, M. Pelloutier, the Hon. Daines Barrington, Dr. Williamfon of America, and Dr. Robertfon; but they have generally written on the fubject in a curfory manner. The moft complete differtation which we have feen, is that of the Abbé Mann, in the 6th volume of the "Tranfactions of the Electoral Academy of Sciences at Manheim." The firft part of this elaborate differtation is employed in demonftrating the fact, that a change of temperature and foil has actually taken place in the climates of Europe; and the fecond part contains an inquiry into the phyfical caufes of this change. The firft teftimony to the fact is that of Herodotus, who informs us, more than once, that in the European part of Scythia, in the Palus Mæotis, the winter continued eight months every year with almoft infupportable feverity; and that the countries farther northwards were on that account uninhabitable; and he adds, that the other four months, called fummer, were alfo exceedingly cold. In this country, which lies between the 44th and 50th degree of N. latitude, nothing of the like kind has taken place for a long time. Cæfar, Virgil, Diodorus Siculus, Ovid, Strabo, Pomponius Mela, Seneca, Petronius, Pliny the naturalift, Statius, Herodian, and Juftin, all fpeak to the fame purpofe of the infupportable cold of the winter in different parts lying in the fame latitude of from 44 to 50 degrees between Gaul and the Euxine fea. The defcriptions they concur in giving are fuch as would at prefent fuit thofe countries which lie between 56 degrees of latitude and the polar circle; and in fome refpects they feem to exceed the cold of the winter in Sweden and Norway. Indeed, their defcriptions of the climate of the middle part of Europe could at prefent be realized only in Lapland, Siberia, and thofe regions of America that lie to the north of Hudfon's bay, where the ftate of the climate is the fame with that which was found 2000 years ago on the banks of the Rhine and the Danube, the Palus Mæotis, the Dnieper, and the Don. The firft effect of the winter's cold in that whole part of Europe between the 44th and 50th degrees of latitude, uniformly mentioned by the ancients, is, that all the feas, lakes, and rivers contained in thofe diftricts were continually frozen, fo that armies of barbarians, Scythians and Sarmatians, paffed with their horfes, waggons, and baggage over the ice, in order to plunder the more fouthern countries. This is exprefsly afferted by Herodotus, Virgil, Ovid, and Strabo, of the European part of Scythia, Dacia, and Thrace, all of them countries which lay in a northern and weftern direction from the Palus Mæotis and the Euxine fea. The fame thing is afferted by Diodorus Siculus, Seneca, Pliny the younger, Florus, Herodian, Ammianus Marcellinus, Fernandez the Goth, and Xiphilinus the abridger of Dio Caffius, in regard to the rivers and lakes of Pannonia, Germany, and Gaul. In the treatife on rivers, afcribed to Plutarch, it is faid, that the Thermodon, a Scythian river, froze even in fummer; a circumftance which never happens at prefent with regard to the rivers of Siberia, Lapland, and Greenland. Ovid tells us, that he himfelf paffed over the Pontus Euxinus on the ice, and that oxen and carriages paffed over it. Plutarch fays, that the preffure of this enormous mafs of ice againft the fides of fhips frozen into it, crufhed them to pieces; and he mentions an inftance of a Roman fhip which had experienced the fame fate in the Danube. Strabo and Virgil fpeak of brafs veffels that burft by the expanfive force of the ice; and we are affured by Virgil and Ovid, that the people in Thrace and on the Danube cut the wine with axes, and diftributed it in folid portions.

> "Udaque confiftunt formam fervantia teftæ
> Vina, nec haufta meri, fed data frufta, bibunt."
> Ovid. lib. iii. el. 10.

They likewife add, that men's hair and beards were often covered with ice.

> "Cæduntque fecuribus humida vina.—
> Stiriaque impexis indurant horrida barbis."
> Virgil, Georg. l. iii.

> "Sæpe fonant moti glacie pendente capilli,
> Et nitet inducto candida barba gelu." Ovid.

If

If we compare this deſcription with the preſent ſtate of France, Germany, Hungary, Romania, Tranſylvania, Wallachia, Moldavia, Bulgaria, Leſſer Tartary, Podolia, and the Ukraine, it will be found that the preſent temperature of theſe countries has no reſemblance to what it was 2000 years ago. Moreover, Herodotus, Pomponius Mela, and Pliny the elder, ſpeak of the European part of Scythia as if its atmoſphere were continually filled with ſnow and fogs, which prevented the view of the neareſt objects, and obſcured the light of day. Diodorus Siculus ſpeaks of Celto-Scythia as covered with ſnow in the winter time; and this relation is confirmed by Florus and Petronius. Virgil, ſpeaking of Thrace and the countries on both ſides of the Danube, ſays, that a continual winter prevailed in them; and that the ſnow lay upon the ground ſometimes to the depth of 7 ells. Ovid ſays that at Tomi, lat. 44½°, placed by Dr. Wells, in his maps of Ancient Geography, in the 44th degree of N. latitude, the ſnow continued 2 years without being melted by the ſun or rain. Diodorus Siculus, Tacitus, and Ovid, when they ſpeak of Gaul, Germany, and Thrace, take notice of the prodigious force of the wind which prevailed in theſe countries in theſe times, and during the preceding centuries. Theſe winds raiſed even ſtones and men from the earth; carried away the roofs of houſes; tore up trees by the roots, and overturned turrets and houſes. Varro, Diodorus Siculus, Ovid, Pomponius Mela, Seneca, Petronius, Pliny the elder, Tacitus, Appian, Dio Caſſius, and Herodian, all agree in ſaying that the ſeverity of the climate and weather, which in their time prevailed in Gaul, Germany, Pannonia, Thrace, Moeſia, and Dacia, would hardly allow the culture of vines, olives, or any kind of fruit trees: and that, in cultivating them, it was neceſſary to cover them with dung, or with earth, to preſerve them throughout the winter. It is obſerved by Herodotus, Strabo, and Tacitus, that the oxen in the European part of Scythia and the country of the Celto-Scythians had no horns, or horns exceedingly ſmall; which they aſcribed to the ſeverity of the cold and climate. Strabo, as a proof of the great cold which prevailed in the country now called the Ukraine, obſerves, that it produced no aſſes;—animals, ſays he, that cannot endure the cold; and he adds, that the horſes there are extremely ſmall. Pauſanias expreſsly ſays, that in Thrace there were in his time bears and wild ſwine of a white colour. Such animals are found at preſent only in the remoteſt parts of the north, on the other ſide of the polar circle. Virgil, Ovid, and Pomponius Mela, inform us, that the inhabitants of the European part of Scythia and Thrace lived, during the whole winter, under the earth, as the Laplanders do at preſent; that they burnt large logs of wood to keep themſelves warm; that they never went abroad without being wrapped in ſkins; and that they left no part of the body uncovered but the mouth and eyes.

As a farther evidence of a change of climate, it has been alleged, that the rein-deer, from which the ſavage of the north derives the beſt comforts of his dreary life, is of a conſtitution that ſupports, and even requires the moſt intenſe cold. He is found in the rocks of Spitzberg, within 10 degrees of the pole; he ſeems to delight in the ſnows of Lapland and Siberia; but, at preſent, he cannot ſubſiſt, much leſs multiply, in any country to the ſouth of the Baltic; whereas in the time of Cæſar (vid. De Bell. Gallic. vi. 23, &c.) the rein-deer, as well as the elk and the wild bull, was a native of the Hercynian foreſt, which then overſhadowed a great part of Germany and Poland.

With a view of aſcertaining the boundaries of the northern countries, which the ancients deemed deſolate and uninhabitable on account of the great intenſity of the cold, we learn from Herodotus, that beyond the Melanchlini, a Sarmatian people, ſo called from their black hair, there were only lakes, moraſſes and unoccupied diſtricts as far as was then known; and we learn alſo from Ovid, that on the other ſide of the Cimmerian Boſphorus, the Tanais, and the Scythian moraſſes, a cold prevailed which rendered the country uninhabitable. Strabo repeatedly ſays, that all the lands towards the north of the tribes, who lived on the banks of the Tanais and the Boryſthenes, were uninhabitable on account of the ſeverity of the cold. This river, as far as it has been traced, does not lie beyond the 55th degree of latitude; and therefore it is on the ſame parallel with the northern parts of England and Germany, the middle of Lithuania, and the middle of Ruſſia. Strabo alſo ſays, that the whole northern part of Britain was very thinly peopled on account of the cold, and that he believed all the countries lying beyond it to be uninhabited. As no part of Great Britain extends beyond the 60th degree of north latitude, that parallel muſt include all Norway, almoſt the whole of Sweden, and the half of Ruſſia. Theſe countries, therefore, in the time of Strabo, that is, about the period of Auguſtus, were conſidered as uninhabited. The ancients, in general, ſpeak of all the lands which lay beyond the 55th degree of N. latitude as filled with lakes, moraſſes, ice, ſnow, and fogs, almoſt like thoſe countries to the north of Hudſon's Bay. From the authorities above cited, we derive ſufficient evidence of the exceſſive ſeverity which prevailed 2000 years ago in the climate of thoſe countries of Europe, lying between 44° and 50° N. lat. and of the difference between the ſtate of their temperature in that period and the preſent. The more northern lands, which the ancients, on account of their inſupportable cold, conſidered as uninhabitable; Iceland, Norway, Lapland, and the northern part of Ruſſia, and Siberia; are habitable, and actually inhabited, though exceſſively cold. The ancients alſo ſpeak of effects produced by the cold of winter in Italy, Greece, Leſſer Aſia, &c. which at preſent are certainly unknown. The ſoil of the latter countries, as well as that of the ancient Aſſyria, Chaldæa, Paleſtine, the Roman part of Africa, and Spain, is at preſent remarkably ſtony, and burnt up with heat. We know, however, that Spain in particular, about 1800 years ago, was exceedingly rich and fruitful, and abounded with all ſorts of proviſions, which are no longer to be found in it. The change of the ſoil and fertility in all the countries bordering on the Mediterranean Sea, and which formed the greateſt and moſt beautiful part of the Roman empire, is admitted as a certain fact, by all thoſe who have ſpoken of their former and preſent ſtate.

Upon the whole it may be affirmed as an unqueſtionable truth, that the ſoil and temperature of all the lands from Spain to India, and from the ridge of mount Atlas to Lapland and the remote parts of the north, have, in the courſe of ages, ſince the period of the oldeſt hiſtorical monuments ſtill extant to the preſent time, been gradually ſubjected to a complete change, from the utmoſt degree of moiſture and cold, to a great degree of dryneſs and warmth. The effect has been conſtant and uniform, and muſt therefore be traced to a correſponding cauſe. Dr. Williamſon (ubi ſupra) aſſerts, that the climate of America is becoming continually milder; and he confirms the aſſertion by a number of facts. This effect, indeed, is directly contrary to the hypotheſis of the celebrated naturaliſt, Buffon, reſpecting the theory of the earth and planets, who aſſerts, that they have been continually loſing warmth, ſince they were firſt in a ſtate of fuſion, and are becoming always colder; ſo that they will at length be incapable of keeping alive any animal or vegetable production. All hiſtorical and phyſical monuments, however, prove the contrary.

It is not merely in modern times, and ſince the improvement

ment of natural philosophy, that this change of temperature and soil has been noticed. A great number of places, well known and described by the ancients, in Palestine, Syria, Lesser Asia, Greece, Italy, Spain, and Barbary, exhibit proofs of the changes which have taken place in the soil and temperature in the course of time. Their present dry and barren state is well known, and seems to be irremediable. Columella is the first author who speaks of vines in Gaul; and he says that the Sabines and the Romans in the preceding century had procured, amidst the devastation of war, more abundant crops than had been procured in his time during a state of perfect peace. With regard to the changes of climate his observation is remarkable. "I find," says he, "that it is the opinion of many respectable authors, that the quality and state of the atmosphere became changed in the course of a long series of ages: for Saserna, in that work which he has left on agriculture, infers that the state of the atmosphere is changed, because certain districts, which formerly were incapable of producing vines and olives on account of the continued severity of the winter, now yield abundant vintages and plenty of oil, by the climate having become milder and warmer."

Many different causes have been alleged in order to account for those alterations of climate which we have above recited. Of these some are only accidental, and have taken place in different countries at very different periods; while in others some of them have not occurred at all. Among these the principal are the draining of lakes and morasses, the extirpation of forests, and the cultivation of land. All the ancient writers who speak of the countries of Europe beyond 50° N. lat. represent them as filled with lakes and morasses, and covered with immense forests, almost as America, in various parts of it, is at present. But of late years the people of America have been employed in extirpating the forests, draining the marshes, and cultivating the land; and it is well known that the climate there is become milder and more temperate. In the same manner the inhabitants of all the northern parts of Europe have for a thousand or two thousand years employed themselves in the improvement of the soil; and thus they have contributed to ameliorate the climate, not only in the countries that were thus cultivated, but even in neighbouring regions exposed to the effects of their atmosphere. In the southern parts of Europe there also existed a great number of lakes and morasses, which must have rendered the air exceedingly cold and moist, and consequently unhealthful; but in later periods few of these have remained, if we except such as may still be found in Sweden and Norway; though the places where they existed, both in England and on the continent, in Gaul, Germany, and the European Sarmatia, may still be distinctly perceived. It is well known, that in the time of Julius Cæsar, and even long after, almost the whole of Germany and Sarmatia was covered with immense forests. The Hercynian forest in particular was sixty days' journey in length, commencing in Belgic Gaul near the sea and extending through Germany and Poland. These forests which covered the mountains and plains, and the lakes or marshes which occurred in almost every valley, must have vitiated the air; and it is obvious that a very considerable change must have been produced by clearing the woods and draining off the stagnant waters. Large and thick woods prevent the solar beams from penetrating into the soil, and warming it; whilst their fallen leaves and branches rot on the ground and occasion a thick crust which impedes the escape and diffusion of the internal heat. They also concentrate the cold and moist vapours, render them putrid, and corrupt the whole atmosphere. This we find from the account of Dr. Williamson to have been particularly the case in the middle colonies of North America; and the consequences were bilious and intermittent fevers in summer and autumn, and inflammatory fevers in winter. But when these countries were cleared and cultivated, and the land was rendered more open and dry, the prevalence of such fatal diseases was restrained and diminished. The case must formerly have been the same in Europe under the like circumstances, and similar causes must have contributed to render its climate milder and more salubrious. The progress of cultivation and of agricultural improvements, was, however, in a great degree obstructed by the dispositions and habits of the Celts and Sarmatians, who were the first occupiers of all the European countries, which lay to the north of Italy and Greece. Like the other barbarous people that descended from them under different names, and over-ran the Roman empire in the 5th and 6th centuries, they despised agriculture, and cultivated only land sufficient to supply the wants of the current year. They subsisted chiefly by hunting and by feeding on the flesh of domestic animals which they reared in great numbers; and attention to these objects was regarded by them as much more dignified and important than the cultivation of land. This error has been sufficiently detected and exposed by the practice of more modern times; as it has been found that the culture of the earth, by breaking and softening its surface, has thus rendered it capable of imbibing the rays of the sun in summer, and of affording a passage to the internal heat in winter, and accordingly contributed to preserve a continual equilibrium between the heat of the earth and that of the atmosphere. The contrary takes place in all uncultivated countries, especially when they are moist and covered with wood. It cannot justly be questioned that the gradual draining of the stagnant water in Celto-Scythia and European Sarmatia, together with the destruction of their large forests and the general cultivation of the fields in these countries, must have had an influence, not only on the state of their own climate, but also on the atmosphere of Greece and Italy. Those cutting north-winds which converted every thing into ice, and of which the Greeks and the Romans complain so much, have in a great measure ceased, since the principal causes that produced them no longer exist. As long as Germany, Pannonia, Dacia, Moesia, and Thrace remained uncultivated and covered with immense forests, their atmosphere was extremely cold, thick, and heavy, and had a considerable influence on that of Italy and Greece, in which, because they were more open and warm countries, the atmosphere was consequently far lighter. The exertions of this fluid to recover its equilibrium were the causes of the cutting north-winds, of which the Greeks and the Romans complained so much. But when the whole of Celto-Scythia and Sarmatia became more open and better cultivated, their atmosphere must have come nearer to an equilibrium with that of Greece and Italy, and consequently those streams of air from the north must have decreased in the same proportion. This is a circumstance which must have contributed to moderate the climate of Greece and of Italy, and to render it much milder than it was about 1800 or 2000 years ago: and to such a degree that, if there had been no other cause, we could no longer wonder at, or entertain a doubt of, the effects of the cold which the ancients remarked in their time, and which are not observed at present. The honourable Daines Barrington (See Phil. Trans. vol. 58.) having shewn by the authorities which we have already cited, contrasted against those of modern travellers, that the climate of Tomus or Tomi, supposed to be the same with the present Temesware, whither Ovid was banished, has undergone a very considerable change, urges this fact against the

the common obfervation, that the cultivation of a country will render the climate more temperate: "becaufe," he fays, "the adjacent country is now in the fame ftate that it was in the time of Ovid." He adds, "that Italy was better cultivated in the Auguftan age than it is now, which fhould confequently have made the temperature of the air more warm than it is now experienced to be. Virgil, in his "Georgics," is conftantly advifing precautions againft fnow and ice in the management of cattle; and fpeaking of Calabria, the moft fouthern part of Italy, he expreffes himfelf with regard to the rivers being frozen, as what was commonly to be expected. It appears alfo from the 6th fatire of Juvenal, that the Tyber's being commonly frozen in winter, fupplied the ladies of Rome with a very extraordinary inftance of implicit deference to the commands of the Egyptian priefts in the performance of their ablutions.

"Hybernum fracta glacie defcendet in amnem,
Ter matutino Tyberi mergetur ——"

In farther proof of the fact, that the Italian rivers were conftantly frozen over, a paffage is cited from Ælian (De Animal. lib. xiv. cap. 29.), which confifts of inftructions how to catch eels, whilft the water is covered with ice; whereas, if we may believe the concurrent accounts of modern travellers, it would be almoft as ridiculous to advife a method of catching fifh in the rivers of Italy, which depended entirely upon their being commonly frozen over, as it would be to give fuch directions to an inhabitant of Jamaica. Many paffages of Horace fuppofe the ftreets of Rome full of fnow and ice. The winters are now unqueftionably much more temperate at Rome than formerly. At prefent the Tyber no more freezes at Rome, than the Nile at Cairo. Indeed, the Romans term the winter very rigorous, if the fnow lie two days; and, if one fee for 48 hours a few icicles hang from a fountain that has a north expofure. To the facts above-mentioned, it may be fufficient to refer to what has been already obferved with regard to the influence of the winds; or to allege, that the cultivation of a country, though one, is not the only caufe of the amelioration of its climate. If it fhould be faid, that as the cold of winter decreafes, by the operation of the caufes now recited, the heat of fummer ought to increafe in the fame proportion; the abbé Mann admits the fact, and thinks it demonftrable by many monuments, hiftorical as well as phyfical, that the fum-total of the mean fummer heat is greater than it was formerly, and that it continually increafes, though at long intervals, and in an imperceptible manner. With refpect to that ftifling heat which is occafionally experienced even in Lapland, he thinks that it is leffened by all the caufes which diminifh the cold of winter. Experience teaches us, that the thinner, purer, and more elaftic the air is, the lefs, in the fame proportion, is the intenfity of the fummer heat; and, on the contrary, the thicker the atmofphere is, and the more it is filled with ftagnant and concentrated vapours, the heat is more intenfe and more ftifling. For this reafon it is always cooler on the fummits of high mountains, while a ftifling and infupportable heat prevails in the neighbouring plains, efpecially when they are furrounded with wood. This is always obferved in the favannahs of America. Dr. Williamfon concurs in this opinion, and obferves, that when the extenfive country of North America becomes entirely open, when its woods are cut down, and its plains cultivated, the feverity of the winter cold will not only decreafe, but the ftifling unhealthful heat of the fummer will be moderated. The quantity of fnow, ice, and moifture, is already evidently leffened; and many plants, which could not be cultivated there formerly, now thrive and fucceed. The abbé Mann alleges another, and, in his eftimation, principal caufe of the amelioration of climate, the agency of which is general and uniform, that is, an union of the two diftinct principles, moifture and heat. The principle of heat, he fays, increafed continually in the courfe of time, fo as to overcome the oppofite principles of moifture and cold, renders, by thefe means, the earth drier and fuller of ftones, and confequently increafes the fum of the degree of heat. Without this principle, it is his opinion, that we can never find fufficient grounds for the wonderful changes which have taken place in the nature of the foil of all thofe lands which border on the Mediterranean fea, which formed the ancient empire of Rome, from Syria to India, and which at prefent are all become uncommonly fruitful, dry, and ftony. The mere neglect of agriculture could never have produced thefe effects, and muft have been attended rather with effects of a contrary nature.

That the difference of climate has a very confiderable influence on the productions of the foil, and on the animals of every fpecies, that occupy particular diftricts of the globe, is a fact that has been very generally acknowledged. But the extent and degree of this influence are fubjects, with regard to which different writers have expreffed very different fentiments. Dr. Robertfon adopts the general ideas of count de Buffon, and M. de Paw, on this fubject; and in its relation to America, obferves, that the uncultivated ftate of the New World affected not only the temperature of the air, but the qualities of its productions. The principle of life, he fays, feems to have been lefs active and vigorous there than in the ancient continent. So that, notwithftanding the vaft extent of America and the variety of its climates, the different fpecies of animals peculiar to it are much fewer in proportion than thofe of the other hemifphere. Of 200 different kinds of animals, according to Buffon, fpread over the face of the earth, only about one-third exifted in America at the time of its difcovery. Befides, nature, it is faid, was not only lefs prolific in the new world, but fhe appears to have been likewife lefs vigorous in her productions. The animals originally belonging to this quarter of the globe appear to be of an inferior race, neither fo robuft nor fo fierce, as thofe of the other continent. The fame qualities in the climate of America, which ftinted the growth, and enfeebled the fpirit of its native animals, have proved pernicious to fuch as have migrated into it voluntarily from the other continent, or have been tranfported thither by the Europeans. Moft of the domeftic animals with which the Europeans ftored the provinces in which they fettled, have degenerated with refpect either to bulk or quality, in a country whofe temperature and foil feem to be lefs favourable to the ftrength and perfection of the animal creation. It is further alleged, that the fame caufes which checked the growth and the vigour of the more noble animals, have favoured the propagation and increafe of reptiles and infects, which multiply fafter, perhaps, in America than in other parts, and grow of a more monftrous bulk. The birds, alfo, of the new world, are not diftinguifhed by qualities fo confpicuous and characteriftical, as thofe which have been obferved in its quadrupeds; fo that fuch as are peculiar to America nearly refemble thofe with which mankind were acquainted in fimilar regions of the ancient hemifphere. The American birds of the torrid zone, like thofe of the fame climate in Afia and Africa, are decked in plumage, which dazzles the eye with the vivid beauty of its colours; neverthelefs, nature, fatisfied with clothing them in this gay drefs, has denied moft of them that melody of found, and variety of notes, which catch and delight the ear. In fome diftricts of America, the unwholefome temperature of the air feems to be unfavourable even to this part of the creation. The number of birds is lefs than in other countries, and

and the traveller is ſtruck with the amazing ſolitude and ſilence of its foreſts. Moreover, although the ſoil, in a continent ſo extenſive as America, muſt of courſe be extremely various; yet it may be obſerved in general, that moiſture and cold, which predominate ſo remarkably in all parts of America, muſt have great influence on its nature and productions; and, therefore, chilled by intenſe cold, the ground never acquires warmth ſufficient to ripen the fruits, which are found in the correſponding parts of the other continent. Allowing, however, for the diverſity that occurs in a continent ſo extenſive, the ſoil of America is naturally as rich and fertile as in any part of the earth.

In order to account for the condition and character of the Americans, ſome philoſophers (as count de Buffon) have maintained, that that part of the globe, occupied by them, had but lately emerged from the ſea, and become fit for the reſidence of man; that every thing in it bore marks of a recent original; and that its inhabitants lately called into exiſtence, and ſtill at the beginning of their career, were unworthy to be compared with the people of a more ancient and improved continent. Others (*e. g.* M. de Paw) have imagined, that, under the influence of an unkindly climate, which checks and enervates the principle of life, man never attained in America the perfection which belongs to his nature, but remained an animal of an inferior order, defective in the vigour of his bodily frame, and deſtitute of ſenſibility, as well as of force, in the operations of his mind. In oppoſition to both theſe, other philoſophers (as M. Rouſſeau) have ſuppoſed, that man arrives at his higheſt dignity and excellence long before he reaches a ſtate of refinement; and, in the rude ſimplicity of ſavage life, diſplays an elevation of ſentiment, and independence of mind, and a warmth of attachment, for which it is vain to ſearch among the members of poliſhed ſocieties. Accordingly the rude manners of the Americans have been propoſed as models to the reſt of the ſpecies. Dr. Robertſon, in his judicious and elaborate inveſtigation of this intereſting ſubject, cautions thoſe who inquire concerning either the bodily or mental qualities of particular races of men, from being miſled by the common or ſeducing error of aſcribing to a ſingle cauſe thoſe characteriſtic peculiarities, which are the effect of the combined operations of many cauſes. Some philoſophers of great eminence, he ſays, finding that the climate and ſoil of America differ, in ſo many reſpects, from thoſe of the other hemiſphere, have laid hold on this as ſufficient to account for what is peculiar in the conſtitution of its inhabitants. Accordingly they reſt on phyſical cauſes alone, and conſider the feeble frame and languid deſire of the Americans as conſequences of the temperament of that portion of the globe which they occupy. But he thinks that the influences of political and moral cauſes ought not to have been overlooked. Theſe operate with no leſs effect than that on which many philoſophers reſt as a full explanation of the ſingular appearances that are diſcernible in the bodily conſtitutions and mental qualities of the inhabitants of the New World. However, in contemplating the inhabitants of a country ſo widely extended as America, great attention ſhould be paid to the diverſity of climates under which they are placed. The American provinces are of ſuch different temperament, that this alone is ſufficient to conſtitute a diſtinction between their inhabitants. In every part of the earth where man exiſts, the power of climate operates, with deciſive influence, upon his condition and character; and in thoſe countries which approach near to the extremes of heat or cold, this influence is ſo conſpicuous as to ſtrike every beholder. Whether we conſider man, ſays Dr. Robertſon, merely as an animal, or as a being endowed with rational powers, which fit him for activity and ſpeculation, we ſhall find that he has uniformly attained the greateſt perfection of which his nature is capable, in the temperate regions of the globe. There his conſtitution is moſt vigorous, his organs moſt acute, and his form moſt beautiful. There, too, he poſſeſſes a ſuperior extent of capacity, greater fertility of imagination, more enterpriſing courage, and a ſenſibility of heart which gives birth to paſſions, not only ardent, but perſevering. In this favourite ſituation he has diſplayed the utmoſt efforts of his genius, in literature, in policy, in commerce, in war, and in all the arts which improve or embelliſh life. (See Ferguſon's Eſſay on the Hiſtory of Civil Society, part iii. c. i.) This powerful operation of climate is felt moſt ſenſibly by rude nations, and produces greater effects than in ſocieties more poliſhed. The talents of civilized men are continually exerted in rendering their conſtitution more comfortable; and by their ingenuity and inventions, they can, in a great meaſure, ſupply the defects, and guard againſt the inconveniences, of any climate. But the improvident ſavage is affected by every circumſtance peculiar to his ſituation. He takes no precaution either to mitigate or to improve it. Like a plant or an animal, he is formed by the climate under which he is placed, and feels the full force of its influence. This natural diſtinction between the inhabitants of the temperate and torrid zones is ſignally exemplified among the rude nations of America. Thoſe of the former claſs comprehend the North Americans from the river St. Lawrence to the gulf of Mexico, together with the people of Chili, and a few ſmall tribes towards the extremity of the ſouthern continent. In this claſs, the human ſpecies appears manifeſtly to be more perfect; the natives are more robuſt, more active, more intelligent, and more courageous; and they poſſeſs, in the moſt eminent degree, that force of mind, and love of independence, which are the chief virtues of man in a ſavage ſtate. To the other claſs belong all the inhabitants of the iſlands, and thoſe ſettled in the various provinces which extend from the iſthmus of Darien almoſt to the ſouthern confines of Braſil, along the eaſt ſide of the Andes; and over theſe the Europeans have moſt completely eſtabliſhed their dominion, whilſt the others have defended their liberty againſt them with perſevering fortitude. It is allowed, however, that moral and political cauſes affect the diſpoſition and character of individuals, as well as nations, ſtill more powerfully than the influence of climate. Accordingly, ſome tribes have been found in various parts of the torrid zone, who poſſeſs courage, high ſpirit, and the love of independence, in a degree hardly inferior to the natives of more temperate climates. Upon the whole, it is not by attending to any ſingle cauſe or principle, however powerful and extenſive its influence may appear, that we can explain the actions, or account for the character of men. Even the law of climate, more univerſal, perhaps, in its operation than any that affects the human ſpecies, cannot be applied in judging of their conduct, without many exceptions. (Robertſon's Hiſt. Amer. book iv.)

Clavigero, in his "Hiſtory of Mexico," has defended the climate and ſoil of America againſt the objections of count de Buffon and M. de Paw. He begins with ſhewing that the lakes and marſhes, which theſe writers have conſidered as traces of a general inundation, are merely the effects of the great rivers, innumerable fountains, and very plentiful rains of America. Whoever has obſerved, he ſays, the ſtupendous elevation of the inland countries of America, will not eaſily perſuade himſelf that the water could riſe ſo as to cover them without inundating Europe. To the proof alleged by M. de Paw of the overflow of the ſoil by water, from

from the veins of metals which are found near the ſurface of the earth, he replies that this phenomenon may much more [illegible] be accou[illegible]er by ſuppoſing that ſome violent eruptions of ſubterraneous fires, which appear manifeſt in the many volcanoes of the Cordilleras, deſtroyed the ſurface of ſome ſoils, and left the veins of metals almoſt naked. The diſcovery of marine bodies, heaped up together in ſome inland places of America, if it ſhould prove the pretended inundation, would prove ſtill more ſtrongly a greater inundation of the old continent, in which they are much more abundant. As to the extinction or deſtruction of the great quadrupeds of America, which M. de Paw ſays are the firſt to periſh in water, and which, as he ſuppoſes, periſhed in this imaginary inundation, Clavigero thinks it aſtoniſhing that elephants and camels, which are ſo ſwift in their motion, ſhould periſh, and that the ſloth, which is ſo ſlow, and unable to move, ſhould have eſcaped. Although we ſhould admit that ſuch quadrupeds have formerly exiſted in America, we are not obliged to believe that their deſtruction has been occaſioned by the ſuppoſed inundation, becauſe it might be aſcribed to other very different cauſes. After examining and refuting ſome other arguments of M. de Buffon, Clavigero denies the reality of the inundation, which theſe writers ſuppoſe; more eſpecially as there has been no record or tradition among the Americans of any other inundation than that univerſal deluge which is mentioned in ſcripture.

Againſt the charges of Meſſrs. Buffon and de Paw, who repreſent the ſoil of America as barren, and its whole territory as compoſed of inacceſſible mountains, impenetrable woods and waſtes, watry plains and marſhes, the Mexican hiſtorian alleges the teſtimony of Acoſta, who obſerves, that if there be any land in the world to which the name of Paradiſe may be applied, it is that of America, and he adduces the multitude, variety, and excellence of its vegetable productions, and particularly thoſe of Mexico and Peru, as an evidence of the fertility of its lands.

Clavigero, after a variety of obſervations on the ample ſupply of vegetables furniſhed by the different climates of America, proceeds to examine one of the principal arguments urged by Buffon and de Paw in proof of the poverty of the ſoil and malignity of the climate of America, which is the degeneracy of animals, both ſuch as are natives and ſuch as are tranſported thither from the ancient continent. The firſt ground of diſparagement to America, in the judgment of count de Buffon, is the ſmall number of its quadrupeds, compared with thoſe of the old continent. He reckons (as we have already obſerved) 200 ſpecies of quadrupeds hitherto diſcovered over the whole globe, of which 130 belong to the old continent, and only 70 to the new world. To this argument it is replied, that the extent of America is one-third part of the whole earth, and that it appears to have one-third part, or its due proportion, of all the ſpecies of quadrupeds. But it is difficult to aſcertain the true number of ſpecies, and to aſſign to each its proper proportion; and therefore all reaſoning on this topic muſt be in a degree vague and inconcluſive. In the enumeration and arrangement of the natural hiſtorian himſelf, there is a conſiderable degree of confuſion and ſelfcontradiction. But it is alleged, that all the animals of America are of a much ſmaller ſize than they are in Europe; but no argument can be fairly deduced from this circumſtance againſt the ſoil or climate of America; becauſe according to principles eſtabliſhed by Buffon himſelf, the larger kinds of animals are peculiar to intemperate climes, and the ſmaller to climes which are mild and temperate: and if the advantages of climate are to be deduced from the ſize of quadrupeds, one might juſtly ſay, that the climate of Africa and the ſouth of Aſia is much better than that of Europe. But the fact, in its unlimited extent, is not true, and has been contradicted even by Buffon himſelf. It has been alſo ſaid that the animals of South America, which are thoſe that properly belong to the new continent, are almoſt all deprived of tuſks, horns, and tails; that they are deformed in figure, their limbs being diſproportionate, and ill ſet; and that ſome of them, as the ant-killers and ſloths, are of ſo miſerable a nature, that they have hardly ability to move and eat. However, it would be difficult to prove that any irregularity in the conformation of different animals is owing to the climate of America, or that it is peculiar to that country. What our philoſophers have ſaid with reſpect to the leſs ferocity of American wild beaſts; inſtead of aſſiſting them to prove the malignity of that climate, ſerves only, on the principle expreſsly ſtated by Buffon himſelf, to demonſtrate its mildneſs and bounty. A decreaſe of ferocity, therefore, cannot be juſtly pleaded as a proof of degeneracy occaſioned by the malignity of the climate. But if the American quadrupeds are ſmaller in ſize, more ungraceful in form, and more puſillanimous in their nature than thoſe of the old continent, this circumſtance would not afford a certain argument of the malignity of the American climate, becauſe the ſame degeneracy is not manifeſt in the reptiles and birds of America. It has been ſaid, with regard to American birds, that, though they are ſuperior in beauty of plumage, they are exceeded in excellence of ſong by thoſe of Europe. This fact, however, has been contradicted; and it has been aſſerted that the ſong of the nightingale is more melodious, more varied, and more durable in America than in Europe. The centzontli or polyglot is preferred even to the nightingale, with reſpect to the ſingular ſweetneſs of its ſong, the prodigious variety of its notes, and the talent it poſſeſſes of counterfeiting the different tones of the birds and quadrupeds which it hears. As a further proof of the degeneracy of quadrupeds in America, it has been ſaid that all the animals tranſported from Europe to America, ſuch as horſes, aſſes, bulls, ſheep, goats, hogs, and dogs, are conſiderably ſmaller there than they are in Europe, and, as Buffon ſays, without one ſingle exception. If we ſeek for the proof of this univerſal aſſertion, we ſhall find no other, ſays Clavigero, in the whole hiſtory of that philoſopher than that cows, ſheep, goats, hogs, and dogs, are ſmaller in Canada than they are in France. The Mexican hiſtorian proceeds to examine and refute the charge of degeneracy in the human ſpecies occaſioned by the malignity of the climate. Accordingly he maintains, that the Americans, in general, are neither more diminutive in ſtature, nor more deformed and feeble, nor more ſubject to diſeaſe than the Europeans; and where any inſtances occur to the contrary, he attributes them to incidental cauſes and not to the influence of the climate. After an inveſtigation of the corporeal qualities of the Americans, he produces a variety of atteſtations and arguments in favour of their mental powers and attainments. Although ſome miſſionaries, aſtoniſhed equally at their ſlowneſs of comprehenſion, and at their inſenſibility, have pronounced them to be a race of men ſo brutiſh, as to be incapable of underſtanding the firſt principles of religion, Clavigero contends, that their teſtimony cannot be truſted. He corrects ſome miſtakes of Dr. Robertſon on this ſubject, and particularly his miſapprehenſion of a decree iſſued by a council at Lima in 1552, which excluded the Indians from the euchariſt on account of their incapacity, and alſo of a bull of Paul III. iſſued in 1537, which is ſaid to have declared them to be rational creatures, intitled to all the privileges of chriſtians; whereas, he ſays, it was merely intended to certify their right to all the privileges of men, and thus to condemn their oppreſſors. "We have had intimate commerce with the Americans," ſays the hiſtorian of Mexico, "have lived for

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fome years in a feminary deftined for their inftruction, faw the erection and progrefs of the royal college of Guadaloupe, founded in Mexico, by a Mexican Jefuit, for the education of Indian children, had afterwards fome Indians among our pupils, had particular knowledge of many American rectors, many nobles, and numerous artifts; attentively obferved their character, their genius, their difpofition, and manner of thinking; and have examined befides with the utmoft diligence their hiftory, their religion, their government, their laws, and their cuftoms: and after fuch long experience and ftudy of them, from which we imagine ourfelves enabled to decide without danger of erring, we declare to M. de Paw, and to all Europe, that the mental qualities of the Americans are not the leaft inferior to thofe of the Europeans, that they are capable of all, even the moft abftract fciences, and that if equal care was taken of their education, if they were brought up from childhood under good mafters, were protected and ftimulated by rewards, we fhould fee rife among the Americans, philofophers, mathematicians, and divines who would rival the firft in Europe. But it is a little difficult, not to fay impoffible, to make great progrefs in the fciences in the midft of a life of mifery, fervitude, and oppreffion." He adds, "the whole ancient hiftory of the Mexicans and Peruvians evinces to us, that they knew how to think and order their ideas, that they are fufceptible of all the paffions and impreffions of humanity, and that the Europeans have had no other advantage over them than that of having been better inftructed. The civil government of the ancient Americans, their laws, and their arts, evidently demonftrate they fuffered no want of genius. Their wars fhew us that their fouls are not infenfible to the excitements of love, as count de Buffon and M. de Paw think;" and of their courage there can be no queftion. For other particulars with regard to their general character, cuftoms, literature, &c. &c. we muft refer to the "Differtations" annexed to Clavigero's Hiftory of Mexico.

Montefquieu in his "Spirit of Laws," (Book xiv. xvii.) examines the influence of different climates on the bodily conftitution of individuals, and on the manners, characters, government, laws, and religion of different nations. The character of the mind, fays this writer, and the paffions of the heart are extremely different in different climates; and the laws ought to be relative both to the difference of thefe paffions, and to the difference of thofe characters.

In cold countries people are more vigorous; and fuperiority of ftrength produces a great many effects; *v. g.* a greater boldnefs, that is, more courage; a greater fenfe of fuperiority, that is, lefs defire of revenge; a greater opinion of fecurity, that is, more franknefs, lefs fufpicion, policy and cunning. On the other hand, the inhabitants of warm countries are more feeble and timorous, and poffefs a more exquifite fenfibility; fo that as climates are diftinguifhed by degrees of latitude, they might alfo be diftinguifhed in fome meafure, by degrees of fenfibility. The heat of the climate, he fays, may be fo exceffive as to deprive the body of all vigour and ftrength. Then the faintnefs is communicated to the mind; there is no curiofity, no noble enterprize, no generous fentiment; the inclinations are all paffive; indolence conftitutes the utmoft happinefs; no punifhment hardly is fo fevere as the action of the foul; and flavery is more fupportable than the force and vigour of mind neceffary for human conduct. Hence the Indians are naturally a cowardly people; and even the children of the Europeans, born in the Indies, lofe the courage peculiar to their own climate. This celebrated writer, reflecting on what the Greeks and Romans have faid of Afiatic effeminacy, and the accounts given by travellers of the indolence of the Indians, is of opinion, that this indolence forms the diftinguifhing character of thofe countries. Purfuing his inquiries into the common caufe of this general fact, and finding, that all thefe nations inhabit what are called "hot countries," he has attributed the caufe of their indolence to heat; and affuming the fact as a principle, has laid it down as an axiom, that the inhabitants of hot countries muft neceffarily be indolent, inert of body, and from analogy, likewife inert of mind and character. He proceeds even ftill farther, remarking, that unlimited monarchy is the moft ufual form of government among thefe nations; and confidering defpotifm as the effect of the fupinenefs of a people, he concludes that defpotifm is as much the natural government of thefe countries and as neceffary as the climate under which they live. This fyftem has been received with great applaufe in France, nay, even throughout Europe, and the opinion of Montefquieu is become, among the moft numerous clafs of reafoners, an authority from which it is prefumptuous to differ. A late writer (Volney) has contefted this opinion, and fuggefted feveral objections againft it. "The doctrine," he fays, (Travels in Egypt and Syria, vol. ii.) "of the general indolence of the oriental and fouthern nations, is founded on that opinion of Afiatic effeminacy originally tranfmitted to us by the Greeks and Romans; but what are the facts on which that was built?"—"Admitting the facts as we receive them from hiftory, were the Affyrians, whofe ambition and wars during 500 years threw Afia into confufion; the Medes, who fhook off their yoke, and difpoffeffed them; the Perfians, who, under Cyrus, within the fpace of 30 years, extended their conquefts from the Indus to the Mediterranean; were thefe inert and indolent people? May we not oppofe to this fyftem the Phœnicians, who, for fo many centuries, were in poffeffion of the commerce of the whole ancient world: the Palmyrenians, of whofe induftry we poffefs fuch ftupendous monuments; the Carduchi of Xenophon, who braved the power of the "great king," in the very heart of his empire: the Parthians, thofe unconquerable rivals of Rome; and even the Jews, who, limited to a little ftate, never ceafed to ftruggle, for a thoufand years, againft the moft powerful empires? If the men of thefe nations were inert, what is activity? If they were active, where then is the influence of climate? Why in the fame countries where fo much energy was difplayed in former times, do we at prefent find fuch profound indolence? Why are the modern Greeks fo debafed amidft the very ruins of Sparta and Athens, and in the fields of Marathon and Thermopylæ? Will it be alleged, that the climate has changed? Where are the proofs? Suppofing this true, it muft have changed by irregular fits; the climate of Perfia muft have altered greatly from Cyrus to Xerxes; that of Athens from Ariftides to Demetrius Phalereus; and that of Rome from Scipio to Sylla, and from Sylla to Tiberius. The climate of the Portuguefe muft have changed fince the days of Albuquerque; and that of the Turks fince Solyman? If indolence be peculiar to the fouthern countries, how are we to account for a Carthage in Africa, Rome in Italy, and the Buccaneers at St. Domingo? Why do we meet with the Malays in India, and the Bedouins in Arabia? Why, too, at the fame period, and under the fame fky, do we find a Sybaris near Crotona, a Capua in the vicinity of Rome, and a Sardis contiguous to Miletus? Whence is it, that we fee, under our own eyes, and in Europe itfelf, northern governments as languid as thofe of the fouth? Why, in our own country, are the fouthern more active than the northern provinces? If the fame effects are obfervable under directly contrary circumftances, and different effects under the fame circumftances, what becomes of thefe pretended principles? What is this induinfluence of climate? and what is to be underſtood by activity? Is it only to be accorded to warlike nations? and was Sparta when not engaged in war to be eſteemed inert? What do we mean by hot countries? Where are we to draw the line of cold and temperate? Let the partizans of Monteſquieu aſcertain this, that we may henceforward be enabled to determine the quantity of energy in a nation by the temperature, and at what degree of the thermometer we are to fix its aptitude to ſlavery or freedom. But a phyſical obſervation has been called in to corroborate this poſition; and we are told that heat abates our ſtrength; we are more indolent in ſummer than in winter: the inhabitants of hot countries, therefore, muſt be indolent. Let us ſuppoſe this true. Whence is it then, that, under the ſame influence of climate, the tyrant poſſeſſes more energy to oppreſs than the people to defend themſelves? But, is it not evident that we reaſon like the inhabitants of a country where cold is more prevalent than heat? Were a ſimilar theſis to be maintained in Egypt and Africa, it would there be ſaid, that cold prevents motion, and obſtructs the circulation? The truth is, that our ſenſations are relative to our habits, and that bodies aſſume a temperament analogous to the climate in which they live; ſo that they are only affected by the extremes of the ordinary medium. We hate ſweating; the Egyptian loves it, and dreads nothing ſo much as a failure of perſpiration. Thus, whether we refer to hiſtorical or natural facts, the ſyſtem of Monteſquieu, ſo ſpecious at firſt ſight, turns out, when examined, to be a mere paradox, which has owed its ſucceſs only to the impreſſion made by the novelty of the ſubject, at the time the "Spirit of Laws" appeared, and the indirect flattery it offered to thoſe nations by which it was ſo favourably received."

The author then proceeds to inveſtigate the origin and motives of activity in man; and concludes, that all action, whether of body or mind, has its ſource in our neceſſities, and augments as they increaſe. Accordingly we may follow its gradations from the rudeſt beginnings in the moſt ſavage ſtate of man, when hunger and thirſt awaken the firſt exertions of the ſoul and body, to the ſtate of the moſt mature improvement. In ſuch a progreſs, as in the primary cauſe, it muſt be acknowledged, that activity has little or no connection with heat; only the inhabitants of the north being reputed to ſtand more in need of nouriſhment than thoſe of the ſouth, it may be alleged, that they muſt conſequently be poſſeſſed of more activity; but this difference in neceſſary wants has very narrow limits. The facility of obtaining a great quantity of food, which is perhaps the primary cauſe of voraciouſneſs, depends leſs, eſpecially in a ſavage ſtate, on climate than on the nature of the ſoil, and its richneſs or poverty in paſturage, in foreſts, and in lakes; and conſequently in game, fiſh, and fruits; circumſtances which are found indifferently under every parallel. Hence it appears, that the nature of the ſoil has a real influence on activity; and we muſt perceive, that, in the ſocial as in the ſavage ſtate, a country, in which the means of ſubſiſtence are ſomewhat difficult to be procured, will have more active and more induſtrious inhabitants; while in another, where nature has laviſhed every thing, the people will be indolent and inactive. This is perfectly conformable to hiſtorical fact; for we always find the conquering nations poor, and iſſuing from lands either barren, or difficult of cultivation; while the conquered people are inhabitants of fertile and opulent countries. Theſe needy conquerors, eſtabliſhed among rich nations, ſhortly loſe their energy, and become effeminate. Such was the caſe with the Perſians, who, under Cyrus, deſcended from the Elymais into the fertile fields watered by the Euphrates; ſuch were the Macedonians under Alexander, when tranſplanted from mount Rhodope to the plains of Aſia; ſuch the Tartars of Gengis-khan, when ſettled in China and Bengal; and ſuch the Arabs ſo victorious under Mahomet, after the conqueſt of Spain and Egypt. It is not, therefore, as inhabitants of hot, but as inhabitants of rich countries, that nations are inclined to indolence; and this maxim is exactly conformable with what we obſerve in ſociety in general, ſince we ſee there is always leaſt activity among the more opulent claſſes; but as this ſatiety and poverty do not exiſt for all the individuals of a nation, we muſt recur to reaſons more general and more efficacious, than the nature of the ſoil. "I mean," ſays M. Volney, "the ſocial inſtitutions, called *Government* and *Religion*." Theſe are the true ſources and regulators of the activity or indolence of individuals and nations. Theſe are the efficient cauſes, which, as they extend or limit the natural or ſuperfluous wants, limit or extend the activity of all men. A proof that their influence operates in ſpite of the difference of climate and ſoil is, that Tyre, Carthage, and Alexandria, formerly poſſeſſed the ſame induſtry as London, Paris, and Amſterdam; that the Buccaneers and the Malayans, have diſplayed equal turbulence and courage with the Normans; and that the Ruſſians and Polanders have the apathy and indifference of the Hindoos and the Negroes. But as civil and religious inſtitutions are perpetually varied and changed by the paſſions of men, their influence changes and varies in very ſhort intervals of time. Hence it is that the Romans, commanded by Scipio, reſembled ſo little thoſe governed by Tiberius; and that the Greeks of the age of Ariſtides and Themiſtocles were ſo unlike thoſe of the time of Conſtantine. Let us examine what paſſes within ourſelves. Do we not experience, that our activity has leſs dependence on phyſical cauſes, than the actual circumſtances of the ſociety of which we are members? Are our deſires excited by neceſſary or ſuperfluous wants; both our bodies and minds are animated with new life; paſſion inſpires us with an activity ardent as our deſires and perſevering as our hopes. Are theſe hopes diſappointed; deſire decays, activity languiſhes, and diſcouragement induces apathy and indolence. This explains why our activity varies with our conditions, our ſituations, and the different periods of our life. Why does the man, who was active in his youth, become indolent in his old age? why is there more activity in capital and commercial cities, than in towns without commerce and in the country? To awaken activity, there muſt be objects of deſire, and to maintain it, the hope of arriving at enjoyment. If theſe two eſſentials are wanting, there is an end to individual and national activity. Such is the condition of the Orientals in general.—What ſhould induce them to move, if no motion procures them the hope of an enjoyment equivalent to the trouble they muſt take? How can they be otherwiſe than indolent in their moſt ſimple habits, if their ſocial inſtitutions render it a ſort of neceſſity? The moſt intelligent obſerver of antiquity, after having made the ſame remark on the Aſiatics of his time, has aſſigned the ſame reaſon.

"As to the effeminacy and indolence of the Aſiatics (ſays Hippocrates, De Aëre, Locis, et Aquis), if they are leſs warlike and more gentle in their manners than the Europeans, no doubt the nature of their climate, more temperate than ours, contributes greatly to this difference. But we muſt not forget the form of their governments, which are all deſpotic, and ſubject to the arbitrary will of their kings. Men who are not permitted the enjoyment of their natural rights, but whoſe paſſions are perpetually under the guidance of their maſters, will never be found courageous in battle. To

them

them the riſks and advantages of war are by no means equal. Obliged to forſake their friends, their country, their families; to ſupport cruel fatigues, and even death itſelf, what is the recompence of ſo many ſacrifices? Danger and death. Their maſters alone enjoy the booty and the ſpoils they have purchaſed with their blood. But let them combat in their own cauſe, and reap the reward of their victory, or feel the ſhame of their defeat, they will no longer be deficient in courage; and the truth of this is ſufficiently proved by both the Greeks and Barbarians, who, in thoſe countries, live under their own laws, and are free; for they are more courageous than any other race of men." Upon the whole, M. Volney obſerves, as a fact which cannot be diſputed, that "the moral character of nations, taken from that of individuals, chiefly depends on the ſocial ſtate in which they live; ſince it is true, that our actions are governed by our civil and religious laws; and ſince our habits are no more than a repetition of thoſe actions, and our character only the diſpoſition to act in ſuch a manner, under ſuch circumſtances, it evidently follows, that theſe muſt eſſentially depend on the nature of the government and religion."

CLIMATE *for plants*. See TEMPERATURE.

CLIMATE, in *Agriculture*, a certain tract or ſpace on the ſurface of the earth, varying in the ſtate or temperature of the air. It has been ſtated by Mr. Donaldſon, that "it is the firſt natural advantage of every country; that which is abſolutely requiſite for animal, as well as vegetable life; that without which, ſoil and cultivation will avail little; for although ſoil may be improved with complete ſucceſs, climate cannot to any very conſiderable extent. It is well known that, beſides the particular ſituation of a country on the globe, other circumſtances combine in forming its climate; ſuch as its elevation, proximity to oceans, ſeas, mountains, marſhes, ſoil, and the like; upon ſuch natural cauſes, the climate of this country, he ſays, depends; and from theſe receives its character. (See the preceding article.) There are three diſtinct characteriſtics of our climate, that cannot eſcape the obſervation of thoſe who have made it an object of attention, and from which its advantages or diſadvantages muſt appear: 1ſt, its mildneſs; 2d, its variableneſs; and 3d, the productions dependent on it."

With regard to the firſt, it is remarked, that "from the high degree of north latitude in which this country is placed, one would not, at firſt, he ſays, ſuppoſe that its air ſhould be naturally mild; yet, on being compared with the temperature of other countries in the ſame parallel of latitude, it is certainly entitled to this character. The city of Moſcow, about half a degree ſouth of Edinburgh, is very different in point of climate. In the former city, ſo rigorous is the winter, that it is not uncommon for people to periſh by cold; the lips, noſes, ears, and fingers, of the inhabitants, are frequently froſt-bit; and water, thrown from a window, falls on the ground in ice; ſuch ſevere effects of cold may be ſaid to be unexperienced in the latter city, or in any part of the iſland. The iſland of Newfoundland, a diſtant branch of the Britiſh empire, lies in a lower latitude than England, and yet the extreme colds in winter, and the exceſſive heats in ſummer, render it very diſagreeable to the inhabitants. The ſame holds in regard to Canada, though ſituated in the 48th degree of north latitude: the climate, in point of mildneſs, is not equal to that of the mother country. Nay, in point of mildneſs, Britain excels lands on the continent, which one would think ſhould have naturally enjoyed a ſofter climate. We hear, with ſurpriſe, of the great falls of ſnow, the ſevere and long-continued froſts, the ſudden tranſition from theſe to ſultry heats, exceſſive rains, deſtructive hurricanes, and tremendous thunder-ſtorms, lightenings, and earthquakes, which ſcourge thoſe countries, whoſe inhabitants we are ready to envy, on account of their favourable climate; while, unconſcious of our own happineſs in this reſpect, we little think, that, in general, we breathe a purer air, untainted by noxious vapours, and fiery particles, that engender diſeaſe and death. In winter, too, our bodies are ſeldom ſo cramped with cold, or, in ſummer, ſo relaxed by heat, as to unfit us for paſtime or labour. This ſingular felicity of this iſland, as to climate, may be accounted for from its connection with the ocean. That immenſe body, from being always in motion, from never freezing, and from conſtantly inhaling the rays of the ſun, poſſeſſes a conſiderable degree of natural warmth. Of conſequence, the vapours exhaled from the ſea, by the action of the ſun, and which neceſſarily partake of the ſame warmth, when they mingle with our atmoſphere, muſt ſoften the coldneſs of the air. This is effected more eſpecially by the ſouth-weſt winds, which are prevalent in this country. Theſe, by the time they have croſſed the Atlantic, and reached our coaſts, muſt be charged with thoſe nutritive principles and genial vapours, which, being impregnated with the colder air of this iſland, deſcend in gentle dews and rains, that fertilize the ſoil. The ſame holds, though not in an equal degree, in regard to the wind that blows from the north, though colder than the weſt wind, in as much as it proceeds from countries nearer the pole; yet, in paſſing over the ocean it imbibes a portion of its warmth; and, when it reaches the country, is comparatively warmer than when croſſing the frozen mountains of the north. Hence, the reaſon why ſnow ſeldom lies above a few days on lands adjacent to the ſea-coaſt; hence, too, the influence of ſea-breezes, operating with other internal cauſes, namely, the natural fertility and warmth of the ſoil, the extenſive woods and plantations, with thoſe canals and rivers that carry off ſuperfluous water, the high ſtate of cultivation, the many cities, towns, villages, houſes, and animals, all combine in tempering the climate of this iſland; inſomuch, that it cannot be ſaid that, in any part of the iſland, high lands excepted, the climate is ſo intemperate as to prevent graſs growing, grain ripening, or the inhabitants from enjoying the comforts of life. Upon the whole, it appears, that a happy concurrence of circumſtances renders the climate of this country milder than that of other countries, which, from their local ſituation on the globe, might be expected to enjoy a more deſireable temperature."

In conſidering the ſecond diſtinction of climate, he remarks, that, "like the ocean that encompaſſes the iſland, our climate has been repreſented as inconſtant, unſettled, varying in the ſpace of a few hours, from dry to moiſt, from heat to cold, from clear to cloudy, and from the moſt pleaſant ſerenity to all the violence of tempeſt. He muſt, indeed, (he ſays), be an enthuſiaſtic admirer of the climate of Great Britain, who can give it a preference in point of uniform ſteadineſs to the climates of ſome continental countries. It muſt be admitted, that Britain does not enjoy that permanency of clear air and warm weather, nor that agreeable viciſſitude of ſeaſons peculiar to ſome kingdoms; nor is this poſſible, without the ſubverſion of thoſe laws which regulate ſeaſons and their changes. Upon the principles already laid down, it is obvious, that the iſland of Great Britain, waſhed upon three ſides by immenſe bodies of water, muſt neceſſarily be affected thereby; and it is impoſſible that its climate ſhould be ſo uniformly ſteady as that of other countries, ſituated in the centre of a vaſt continent, and ſheltered by ranges of mountains from the frequent inclemencies of winds and waves. To ſuch natural cauſes muſt be aſcribed the ſudden and frequent variations of our climate, felt at times ſo

 uncomfortably

uncomfortably by the natives; and which draw from those habituated to more constant climes heavy complaints against our atmosphere. "These irregularities of climate, however disagreeable, (he says), lay a foundation for advantages more substantial than any that result from a more pleasant and steady temperature of the air. It is not in countries where the seasons of heat and cold, wind and rain, are periodical, or where the greatest regularity of climate takes place, that mankind are most vigorous, or the fruits of the earth most perfect. There is a sameness of climate as well as of other things that is prejudicial to man. Besides, the air, from being long acted upon by heat or cold, moisture or dryness, is put into a state no less unfriendly to vegetable than animal tribes. But in Britain, the air, from being refined and quickened by the frequent changes it undergoes, is in little danger of being affected by such causes. In spring, it must be admitted, that the country is frequently drenched with rain, and the seed-time, of course, interrupted. But, excessive as the rains sometimes are, their bad effects are generally prevented by the keen sharp winds and dry air that quickly follow, insomuch, that a few days after it cannot be known that such weather had prevailed. It accordingly seldom happens in Britain, that the active husbandman is prevented by the inconstancy of the weather, from ploughing the land and sowing the seed in season. Seldom is that seed killed in the earth, or when sprung withered in its tender blade, either by untimely frost or inclement winds. In summer, the verdure of our hills and luxuriancy of our crops are seldom blasted by a long continuance of dry, scorching weather, or immoderate falls of rain. Sunshine and shade, genial warmth and moisture, succeed in grateful variety, and render our summer no less delightful to man than friendly to vegetation. The climate in harvest resembles that of spring, the weather suddenly shifting from ripening showers and mild sunshine to heavy clouds and sudden bursts of rain, that seem to threaten the promised harvest. Yet often when the heart of the husbandman is ready to despond, he beholds the season return in all its beauty, and has reason to acknowledge with gratitude the truth, that seed-time and harvest have not failed.

From autumn to the end of the year, the climate of Britain, is, he says, most variable, and its inconstancy is the more ungrateful from the advanced period of the season. Then the days, as well as nights, are liable to frequent changes, veering between frost and thaw, snow and rain, clearness and fogs; while often obscure and joyless rains descend, which deform the face of nature, and depress the spirit of man; yet it should be remembered, that these rains fall at a period when the fruits of the year are secured, when nature reposes (with the husbandman) after labour, and when, from the shortness of the day, little can be done without, and men are disposed to enjoy comfortable society within doors. Philosophers also maintain, that our rains in consequence of proceeding more immediately from the ocean, are more pure, and more impregnated with salts, than the rains which fall in most other countries; and though sometimes falling in prodigious quantities, yet tend to fertilize the soil. The climate of Britain in winter partakes of the same variableness that distinguishes it in other seasons. Sometimes the weather is open and mild; at other times frost sets in, and is succeeded by heavy falls of snow which cover, for weeks, the surface of the earth. However much the inhabitants may then suffer from the inclemency of cold, it is generally understood that the effects of frost and snow are, upon the whole, friendly to vegetation. Frost, by expanding the water or moisture contained in the soil, separates the particles of earth from each other, and thus renders the soil more loose, tender, and friable, than it would have otherwise been. This holds especially in regard to tough clay, upon which frost acts with a salutary effect, by reducing its stubborn nature and rendering it more fit for vegetation. The snows so frequent in Britain during winter, tend in various ways to fertilize the soil. Our winter snows, by covering the roots of vegetables, such as rye, wheat, &c. preserve them from the killing colds of the atmosphere. By snow covering the surface of the earth, its heat is cherished. Upon the principles of those who make oil the food of plants, snow must necessarily, he thinks, be a great fertilizer of the soil, from the oily particles it contains. Besides, snow, when it melts, moistens and separates the soil which had been bound up by the frost, and, as its water tends to putrefaction, it must, independently of the nitrous particles with which it is supposed to be impregnated, be greatly in favour of vegetation. In fine, says he, if the climate of Britain be less agreeable than some others, it has more variety." See Snow.

In regard to the influence of climate on the productions of the country, it is supposed that it is "from these the excellence or the defects of climate must be ascertained. These are evidences to which a safe appeal may be made. They are not, like natural causes, liable to be mistaken or misrepresented, but are open to the inspection of all. The productions dependent on climate, are plants, flowers, trees, grain of all kinds, nay animals, such as men, horses, cattle, sheep, &c. Upon a fair comparison of these with similar productions of other climates, a just estimate of the excellence of the climate may be formed. It is true, the author says, that there are fruits of various kinds that cannot arrive at maturity in Britain. Some natives of the torrid zone, when imported here, quickly languish and die; others, when introduced with much fostering care, may thrive for a season, yet from the influence of the air are soon stinted in their growth, and degenerate. But such fruits in general contribute only in a small degree to the subsistence of those who enjoy them, and may be regarded rather as luxuries than necessaries of life. Wheat, barley, oats, peas, beans, rye, cattle, sheep, swine, poultry, &c. are the great articles which constitute the food of man; and these our climate is calculated to produce in plenty and perfection. Upon the whole, from the comparative mildness of our climate, from its varieties, by no means unfriendly to vegetation and the perfection of fruits, and from the productions which depend on it; it appears that in regard to this first and great natural advantage of a country, Great Britain has been favoured in a considerable degree."

With respect to the climate of Middlesex, it has been suggested by Mr. Middleton, that "the temperature of the atmosphere, except, perhaps, so far as the influence of the London fires extends, is nearly the same through the whole county, there being no situation so much elevated as to produce the cold and thin air that we find in mountainous countries. In general it is healthy, owing to the greater part of the soil being naturally dry; and the more moist situations, being well drained, are consequently free from those unhealthy vapours which usually arise from stagnant waters. The fires of London, in which are consumed about 600,000 chaldrons of coals annually, have a sensible effect on the climate in its neighbourhood, by drying and warming the atmospherical air; which, being thus rarefied by heat, constantly passes upwards and makes way for a fresh supply to come in from every side. The most stationary winds are from the south-west and the north-east; all others are variable and unsettled. Those from the south-west are supposed to blow nearly $\frac{6}{12}$ths of the year,' and those from the north-east

east about $\frac{5}{12}$ths. The varying winds blow from all the other points of the compass about the other one-twelfth. Perhaps, he adds, it would be more accurate to say that winds from various points at and nearly the south-west blow about 25, north-east 20, and, from the rest of the circle, nearly seven weeks in every year. The winds seldom blow with so much force in this district as to shake the grain out of the ripe ears of the standing corn. The greatest falls of rain generally come from the south, and are most certain when the wind has passed through the east to the south. In the spring-months the damps on low grounds are sometimes congealed by cold, when there is no such appearance on the hills, and thereby some of the young shoots of the more tender shrubs and plants are destroyed in the former, when no injury happens to those in the latter situation. So great have been the extremes of heat and cold at some particular times, that on the 16th of July, 1793, the thermometer rose as high as $83\frac{1}{2}°$, and on the 24th of January 1795, it fell down to six degrees below 0; though this, perhaps, is the greatest difference in respect of climate ever observed in this kingdom; happily, however, it never continues more than a day or two at such extremes. The salubrity of any district is certainly affected, in a great degree, by the state of the soil and shape of the surface of such district; and hence it follows, that the natural climate of most or all countries may, unquestionably, be considerably improved by using the means best calculated to procure an equable degree of shelter, dryness, and moisture; all which may be effected in bleak, dry, and comparatively barren situations, by dividing them into small inclosures with broad hedge-rows and plantations, in belts of several yards wide; and in low flat situations, by draining off the stagnant water, by enlarging the inclosures, thinning and clipping the hedge-rows; in some instances by grubbing up not only these hedge-rows but also copses, woods, and plantations; thus removing every obstruction to a free circulation of air. This will necessarily absorb and carry off the redundant moisture, and consequently render the climate salubrious and comfortable. Indeed too much attention cannot, he says, possibly be paid, in cases of inclosures, plantations, &c. to the grand articles of drainage and shelter, and also to the nature and situation of the soil; as by a proper regard to these objects, not only the healthiness of the climate, with respect to animals, will be promoted, but the fruitfulness of the soil will be increased in a degree not otherwise to be expected."

It has been fully shown that much advantage may, in many cases of the culture of the soil, be derived from an intimate acquaintance with the nature of the climate, especially as, in the improved state of the art of agriculture, many of its operations are bestowed upon such plants as are exotic to the situation in which they are cultivated. The want of the knowledge of properly adapting the management of different articles of culture to the changes of climate has been often productive of disappointment and failure in such cases as might otherwise have been of great benefit and importance to mankind. Daily experience fully shows that the vegetable productions of one climate may, by proper attention, be readily naturalized in another. The advances of agriculture, in this way, have been great, but much still remains to be effected, which a better knowledge of the nature of climate may have the tendency of greatly facilitating and bringing forward.

CLIMATURE, a word sometimes employed in much the same way with climate. It is a term frequently made use of by some agricultural writers, as Mr. Marshall, in his "Rural Economies of the different Counties of the Kingdom."

CLIMAX, in *Ancient Geography*, a mountain of Asia, in Pisidia, near the town of Selga. It advances towards the sea of Pamphylia, leaving only a narrow passage, through which Alexander on foot conducted his army, according to Plutarch and Strabo.—Also, a mountain of Asia in Phœnicia, placed by Strabo between the river Adonis and the town of Biblos.—Also, a mountain of Arabia Felix, according to Ptolemy.—Also, a castle of Asia, in the maritime part of Galatia.—Also, a place of Peloponnesus, in Arcadia, near the town of Mantinæa, according to Pausanias.—Also, a place of Africa, in the nome of Libya, between Pednopum and Siropum, according to Ptolemy.

CLIMAX, or *gradation*, in *Rhetoric*, a figure, whereby the discourse ascends, as it were by degrees. Such is that of Cicero to Catiline: "Nihil agis, nihil moliris, nihil cogitas; quod ego non audiam, quod etiam non videam, planeque sentiam;" "thou dost nothing, movest nothing, thinkest nothing; but I hear it, nay see it, and perfectly understand it." Thus, the same Cicero to Atticus: "Si dormis, expergiscere; si stas, ingredere; si ingrederis, curre; si curris, advola." See ANTICLIMAX.

CLIMBER, in *Botany*. See CLEMATIS.

CLIMBERRIS, or AUGUSTA, in *Ancient Geography*, formed from *Climberrum*, and called by Mela *Elimberris*, the capital of the Ausci in Gaul.

CLIMBERTUM, or GLINIBERRUM, a place of Gaul, between Lactura and Belsino.

CLIMBING PLANTS, in *Gardening*, are such plants as ascend either spirally round supports, or by means of claspers and tendrils. They are either herbaceous or woody; and which, according to their mode of climbing, may be denominated *twining* climbers, *cirrhous* climbers, and *parasitic* climbers.

The first sort includes all such as have winding stalks, and twist about any neighbouring support, such as scarlet kidney-beans, hops, and some sort of honeysuckle.

The second kind comprehends all such as ascend by means of spiral strings, issuing from the sides of the stalks and branches, or from the foot-stalks of the leaves, and even from the leaves themselves, twisting about any thing they meet with, by which their stalks are supported and arrive at their proper height, such as most of the pea tribe, cucumber, vine, passion-flower, and various others.

And the last plants are also of the same kind, but their claspers plant themselves as roots in the bark of the plants on which they ascend, or in the crevices of walls or pales, thereby supporting themselves, and mounting to their tops, as the ivy, Virginia creeper, radicant bignonia, and several others.

Some of these sorts of plants, both of the herbaceous and shrubby kinds, are very ornamental. The principal of the herbaceous kind are, the everlasting-pea, painted-lady-pea, scarlet and white kidney-bean, nasturtium, gourd, hop-plant, scarlet convolvulus, &c. but there are many others.

The chief of the shrubby kinds, or such as have perennial stalks, are, the radicant and ever-green bignonia, climbing celastrus, different species and varieties of virgin's-bower, kidney-bean-tree of Carolina, ivy, Virginia creeper, many sorts of honeysuckle, passion-flower, many varieties of periwinkle, the vine, &c. but there are several others.

Many of the herbaceous climbers are very ornamental, and may be introduced in large borders, placing sticks for their support. The more tall growing sorts may also be employed to run over arbours or rural seats in pleasure-grounds, and other similar purposes.

The shrubby sorts are most of them proper furniture for shrubberies of considerable extent, in which they may be employed in different ways; some being dispersed in the clumps

clumps, detached from other plants, placing tall, ſtrong ſticks for their ſupport; others placed in large borders and the boundaries of lawns, &c.; and ſome near hardy trees and large ſhrubs, to climb about their ſtems, or interweave in their branches and tops; in the ornamenting of naked or unſightly walls and other high buildings; and in decorating and forming rural arbours, where there is any kind of open-work for the branches to climb upon. They are likewiſe very uſeful, as they ſhoot very rapidly, and ſoon cover ſuch diſagreeable objects.

Theſe ſorts ſhould, many of them, be kept properly cut during the autumn and early ſpring months; that they may not ſpread out too much, and injure other plants that are near them.

CLIMIA of the Arabs. See Klimia.

CLINA, in *Ancient Geography*, a fountain of Aſia Minor, in the Leſſer Myſia; near the town of Cyzicus.

CLINCH, in *Geography*, a mountain of America, in the ſtate of Tenneſſee, which divides the waters of Holſton and Clinch rivers.

Clinch, or Peleson, a river of America in the ſtate of Tenneſſee, being a navigable branch of the Tenneſſee river; it riſes in Virginia, and, after its entrance into the ſtate of Tenneſſee, it receives Powel's and Poplar's creek, and Emery's river, beſides other ſtreams. Its courſe is S.W. and S.W. by W. through Powel's valley, an excellent tract of country, abounding with fine ſprings. Its mouth, which is 150 yards wide, lies 35 miles below Knoxville, and 60 above the Hiwaſſee. It is boatable upwards of 100 miles.

Clinch *of a cable*, in *Sea Language*, is that part of it which is bent about the ring of the anchor, and then ſeized or made faſt.

Inſide clinch is when the end of a cable is paſſed through the hawſe-hole, and reeved through the ring of the anchor; then paſſed round the ſtanding part, through the bight, and a circle, which is called the "clinch," formed of the ſame ſize as the ring of the anchor; a throat and end-band are then clapped on oppoſite each other, and a ſeizing of ſpun-yarn cloſe to the end. All other inſide clinches are ſtopped, ſimilar to the bends of this clinch, with ſmall rope or ſpun-yarn.

Outſide clinch only differs from an inſide clinch, by paſſing the end on the outſide, and not through the bight, for the more readily caſting it off.

Clinch *bolts*, in a ſhip, are ſuch as are clinched, or clenched, with a rivetting hammer at thoſe ends which come through. See Clenching.

CLINCHER-*work*, or Clinker-*built*, the diſpoſition of the planks in the ſide of any veſſel, by which the lower edge of every plank overlays the next under it, like the ſlates on the top of a houſe.

This term is applied to boats that are covered with feather-edged boards lapping over each other; ſuch are generally ſharp-heads and ſterns.

CLINCHAMPS, in *Geography*, a town of France in the department of the Calvados; 5 miles S. of Caen.

CLINCHING, in *Sea Language*, a kind of ſlight calking uſed about the ports, on a proſpect of foul weather; it is done by driving a little oakum into their ſeams, that the water may not come in at them.

CLING, in *Geography*, a town and caſtle of Germany, in the circle of Bavaria, 4 miles E.N.E. of Waſſerburg.

CLINGEN, or Klingen, a town of Germany, in the circle of Upper Saxony, and county of Schwartzburg; 16 miles N. of Erfurt.

CLINIAS, in *Biography*, a Pythagorean philoſopher and muſician, who flouriſhed 524 years before Chriſt. As he was of a very choleric diſpoſition, he is ſaid to have aſſuaged his paſſion by his lyre.

CLINIC, κλινικος, formed from κλινη, a *bed*, a term applied by ſome *Church-hiſtorians* to thoſe among the ancients who received baptiſm on their death bed. It was the doctrine of many of the fathers, that baptiſm abſolutely waſhed away all previous ſins, and that there was no atonement for ſins committed after baptiſm. On this account many deferred that ſacrament till they were arrived at the laſt ſtage of life, and were pretty ſafe from the danger of ſinning any more; and ſuch were called *clinici*.

Magnus, in the third century, made a doubt whether or not clinics were truly baptized, in regard the ceremony was only performed by aſperſion, inſtead of immerſion; he conſulted St. Chryſoſtom on the point, who replied to him, that the ſacrament does not waſh away ſin after the manner of a corporal bath; and ſhews from ſcripture that aſperſion is ſufficient. See Baptism.

Clinic, or Clinical, is an epithet applied, in *Medicine*, to every thing which relates to the treatment and obſervation of diſeaſes, at the bedſide of the ſick. Hence the terms clinical practice, clinical lecture, &c. Clinical lectures, or thoſe lectures which are given upon the caſes of diſeaſe, the progreſs of which has been daily obſerved and regiſtered at the bedſide of the patient, conſtitute the moſt valuable mode of teaching the art of medicine.

CLINKERS, among *Brick Makers*. See Brick.

CLINO, in *Geography*, a town of European Turkey, in the province of Theſſaly; 22 miles W. of Zeiton.—Alſo, a town of Germany, in the biſhopric of Trent; 22 miles W.N.W. of Trent.

CLINOIDES, in *Anatomy*, an epithet given to the four ſmall proceſſes of the *os* sphenoides, one of the bones of the cranium; ſo called, ſay ſome, from their reſembling the feet of a bed.

The word is formed of the Greek κλινη, *a bed*, and ειδος, *form*; either from the reſemblance which the three bones bear to the feet of a bed; or from the cavity they form, which reſembles a bed itſelf.

Theſe together form a little cavity, from its ſhape called *ſella turcia*, or *equina*; wherein is placed the pituitary gland.

CLINOPODIUM, in *Botany*, (κλινοποδιον, Dioſc. Beds-foot, ſo called from the flowers growing in whorls one above another, like the old-faſhioned, turned feet of beds.) Tourn. 92. Linn. Gen. 725. Schreb. 980. Willd. 1115. Juſſ. 115. Vent. vol. ii. p. 342. Claſs and order, *didynamia gymnoſpermia*. Nat. ord. *Verticillatæ*, Linn. *Labiatæ*, Juſſ. Vent.

Gen. Ch. *Cal.* Perianth one-leafed, cylindrical, ſlightly curved, two-lipped; upper lip wider, trifid, acute, reflexed, lower lip divided, ſlender, inflexed. *Cor.* one-petalled, labiate; tube a little longer than the calyx, gradually widened into the throat; upper lip erect, concave, obtuſe, emarginate; lower lip trifid, obtuſe, middle ſegment wider, emarginate. *Bractes* numerous, about the length of the calyx, forming an involucre beneath the whorl or head. *Stam.* filaments four, two longer covered by the upper lip; anthers roundiſh. *Piſt.* Germ ſuperior, four-parted; ſtyle filiform, ſtigma ſimple, acute, compreſſed. *Peric.* none. *Seeds* four, naked, attached to the bottom of the permanent calyx, which becomes a little expanded below, and contracted near the orifice.

Eſſ. Ch. Bractes numerous, forming an involucre under the whorl or head.

Sp. 1. C. *vulgare*, Linn. Sp. Pl. 1. Mart. 1. Lam. 1. Willd. 1. Flor Dan. tab. 930. Lam. Ill. Pl. 511, fig. 1. Eng. Bot. 1401. (C. *origano ſimile*; Bauh. Pin. 224. Tourn. 195. Acinos; Lob. Ic. 504. Wild baſil. "Whorls hairy;

hairy; bractes briftle-fhaped; pedicels branched; leaves flightly ferrated." *Root* perennial, fibrous or fomewhat creeping. *Stems* fomewhat undulated, but not regularly zig-zag. *Leaves* petioled, egg-fhaped, rather obtufe, a little hairy, with veins regularly fringed. *Flowers* purplifh rofe-coloured, whorled, whorls terminal and axillary, few many-flowered; pedicels hairy; bractes hairy, fhorter than the calyx; calyx ribbed, hairy; two lower teeth longeft and moft prominent; corolla twice as long as the calyx, handfome, with two hairy knobs at the orifice; fegments of the lower lip rounded. The whole herb is aromatic, with a faint thyme-like odour. Dr. Smith. A native of England and other parts of Europe, on the borders of woods and in dry hilly fituations; flowering in June. There is a variety raifed by feeds from Canada which differs only in having flowers much fmaller. Two other varieties were fent to Miller from Carolina by Dr. Dale; the firft, which he calls *humile*, is not more than half the fize of the European fort, dividing into many long fide-branches; leaves fmaller and rougher; whorls more numerous, with longer bractes; flowering in June and July. The fecond, which he calls *carolinianum*, has ftems almoft round, the joints four or five inches afunder, with two oblong leaves at each, hairy on their under fide, on fhort petioles; at the bottom of thefe there is a flender branch on each fide, half an inch long, having two or four fmall leaves fhaped like the others. The flowers are white, in fmall whorls, ftanding thinly; bractes longer than the calyxes. It flowers in Auguft. 2. C. *ægyptiacum*, Lam. 2. Willd. 2. (C. vulgare *β*, Linn. Sp. Pl. 3. Mill.) "Whorls axillary, diftant leaves nearly entire, with a fmooth furface." Lam. Nearly allied to the preceding, but conftantly fmaller, lefs villous and more branched. *Root* perennial. *Leaves* ovate, acute, a little ciliated at the edge, with a tint of violet when young. *Flowers* pale red, or flefh coloured; whorls fmall, loofe, hifpid. A native of Egypt. Defcribed by La Marck from a living plant. Willdenow, who profeffes alfo to defcribe from a living plant, afferts that the flowers are never in whorls, but always in terminal heads. 3. C. *incanum*, Linn. Sp. Pl. 2. Mart. 2. Lam. 3. Willd. 3. (C. menthæ folio, incanum; Dill. Elth. 87. tab. 74. fig. 85. C. majus virginianum; Morif. Hift. 3. p. 374. Scot. 11. tab. 8. fig. 4. C. Serpentaria dicta; Pluk. Mant. 51. tab. 344. fig. 7.) "Leaves tomentous underneath; whorls flatted; bractes lanceolate." *Root* perennial. *Stems* two or three feet high, erect, obtufely quadrangular, clothed with a fhort whitifh pubefcence, branched near the top. *Leaves* oppofite, petioled, acutely egg-fhaped, toothed, green above, whitifh underneath, refembling thofe of mint; thofe next the flowers almoft always hoary. *Flowers* pale red, fprinkled with purple fpots, in two or three axillary whorls near the top of the ftem; upper lip fhort, entire. A native of Maryland, Virginia, and Carolina, flowering in Auguft.

C. *africanum procumbens*; Pluk. See Anthospermum *ciliare*.

C. *alpinum*; Pon. Bald. —— *alpinum hirfutum*; Bauh. Pin. Pluk. See Bartsia *alpina*.

C. *amarici folio*; Pluk. See Nepeta *virginica*.

C. *anguftifolium non ramofum*; Pluk. Morif. See Monarda *ciliata*.

C. *anguftifolium virginianum*; Pluk. See Monarda *punctata*.

C. *arvenfe ocymi facie*; Bauh. Pin. See Thymus *acinos*.

C. *afiaticum*; Lour. See Hyptis *afiatica*.

C. *auftriacum*; Rom. See Thymus *alpinus*.

C. *capitatum*; Swartz. Brown. See Hyptis *capitata*.

C. *chamædrys*; Vahl. See Hyptis *chamædrys*.

C. *creticum*; Alp. See Satureia *Græca*.

C. *fiftulofum pumilum*; Pluk. See Ziziphora *capitata*.

C. *flore albo ramofius*; Morif. Hift. See Nepeta *virginica*.

C. *foliis lanceolatis, capitulis terminalibus*; Hort. Cliff. See Nepeta *virginica*.

C. *foliis lanceolatis acuminatis*; Cap. Term. See Thymus *virginicus*.

C. *foliis ovatis acutis ferratis*; Hall. See Thymus *alpinus*.

C. *foliis ovatis dentatis*; Hall. See Thymus *acinos*.

C. *fruticofum*; Forfk. See Phlomis *moluccoides*.

C. *hyffopi latioribus foliis*; Pluk. See Phlomis *zeylanica*.

C. *lufitanicum fpicatum et verticillatum*; Tourn. See Cleonia *lufitanica*.

C. *majus virginiana*; Morif. See Monarda *fiftulofa*.

C. *martinicenfe*; Jacq. See Phlomis *martinicenfis*.

C. *minus exoticum*; Pluk. See Satureia *Græca*.

C. *montanum*; Bauh. Pin. Bocc. See Thymus *alpinus*.

C. *orientale, origani folio*; Tourn. See Satureia *Græca*.

C. *parvum finicum*; Pluk. See Cometes *alternifolia*.

C. *perenne pulegii odore*; Bocc. See Thymus *patavinus*.

C. *pulegii angufto rigidoque folio*; Pluk. See Thymus *virginicus*.

C. *rugofum*; Linn. See Hyptis *radiata*.

C. *fupinum incanum*; Anem. See Ziziphora *acinoides*.

C. *virginianum anguftifolium*; Morif. See Monarda *punctata*.

C. *vulgare*; Lob. See Thymus *acinus*.

CLINOVO, or Kliuno, in *Geography*, a town of Turkifh Dalmatia, generally ufed as a place of rendezvous in a time of war, and a depôt of arms and provifions; 30 miles E.N.E. of Spalatro.

CLINTON, the moft northern county of the ftate of New York in America, bounded on the N. by Canada, E. by the deepeft waters of lake Champlain, which line feparates it from Vermont, and S. by the county of Wafhington: feated on the lake Champlain and lake George, or lying about midway between Quebec and New York, at the diftance from each of about 230 to 240 miles. It is divided into 5 townfhips, *viz.* Plattfburg, the capital, Crownpoint, Willfborough, Champlain, and Peru. The length from N. to S. is about 96 miles, and the breadth from E. to W., including the line upon the lake, is 36 miles. In 1796 the number of inhabitants was eftimated at 6000, of whom 624 were intitled to be electors. The lands are generally of an excellent quality, and produce abundance of the various grains cultivated in other parts of the ftate. The inhabitants manufacture earthen ware, pot and pearl afhes, in large quantities, which they export to New York or Quebec. Their wool is excellent; their beef and pork inferior to none; and the price of ftall-fed beef in Montreal, 60 miles from Plattfburg, is fuch as to induce the farmers to drive their cattle to that market. The forefts fupply them with fugar and molaffes, and the foil is well adapted to the culture of hemp. The land carriage from any part of the country, in tranfporting their produce to New York, does not exceed 18 miles, the carrying place at Ticonderoga is 1½ mile; and from Fort George at the S. end of the lake of that name, to Fort Edward, the diftance is but 14 miles; after which there are fome fmall obftructions that are to be removed by the northern canal. From this country to Quebec are annually fent large rafts; the rapids at St. John's and Chamblee being the only interruptions in the navigation;

tion; and these are not so great, but, at some seasons, batteaux with 60 bushels of salt can ascend them. Salt is sold here at half a dollar per bushel. The rivers which water this [illegible] Boquet: the first of which [illegible] with spears and small scoop nets. [illegible] is usually caught here from May to November; it supplies excellent salted provision, and every cottager, by spending an hour in the evening, may obtain a sufficient quantity for his family. In this country ducks, geese, pigeons, and other kinds of birds are plentiful.

Clinton, a township in Dutchess county, New York, situated above Poughkeepsie, which is large and thriving. It contains 4607 inhabitants, including 167 slaves, and 666 are electors. — Also a settlement in Tioga county, New York, bounded by Fayette on the N., Warren on the S. Green on the W., and Franklin in Otsego county on the E. At the N.E. corner Unadilla river joins the Susquehannah, and the confluent stream runs S.W. to Warren.—Also, a plantation in Lincoln county, and district of Maine, 27 miles from Hallowell.—Also, a parish in the township of Paris, 7 miles from Whitestown, which is a wealthy, pleasant, flourishing settlement, containing several handsome houses, a newly erected Presbyterian meeting-house, a convenient school-house, and an edifice for an academy delightfully situated.

Clinton's *Harbour*, lies on the N.W. coast of N. America, having its entrance in N. lat. 52° 12'. W. long. 136°., so called by captain Gray after governor Clinton of New York.

CLIO, in *Mythology*, one of the *Muses*, daughter of Jupiter and Mnemosyne, the goddess of memory, who presided over history. The name is derived from κλεος, *glory*, or from κλειειν, to *celebrate*. In the portraits of Apollo and the Muses, dug out of Herculaneum, Clio appears seated, and her head is crowned with laurels. In her left hand she holds an open volume, in which she is reading. On the outside is written ΚΛΕΙΩ ΙΣΤΟΡΙΑΝ, *Clio the Historian*; though it should rather be translated, *Clio invented History*. At her feet are six other rolls, or antique volumes, inclosed in a cylindrical case. She is sometimes represented with a lute in one hand, and in the other a plectrum, or quill. Mr. Spence gives the following account of her "Clio presided over the noblest kind of poetry; her office was to celebrate the actions of departed heroes; who, therefore, has a roll, or book, in her hand, or else the longer holds a pipe, as in the relievo of the Muses in the Justiniani palace at Rome. Horace, in speaking of this pipe, seems to give it the shrillness of the trumpet, and, indeed, it is shaped much in the same manner with the trumpet, which the modern artists give to their figure of Fame. As Pindar, and several of the other old Lyric poets, dealt so much in celebrating the actions of departed heroes, this Muse may, perhaps, have been sometimes represented with a lyre too; though I do not remember to have seen any instance of it in the remains of the old artists. Statius makes her descend to lower offices, as if she must preside over any thing written in heroic verse; and his mistake, for it seems to be one, may be easily accounted for, from their looking formerly on every thing in hexameters as an epic poem." See Muses.

Clio, in *Zoology*, the name of a genus of worms, belonging to the order of *mollusca*: the body of which is oblong, and formed for swimming, and furnished with two opposite *alæ* of a membranaceous structure: it has three tentacula, besides two in the mouth. Gmelin enumerates 6 species, *viz* Caudata, Pyramidata, Retusa, Borealis, Helicina, or snail slime-fish, and Linacina: all of which are found in the ocean

CLIP, in *Rural Economy*, a word used to signify shearing sheep. And it also signifies the produce of wool, as the clip of any year implies the quantity that is afforded in it. See Sheep and *Shearing of* Sheep.

CLIPPING, the act of shearing sheep. This sort of business was formerly done in a longitudinal direction, but a later improvement is that of executing it in a circular method. It also signifies a sheep-shearing. See Sheep and *Shearing of* Sheep.

Clipping the *Coin*. See Coin.

CLISOBORA, in *Ancient Geography*, a town of India, placed by Arrian among the principal towns of the Surcenians. Pliny says that the river Jomanes passed between this town and Methora.

CLISSA, in *Geography*, a fortress of Dalmatia, taken from the Turks by the Venetians in 1684: 10 miles N. of Spalatro.

CLISSON, a town of France, in the department of the Lower Loire, and chief place of a canton, in the district of Nantes, seated on the Sevre; 5 leagues S.E. of Nantes. The place contains 1178, and the canton 6139 inhabitants: the territory includes 140 kiliometres and 7 communes. N. lat. 47° 5'. W. long. 1° 23'.

CLIST, a river of England, which runs into the Ex, a little below Exeter.

CLISTHENES, in *Biography*, an Athenian magistrate, who flourished 510 years B.C. and introduced the mode of banishing by *Ostracism*; which see.

CLITÆ, in *Ancient Geography*, a town of Asia Minor in Bithynia, according to Ptolemy; situated towards the N.E. of Amastris.—Also, a place of Greece situated, according to Livy, near mount Athos, in Macedonia.—Also, the surname of the inhabitants of Cilicia Campestris, according to Tacitus; who says that they occupied the parts near the sea, and mount Taurus, in that district of Asia, which was subject to Archelaus, king of Cappadocia. When this king compelled them to pay tribute, they retired to mount Taurus, where they maintained themselves under their chief Trosobor against the troops which he sent against them.

CLITERIUM, or Clitorium, according to Pliny, a town of the Peloponnesus, in Arcadia.

CLITERNIA Larinatum, a town of Italy belonging to the Trentani, E. of Larinum, according to Pliny and Mela.

CLITERNUM, a town of Italy, situated in the country of the Equiculi, according to Ptolemy. Pliny calls the inhabitants Cliternini.

CLITHEROE, in *Geography*, a borough and market town of Lancashire, England, stands on the verge of that county, where it joins with Yorkshire, and is distinguished by its bold and insulated rock of limestone crowned with the keep of an ancient castle. At the northern extremity of the town, is an old mansion called the Alleys, which was formerly the manor-house, and was surrounded by a deep moat. The town of Clitheroe is an ancient borough by prescription, and made its first return of members in the first year of Elizabeth. The right of election is vested in a peculiar kind of burgage-tenure, and the number of electors is forty-two. Here are a weekly market on Saturday, and three annual fairs. The township contains 319 houses, with 1368 inhabitants, and is 217 miles north of London. Whitaker's history of Whalley, 4to.

CLITIS, in *Ancient Geography*, a river of Gaul, supposed by some to have been the Clain.

CLITOMACHUS, in *Biography*, a native of Carthage, who, fond of learning in his early years, visited Carthage for the

the purpose of attending the schools of the philosophers. At Athens he became the disciple of Carneades, and succeeded him in the chair of the New Academy. By diligent study he made himself master of the systems of the other schools; but professed the doctrine of suspension of assent, as it had been taught by his predecessor. Cicero says, that he wrote 400 books upon philosophical subjects. At an advanced age he was seized with a lethargy; but when he in some degree recovered his faculties, he said, "the love of life shall deceive me no longer," and laid violent hands upon himself. He held the office of preceptor in the Academy from the death of Carneades for 30 years, or till the 170th Olympiad, 100 years B. C. According to Cicero, he taught, that there is no certain criterion by which to judge of the truth of those reports which we receive from the senses; and that, therefore, a wise man will either wholly suspend his assent, or decline giving a peremptory opinion; but that, nevertheless, men are strongly impelled by nature to follow probability. His moral doctrine established a natural alliance between pleasure and virtue. He was a professed enemy to rhetoric, and thought that no place should be allowed, in society, to so dangerous an art. Brucker's Hist. of Philos. by Enfield, vol. i. p. 253.

CLITON, or CLITOR, in *Ancient Geography*, a river of Greece, in the Peloponnesus. It ran through Arcadia, and passed near the town of Clitor, according to Pausanias.

CLITONES, the eldest, and all the sons of kings. This word is often met with in our ancient authors.

CLITOR, in *Ancient Geography*, a town of the Peloponnesus, in Arcadia, seated on a river of the same name, S.W. of Lussi; about 60 stadia from the springs of the river Ladon. Pausanias says that Clitor, a very powerful sovereign, built it, and gave it his own name. The principal temples of this town were those of Ceres, Æsculapius, and Castor and Pollux. These two last were denominated there "the great gods;" and their statues were in bronze.

CLITORIA, in *Botany*, (from κλειω, *claudo*, *includo*, expressing the manner in which the essential organs of fructification are enclosed or shut up in the keel and wings of the corolla. Whatever may have been in the thoughts of Petiver, by whom the name was first introduced into botany; or of the illustrious naturalists, by whom it has since been continued, reformed, or sanctioned, we cannot refrain from entering our decided protest against every attempt to associate it directly with an anatomical term, to which, though derived from the same Greek theme, it has in fact only a very remote, factitious analogy. It is greatly to be lamented, that a fondness for these gross allusions should ever have been indulged by any, who, in all other respects, have deserved highly of natural science, and whose splendid talents should have rendered them far superior to such grovelling ideas. By this conduct they have done all in their power to pollute a study, which is, perhaps, more than all others, suited to the loveliest part of the human race, and which, without concealing any essential part of the sexual system, may easily be so conducted, as not to excite an unpleasant sensation in the most delicate female mind. We do not mean to exempt from the full severity of this censure our great master, Linnæus, himself; for when, not only the purity of moral feeling, but also the common decorum of polished life, is infringed, the *nullius in verba* of the poet will, we trust, be uniformly our principle and our practice.) Linn. Gen. 869. Schreb. 1183. Willd. 1352. Gært. 866. Juss. 357. Vent. 3. 404. (ternate, Tourn.) Class and order, *diadelphia decandria*. Nat. Ord. *Papilionaceæ*, Linn. *Leguminosæ*, Juss. Vent.

Gen. Ch. *Cal.* Perianth one-leafed, erect, tubular, five-toothed, permanent. *Cor.* papilionaceous; standard very large, straight, slightly emarginate, obtuse, covering the other petals; wings oblong, shorter than the standard, straight, obtuse; keel shorter than the wings, curved like a sickle. *Stam.* nine, united, one separate; anthers simple. *Pist.* Germ very long, superior, oblong; style ascending; stigma obtuse. *Peric.* Legume very long, linear, generally compressed, two-valved, terminated by an awl-shaped point. *Seeds* numerous, kidney-shaped. Corolla resupinate, or inverted.

Ess. Ch. Standard very large, covering the wings.

Sp. 1. C. *ternatea*, Linn. Sp. Pl. 1. Mart. 1. Lam. 1. Willd. 1. Lam. Ill. tab. 609. Gært. tab. 149. fig. 3. (Phaseolus indicus; Comm. Hort. 1. p. 47. tab. 24. Flos clitorides ternatensium; Breyn. Cent. 76. tab. 31. Flos cæruleus, Rumph. Amb. 5. p. 56. tab. 31. Ternatea, Tourn. Act. 1706. p. 84.) "Leaves pinnated; leaflets inversely heart-shaped; involucre two-leaved, roundish," Lam. "Leaves quinate-pinnated; peduncles axillary, one-flowered," Willd. *Root* perennial. *Stem* four or five feet high, herbaceous, twining, slender, branched. *Leaves* alternate, unequally winged; leaflets five or seven, veined underneath; with two bristle-shaped stipules at the base of each pair of leaflets, and two awl-shaped ones at the origin of the common petioles. *Flowers* large, blue, with a yellowish spot at their centre, generally solitary, on short peduncles. *Legumes* three or four inches long, narrow, lenticular-compressed, without knots, or risings above the seeds, terminated by the longish awl-shaped style, divided transversely into many cells; partitions thin, formed from the internal white cellular membrane of the valves. *Seeds* solitary, from seven to twelve, ovate kidney-shaped, truncated at one end, rather compressed, somewhat gibbous on both sides, smooth, chestnut-brown, Lam. and Gært. A native of the East Indies and Cochinchina; but the seeds were first brought to Europe from Ternate, one of the Molucca islands. There is a variety, figured by Rheed. Mal. 8. p. 69. tab. 38. with white flowers, and obtuser leaflets, in which the flowers generally grow from three to five together, in small axillary racemes. There is also a blue variety, with double flowers, an exuberance not common in this class of plants. 2. C. *heterophylla*, Lam. 2. Desfont. Annals of Botany, vol. i. p. 124. Ventenat Jard. de Cels. tab. 26. "Leaves pinnated; leaflets quinate; some rounder, some lanceolate, some linear," Lam. *Stem* above six feet long, branched, climbing, filiform, slightly pubescent. *Leaves* alternate, lower ones ternate, middle and upper ones pinnated with an odd leaflet; leaflets from seven to nine, small, smooth, opposite, terminated by a bristle-shaped appendage, not unfrequently emarginate; stipules awl-shaped. *Flowers* azure blue, resupinate, axillary, solitary, pendulous; peduncles a quarter of an inch long, very slender, slightly tumid at the summit; bractes four; two lower; two others superior, forming a kind of involucre to the calyx, very small, acute; calyx tubular, somewhat widened upwards, marked with five small prominent lines, terminated by five egg shaped, acute teeth, the three upper ones the largest; standard elongated, streaked, convex outwards, emarginate at the tip, longer than the wings; wings brought close together, obtuse, with a very slender claw; keel not sharp, formed by two contiguous petals, each borne on a pedicel; style somewhat geniculate; stigma pubescent, obtuse. *Legume* about two inches long, linear, smooth, sleek, flattened; pendulous, many-seeded, ending in a point; valves twisting spirally after they have opened. *Seeds* from eight to ten, compressed. Desfont. A native of the East Indies, found by Sonnerat; and of the isle of France, whence it was introduced into the French gardens by seeds brought by M. Cossigny. 3. C. *multiflora*, Willd. 2. Swartz. Prod. 106. "Leaves pinnated; pairs of leaflets many,

many, filky underneath; racemes axillary, many-flowered." *Root* perennial. A native of St. Domingo. 4. C. *Brasiliana*, Linn. Sp. Pl. 2. Mart. 2. Lam. 3. Willd. 3. (Planta leguminosa brasiliana, Breyn. Cent. 78. tab. 32.) "Leaves ternate; calyxes solitary, campanulate." Linn. *Stem* five or six feet high, twining. *Leaves* alternate on long petioles; leaflets ovate-oblong, flightly veined, rather hard. *Flowers* large, purple, axillary, solitary, peduncled; standard much broader, and wings larger than in C. ternate; leaflets forming the involucre of the calyx two, oval, opposite, membranous; bractes on the peduncle of the same shape. A native of Brasil. There is a variety with double flowers raised by Miller from seeds sent from India, but now lost in the English gardens. 5. C. *calcarigera*, Salisb. in Paradisus Londinensis, tab. 51. (C. virginiana, Linn. Sp. Pl. 3. Mart. 3. Lam. 4. Willd. 4. Brown. Jam. 298. Swartz. Obs. p. 282. Clitorius alter trifoliatus, Clayton in Gron. Fl. Virg. ed. 1. p. 73. —— Fœnum græcum phaseloides, Pluk. Alm. p. 175. Phyt. tab. 90. fig. 1.) "Leaves ternate; calyxes in pairs, campanulate." Lam. "Leaflets in one pair, terminated by an odd one; standard swelling at the back into a solid spur, which presses upon the claw." Salisb. *Root* perennial. *Stem* about three feet high, twining, slender, hairy. *Leaflets* egg-shaped, hairy, especially near the margin. *Flowers* in short spikes or racemes, seldom more than two-flowered; bractes striated; calyx much shorter than in other clitorias, scarcely compressed. Standard externally of a dull yellow colour, pubescent; internally lilac, with a yellow middle variegated with red streaks, smooth, furnished with a solid spur just above the claw; wings and keel pale lilac, adhering closely together; nectary very large, like a ruffle. *Legume* narrow with prominent sutures. *Seeds* brown, with a greyish cloud in the middle. A native of Virginia and the West Indies. There is a variety, with narrow elongated leaves; and another with ovate oblong ones figured by Dillenius. Hort. Elth. vol. i tab. 76 Mr. Salisbury observes, that though the leaves of this and the following species are said by Linnæus to be ternate, they are truly pinnated; for though consisting only of a single pair of leaflets beside the odd one, the two are placed upon the common petiole. Notwithstanding our general unwillingness to change trivial names, we have been induced to adopt Mr. Salisbury's as clearly expressing a character peculiar to the species. 6. C. *mariana*, Linn. Sp. Pl. 4. Mart. 4. Lam. 5. Willd. 5. (Clitorius marianus, Petiv. Sicc. 243. n. 55. Gron. virg. p. 83.) "Leaves ternate; calyxes cylindrical." Linn. Stem about five feet high, twining, weak. Leaflets narrower than in the preceding species, grayish underneath. *Flowers* axillary, of a pale blue colour within, whitish without; standard large. *Legumes* long, pointed, a little inflated. *Seeds* roundish. A native of North America. 7. C. *falcata*, Lam. 6. (Phaseolus, Plum. MSS.) "Leaves ternate; peduncles long, with about three flowers; legumes narrow, fickle shaped." *Stems* twining, flender, very long. *Leaves* alternate; leaflets ovate, of a pleasant green colour, resembling the leaves of the orange tree. *Flowers* large, bluish or purple violet; calyx oblong, almost funnel-shaped, with five acute segments, and an involucre resembling another calyx at the base. *Legumes* narrow, compressed, with several apparent articulations. *Seeds* kidney-shaped, shining, white with a red umbilicus. Plum. MSS. A native of St. Domingo. 8. C. *galactia*, Linn. Sp. Pl. 5. Mart. 5. Lam. 7. Willd. 6. Brown. Jam. 298. tab. 32. fig. 2. (Phaseolus, Sloane Jam. 1. p. 182. tab. 114. fig. 4.) "Leaves ternate; raceme erect; flowers pendulous. *Stem* about six feet high, twining, weak. *Leaflets* elliptic-oblong, obtuse, sometimes emarginate. *Flowers* reddish; calyx short, campanulate, four-toothed; corolla a little papilionaceous; all the petals oblong, narrow; standard a little larger than the others. *Legume* flender, cylindrical, pointed. A native of Jamaica, milky in all its parts. This species differs from all the preceding in the form and disposition of its flowers, which rather diverge from the generic character.

Clitoria *foliis pinnatis, caule decumbente*. Hort. Cliff. Gron. Virg. See Galega *virginiana*.

Propagation and Culture. All the species are annual in England, so that unless the seeds ripen they are lost, till they can be renewed by fresh seeds from their native climate. The seeds should be sown in a good hot-bed early in the spring, and the plants, when two inches high, should be transplanted into pots, and treated like other similar exotics. As they have climbing stalks, they will soon grow too tall for the common hot-bed, they must therefore be removed into the stove, and plunged into the bark.

CLITORIDIS *musculus*, in *Anatomy*, a name given by Verheyen to the muscle of the female *pudenda*, usually called *erector clitoridis*. This is the only muscle that is proper to this part; the other, called the *inferior clitoridis*, being properly a *sphincter vaginæ*, or, as Albinus calls it, *constrictor cunni*.

CLITORIS, one of the external organs of generation in the female sex. See Generation, *Organs of*.

CLITORIUS, in *Botany*. See Clitoria.

CLITOW, in *Geography*, a town of Bohemia in the circle of Pilsen, celebrated for its rich silver mines.

CLITUMNO, a river of Italy, which passes by Spoleto, and joins the Tepino between that town and Perugia, anciently *Clitumnus*. The Clitumnus, according to Pliny, (l. viii. ep. 8.) was a fountain with many veins between Hispellum and Spoletium, from which at a small distance arose a large and navigable river. Near it was an ancient and much revered temple, in which the god Clitumnus was placed, in a Roman habit, and where he issued oracles which manifested the presence and power of the divinity. Round him were arranged several small chapels, some of which had fountains and springs; for Clitumnus was the father of many other rivulets which join him. A bridge separated the sacred part of his waters from the profane; above this bridge people were allowed only to pass in boats; but below it they were permitted to bathe. This river flowed into the Tinia, now Tupino, and both together into the Tiber. It was famous, according to Virgil, (Georg. l. xi. v. 1447.) for its milk-white flocks and herds.

CLITUS, in *Biography*, an intimate friend of Alexander the Great; the brother of his nurse, who followed him in his conquests, and preserved his life by cutting off the hand of Rosaces, when he lifted up an axe to kill him at the passage of the Granicus. Clitus, to whom Alexander was affectionately attached, being invited to supper with the prince, and heated with wine, inveighed against adopting the customs of the Persians, and degraded the exploits of Alexander, in order to magnify those of Philip, his father. Alexander was so enraged that he struck him to death with a dart; but soon recollecting himself, he regretted the loss of his friend with such grief, as to fast three days and to form a purpose of starving himself to death: but, by the intercession of his friends, he was dissuaded from executing his purpose. Clitus was buried by Alexander in a very pompous manner.

CLIVE, Robert, baron Plassey, a celebrated English general, was born in the year 1725, at Styche, in Shropshire. During the years devoted to education he exhibited no taste for literature, but was characterised for a daring and adventurous spirit, almost incapable of restraint, and destitute of fear. When he was about 18 years of age, his father obtained for him the place of writer in the East India Company's pany's ſervice, and he arrived at Madras in the year 1744. In 1746 Madras ſurrendered to the French, and all the company's ſervants were made priſoners. The French commander in chief refuſing to ratify the terms of the capitulation, the Britiſh conſidered themſelves juſtified in breaking their parole; and among others, Mr. Clive, diſguiſed as a Moor, made his eſcape. Shortly after, he entered into the military ſervice, for which his temper and mind were well adapted, and in which he diſplayed great talents. He obtained, in the year 1747, an enſign's commiſſion in the Company's ſervice, and behaved with great valour at the ſiege of Pondicherry. He quickly obtained the rank of lieutenant, and in an attack upon fort Devi Cotah, he ſolicited the command of the forlorn hope, though out of his turn. His requeſt was granted, and, at the head of about 30 Britiſh troops and 700 Sepoys, he advanced to ſtorm the breach. The Sepoys inſtantly fled, but the lieutenant and his handful of men puſhed on, and had ſcarcely arrived at the breach, when the enemy ruſhed upon them with ſo much fury, that three only, with their commander, eſcaped inſtant deſtruction. The whole column of European troops then advanced to the attack, lieutenant Clive ſtill in the firſt diviſion, and the fort was reduced. Peace immediately followed. He returned to the civil eſtabliſhment, and was ſoon appointed to the office of commiſſary to the troops. In 1751, Clive reſumed the military character, with a captain's commiſſion, and in this capacity he was employed to attack the city of Arcot, having under his command 210 Europeans, and about 500 Sepoys. Such were the reſolution, ſecrecy, and diſpatch, with which he conducted the enterpriſe, that the enemy knew nothing of his motions until he was in poſſeſſion of the capital, which ſurrendered without a blow. The inhabitants, expecting to be plundered, offered him a large ſum to ſpare the city, but they derived their ſecurity from the generoſity of the conqueror. He refuſed the proffered ranſom, declaring that thoſe who choſe to remain in the city ſhould be protected, and that the others might retire with all their effects, excepting proviſions, for which he promiſed to pay the full value. By this wiſe conduct he ſo conciliated the affections of the people, that they became his ſteady friends, and ſupplied him with exact intelligence of the enemy's deſigns. The town was ſoon inveſted by Raja Saib, at the head of a numerous army, and the operations of the ſiege were conducted by European engineers, but when they came to make their general aſſault, they were repulſed in every quarter with great loſs, and obliged to raiſe the ſiege with the utmoſt precipitation. On this relief captain Clive took the field, and was uniformly ſucceſsful over the enemy. After he had ſubdued all the force oppoſed to him, he returned to Madras, and from thence in 1753 he embarked for England. He was received with every demonſtration of reſpect and gratitude by the Eaſt India Company, who preſented him with a very valuable ſword richly ſet with diamonds. His ſtay in England was but ſhort, and he returned to India governor of St. David's, with the rank of lieutenant-colonel in the king's ſervice. After performing ſome important ſervices, he went to Madras in order to take the command of a ſuccour to be ſent to Bengal, where the nabob Dowlah had declared war againſt the Engliſh, deſtroyed their factories, and taken Calcutta. At this city and period the horrid tragedy of the black-hole was acted. See CALCUTTA.

Admiral Watſon and colonel Clive determined to revenge the cruelties inflicted on their countrymen at Calcutta. The admiral with his fleet proceeded up the river on the 28th of Dcember, and on the next day colonel Clive landed, and, with the aſſiſtance of the ſquadron, ſoon reduced and took poſſeſſion of the town. Clive then took the field with his force of 700 Europeans and 1200 Sepoys, and entrenched himſelf a few miles diſtant from Calcutta. The nabob immediately marched with an immenſe army, conſiſting of 20,000 horſe and 30 000 foot, beſides cannon and elephants, and encamped near Calcutta. Propoſals of peace were ſent to the Eaſtern prince; theſe being contemptuouſly rejected, colonel Clive determined to attack the nabob's camp, which he did with ſo much ſucceſs, as to oblige the nabob to ſue for peace; this was granted him upon terms highly advantageous to the intereſts of the Company. After the concluſion of the treaty, the Engliſh commanders proceeded to the attack of the French fortreſs and factory of Chandernagore, the reduction of which filled the nabob with new apprehenſions, and he threatened to join the French. The mutual injuries inflicted and ſuſtained between Sou-Rajah-Dowlah and the Britiſh being of ſuch a nature as to leave no room to hope for a continued peace, colonel Clive conceived the project of dethroning the nabob. In this ſcheme he had engaged Meer-Jaffier, a diſcontented courtier, who had retired from the palace to his reſidence in the country, from whence he tranſmitted diſpatches to colonel Clive, urging him to begin his march to Moorſhedabad. The colonel immediately put the whole army in motion, and with a firm reliance on his own talents, and on the valour of his troops, croſſing the Ganges, he advanced to Plaſſey, within a day's march of the capital, where he found the nabob encamped with a force of 70,000 men, in all the pomp of oriental magnificence. The number of elephants with their ſcarlet houſings;—the rich embroidery of their tents and ſtandards;—and the martial ſplendour of their cavalry, parading over the field with their drawn ſwords glittering in the ſun,—made a grand and awful, but very intereſting appearance. The nabob, on the firſt intelligence of the march of the Engliſh army, eagerly courted the ſupport and aſſiſtance of Meer-Jaffier, who took a ſolemn oath upon the Koran that he would be his faithful ſoldier. Though the army of the Eaſtern ſovereign was poſted on an eminence, colonel Clive advanced at the head of his troops, conſiſting of only about 3000 men, with great intrepidity to the attack. Such were the diſtruſt and deſpondency prevailing through the Aſiatic army, that ſcarcely any reſiſtance was made; and with a trifling loſs, in compariſon, of about 70 men, a moſt deciſive victory was gained; the camp, artillery, and ſtores of the enemy falling into the hands of the victors. Meer Jaffier, who commanded the left wing of the nabob's army, took no part whatever in the action, but at the cloſe of the day he came over to the Britiſh. The conquered nabob fled to his capital, where he was betrayed and put to death. Colonel Clive now entered Moorſhedabad as conqueror at the famous battle of Plaſſey. The inhabitants of the city were ſufficiently numerous to have deſtroyed the Engliſh army with miſſile weapons only, but they were ſo intimidated by the ſuperior valour of their enemies, that they offered the commander large ſums to ſecure their property, which he did not accept, conſidering himſelf bound to protect them without a bribe. For the Company, he received of Meer-Jaffier, whom he had raiſed to the vacant throne, a crore of rupees, amounting to more than a million ſterling, as an indemnification for their loſſes at Calcutta. He alſo ceded to the company a conſiderable territory in the vicinity of the city. In conſequence of the battle of Plaſſey, colonel Clive was made governor of Bengal. Shortly after this the great mogul conferred on governor Clive the title of omrah of the empire, and he received a grant from Meer-Jaffier of lands, to ſupport his new dignity, worth about 27,000*l* per annum. Having raiſed the Eaſt India Company's affairs from almoſt the brink of ruin, to a highly proſperous ſtate, and having himſelf become great in wealth,

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in rank, and in celebrity, the governor returned to his native country in 1760. The following year he was created an Irish peer by the title of lord Clive, baron of Plassey.

Owing to new disorders in India, and such changes as led the directors to tremble for the safety of their acquired territories in that country, they again applied to lord Clive to accept the presidency of Bengal, and the command of the troops in that province. In 1764 his lordship embarked for India, having been first created knight of the Bath. With him were associated four friends, whose powers were so extensive, that they surpassed and superseded every other authority in the Company's settlements. Before the arrival of lord Clive, affairs had taken such a turn, that the easy task devolved upon him of settling terms with the country powers, which he rendered very advantageous to the Company, who had now the disposal of all the revenues of Bengal, Bahar, and Orissa, deducting only about three hundred thousand pounds for the use of the emperor. Lord Clive then set about the more arduous undertaking of reforming the abuses among the Company's servants; he put the army establishment upon a better footing, and introduced some good regulations into the conduct of the private trade, which, nevertheless, were not so strict as to prevent oppressions among the natives.

In 1767, lord Clive returned to England, having contributed to the prosperity of the company in a most unexampled manner. Six years after this, a resolution was moved in the House of Commons to the following purport, *viz.* "That in the acquisition of his wealth, lord Clive had abused the powers with which he had been entrusted." By the assistance of Mr. Wedderburne, afterwards lord Loughborough, he defended himself against all the charges brought against him, which at one time put on a very serious aspect; at length the original motion was rejected, and it was resolved, "That lord Clive had rendered great and meritorious services to his country." Though he thus escaped a public prosecution, he, from this time, fell a prey to the most gloomy depression of spirits, which, it has been confidently said, resulted from the recollection of his misconduct in India, and which neither the wealth accumulated for his own use, nor the prosperity which he obtained for his employers, could ward off. At length, at the age only of 50, in November 1774, he put an end to his own life, leaving behind him five children and a widow, the sister of Dr. Maskelyne, the present astronomer-royal.

Lord Clive was of a reserved temper, but among particular friends he was cheerful and even jocular; and in domestic life he was kind and amiable. He had, as we have seen, the fine talent of inspiring confidence into those under his command;—hence he was characterised by the great lord Chatham "the heaven-born general, who, with little experience, surpassed all the officers of his time." He represented the town of Shrewsbury in parliament from 1760 to 1774, but rarely spoke in the house, though upon particular occasions he displayed great powers of elocution. By his will he bequeathed 70,000*l.* to the invalids in the Company's service.

CLIVERS, in *Botany*. See Galium *Aparine*.

CLOACA, formed from κλύζω, *I wash away*, among the *Ancients*, was a subterraneous aqueduct, or common sewer, for the reception and discharge of the filth of a city or house. Tarquinius Priscus is said (Liv. i. 38.) to have been the first who contrived *cloacæ* in ancient Rome, which extended under the whole city, and separated into various branches. The arches which supported the streets and buildings were so high (being in some places upwards of 100 feet), and so broad, that, as Procopius says, a man on horseback might easily ride through them, even in the ordinary course of the channel, and a wain loaded with hay might pass, and vessels sail in them. Hence Pliny calls them (xxxvi. 13.) "Operum omnium dictu maximum, suffossis montibus, atque urbe pensili subterque navigatâ." The principal sewer, now existing, with which the rest communicated was called "cloaca maxima," and was principally the work of Tarquinius Superbus (Liv. i. 56.). This was formed of large blocks of stone joined together without any cement, and covered with a triple vault composed of three ranks of voussoirs bonded with one another. It began in the Forum Romanum, measured 300 paces in length, and about fifteen feet in width, being in several places divided into three parts, forming a causeway on each side, and a channel in the middle; and emptied itself between the temple of Vesta and the Pons Senatorius. The cloacæ were at first carried through the streets; but through the want of regularity in rebuilding the city, after it was burnt by the Gauls, they in many places passed under private houses. There were as many principal cloacæ as hills. In the streets, at proper distances, were openings for the admission of dirty water, or any other filth, which persons were appointed always to remove, and also to keep the cloacæ clean. This was the more easily effected by means of the declivity of the ground, and the plenty of water with which the city was supplied. In the time of the republic, about 400 years after the completion of the original drains, they were repaired by Cato the censor, and his colleague, Valerius Flaccus, who constructed several new cloacæ in those parts of the city to which the old channels did not extend, as upon the Aventine, at an expence, according to Dionysius of Halicarnassus, of 1000 talents. Agrippa distinguished himself during his ædileship, by constructing cloacæ so long and numerous as to occasion the observation of Pliny above-mentioned.

The care and inspection of the cloacæ, which constituted one of the distinguished and most celebrated monuments of Rome, on account of the grandeur and utility of the work, as well as the enormous expence that attended it, belonged to the censors and the ædiles till the time of Augustus, who appointed "curatores cloacarum" on purpose; and a tax called "cloacarium" was imposed for keeping them in repair. The "servitus cloacæ" was the right of conveying a private common sewer through the property of a neighbour into the "cloaca maxima" of Tarquin. The Romans had also their Cloacina, or goddess, who presided over the cloacæ.

Cloaca, in *Comparative Anatomy*, imports that canal in birds through which the egg descends from the ovary in its exit. In this it is remarkable, that the part which is next the ovary is jagged, like the *morsus diaboli*, and fluctuates in the abdomen without any attachment to the ovary; hence anatomists have been somewhat puzzled to comprehend by what means the egg falls into the ovary. See Egg.

CLOAK Bay, in *Geography*, a bay on the N.W. coast of America, that separates Queen Charlotte's isles from North island; the middle of the entrance of which is situated in N. lat. 54° 10′. W. long. 133° 20′.

CLOATHING *the bolsters*, in *Rigging of Ships*, denotes laying several thicknesses of worn canvas well tarred over them, to make an easy bed for the shrouds.

CLOATHS, or Clothes. See Habit. By stat. 6. Geo. I. c. 23. the wilful and malicious tearing, cutting, spoiling, burning, or defacing of the garments or clothes of any person passing in the streets or highways, with intent so to do, is felony. This was occasioned by the insolence of certain weavers and others, who, upon the introduction of some Indian fashions prejudicial to their own manufactures, made it their practice to deface them, either by open outrage, or by privily cutting, or casting aquafortis in the streets upon such as wore them.

CLOCHE *Sujette a la Taxe Militaire.* From the moment a place that has stood the fire of cannon is taken, the inhabitants are obliged to re-purchase with money the bells of the churches and divers utensils of copper and other metals. The sum arising from this belongs to the commanding officer of artillery, who nevertheless frequently retains but a certain part of the said sum, leaving the remainder thereof to be divided in just proportions among the officers under his command. This at least used to be the case.

CLOCK, CLAAS, or NICHOLAS, in *Biography,* a painter and engraver, native of Leyden, and scholar of Francis Floris. Amongst his engravings, which are something in the stile of Cornelius Cort, though coarser in their execution, may be noticed a large print representing the judgment of Midas, from Carlo Van Mandere, dated 1589, and the four Elements, half figures, dated 1597, which are probably from his own designs. Heinecken. Strutt.

CLOCK, in *Horology,* is a machine which measures, subdivides, and indicates the successive portions of time with a degree of accuracy that has deservedly given it the preference over the clepsydra, and brought it into general use for civil, domestic, philosophical, and astronomical purposes; it is constructed of various materials, and after different models, to accommodate the views of various individuals; its value, therefore, varies from three half-crowns to one hundred pounds and upwards; but though every householder almost is now in possession of a clock, few individuals, comparatively speaking, know either the theory of its action, or the subserviency of the separate parts of its mechanism to produce their destined effect; and yet, no instrument has been more the object of ingenuity, or the subject of science, for two or three successive centuries, than the machine in question, before it attained its present most improved construction. Its name is derived either from the German *die gloke* or *die kloke,* a clock, or from the French *la cloche,* a bell, against which it usually strikes the hour indicated.

In tracing the records of antiquity for the origin of the first horological machine, that had a suspended gravitating body as a maintaining power, and a regulator of some determined shape and dimensions to check its velocity at small equidistant intervals, different authors have fixed upon different ingenious men as its inventor, and have quoted with some confidence passages from the more ancient writers in confirmation of their respective opinions: hence Archimedes and Possidonius before the Christian æra, Boethius in the fifth century, or about the commencement of the sixth, Pacificus about the middle of the ninth, Gerbert at the end of the tenth, Wallingford near the beginning of the fourteenth, and Dondi at the end of the fourteenth, have severally been asserted to have been the first contrivers of a clock. The difficulty of ascertaining the exact period when a regulated machine for measuring time without the assistance of water was first invented, arises from this consideration, which has not been sufficiently attended to; *viz.* the appellation *horologium* has by ancient writers been indiscriminately applied to all instruments that had any thing to do with hours, whether regulated or not, such as sun-dials, clepsydræ, and instruments for merely representing the motions of the heavenly bodies, like our orreries and planetaria; and, lastly, clocks, or machines with a bell, to strike the hours, placed in the steeple *(le clocher),* of some abbey.

The sphere of Archimedes, made two hundred years before Christ, as mentioned by Claudian, was evidently an instrument with a maintaining power, but without a regulator, and therefore would not measure time in any other way than as a planetarium, turned by a handle, measures, or rather exhibits, the respective velocities of the planetary bodies. The same may be said of the sphere of Possidonius eighty years before Christ, as mentioned by Cicero (De Natura Deorum), notwithstanding the deference which is due to the opinion of Dr. Derham.

When Bernardus Saccus (Hist. Ticin. lib. vii. c. 17.) ascribes the invention of clocks to Boethius in the year 510, he passes over that part of the quotation from Cassiodorus, which says, "that the hours were determined *guttis aquarum,* by drops of water;" hence his horologium was evidently nothing more than a clepsydra. The authority upon which Pacificus, archdeacon of Verona, has been deemed the inventor of clocks in the year 850, is the subjoined portion of his epitaph:

"Horologium nocturnum nullus ante viderat,
En invenit argumentum et primus fundaverat;
Horologioque carmen spheræ cœli optimum
Plura alia graviaque prudens invenit."

Professor Hamberger, in a paper read to the Society at Gottingen in 1758, (vide Beckmann, vol. i. page 419, & seq.) has given reasons for believing this "Horologium nocturnum," as it is called in opposition to a sun-dial, or horologium diurnum, to have been a clepsydra, notwithstanding the "nullus ante viderat," for it was in the ninth century that Hildemar, speaking of the Monks, in regard to their observing the hours, says, "he who wishes to do this properly must have "horologium aquæ," which is considered as a proof that clocks did not then exist. (Commentar. in Reg. S. Bened. cap. 8.) On the contrary, Bailly in his "History of Modern Astronomy" (vol. i. p. 321.) asserts, that Pacificus was the inventor of a clock going by means of a suspended weight, an escapement, and a balance; if this information be accurate, no doubt he was the first who is known to have made a clock; but F. Berthoud (Histoire de la Mesure du Tems, tom. i. p. 49.) very properly observes, that the celebrated author has adduced no authority for the assertion he has used, and that he believes it to be inaccurate. With respect to Gerbert, who was made pope Silvester II. in the year 999, Dithmar (Chron. lib. vi. p. 83. fol. 1580.) believes that his horologium was only a sun-dial which he made at Magdeburg; his words are "Gerbertus, a finibus suis expulsus, Ottonen petiit imperatorem, et cum eo diu conversatus, in Magdeburg horologium fecit, illud recte constituens, considerata per fistulam quadam stellâ nautarum duce." Here no wheels or weights are mentioned, but, on the contrary, his observation only of the pole-star, which assisted him in fixing the horologium or dial; nay, in Gerbert's book "De Astrolabio" he explains the method of erecting dials for all latitudes, but says nothing of any other kind of horologia. To what has been above remarked, concerning the different significations of the word horologium, may be added what is said by the anonymous author of the life of William Abbot of Hirshau, who lived in the eleventh century, *viz.* "naturale horologium ad exemplum cœlestis hæmisphærii excogitâsse," which expression alludes to some piece of astronomical mechanism at that time invented; and according to the account of Trithemius respecting the horologium made in 1232, and sent by the sultan of Egypt to the emperor Frederic II. (Chron. Hirsaug. ad. h. a.) as well as from Leland's description of Richard Wallingford's horologium, called Albion, (all by one) made in 1326, these must have been instruments classing rather with our orreries than our clocks; for the motions of all the heavenly bodies appear to have been conducted by the maintaining power, whatever it was, without any controlling or regulating mechanism. (Vide Tanneri Biblioth. Brit. Hibern. p. 629.) It may be further remarked here, that the words, "horolo-

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gium dirigere," "ordinare," temperare," &c., which denote the office of the facriftan, in the writings of the faid William Abbot of Hirfhau, evidently allude to the adjuftments of the clepfydra. Hence it may be fairly inferred, that no one of the preceding contrivers of horologia was alone the inventor of a regulated clock: the invention was, no doubt, of monaftic origin, or, at leaft, intended firft for monaftic purpofes, when the ftated periods of prayer required the attendance of the monks by night as well as by day. That the horologium of Dondi, however, was a clock can admit of but little doubt; it was conftructed at Padua about the end of the fourteenth century, by order of Hubert, prince of Carara; and the defcription given of it by Petrus Paulus Vergerius (in Vit. Princip. Carrar. ap. Murator. tom xvi. p. 171.) is this; "Horologium quo per diem et noctem quatuor et viginti horarum fpatia fponte fuâ defignarentur, in fummâ turri conftituendum curavit." This fpontaneous defignation of 24 hours of day and night, by an horologium, placed on the fummit of a turret or fteeple, correfponds exactly to our church-clock; but ftill it remains uncertain whether or not Dondi, who was afterwards called Horologius, was the original inventor. About the middle of the fourteenth century feems then to be the time that affords the firft certain evidence of the exiftence of a clock, or regulated horological machine, notwithftanding the frequent mention of horologia in preceding ages, as applied to other horological inftruments; and the following are fome of the earlieft authentic notices that hiftory has recorded on the prefent fubject.

1. In the "Chronica Mifcella Bononienfis" (in Muratori. tom. xviii. p. 444.) it is faid that the firft clock at Bologna was fixed up in the year 1356.

2. About the year 1364, Henry de Wyck or Henri de Vic, a German artift, placed a clock in the tower of Charles V.'s palace. (Vide Moreri. Diction. art. Horloge du Palais.)

3. In Rymer's Fædera is mentioned the protection of Edward III. to three Dutchmen, Orlogiers, who were invited from Delf into England in the year 1368, from which time we may probably date the introduction of clock-work into England.

4. Conradus Dafypodius has given an account of a clock erected at Strafburg about the year 1370.

5. According to Froiffard, Courtray had a clock about the fame period, which was carried away by the duke of Burgundy in the year 1382.

6. Lehmann fays that at Spire was a clock in the year 1395.

7. Nuremberg had a clock in 1462, Auxerre in 1483, and Venice in 1497; and it appears from a letter of Ambrofius Camaldulenfis (lib. xv. Epift. 4.) to Nicolaus of Florence that clocks began to be common in private familes on the continent, about the end of the fifteenth century. (Beckmann.) It is probable therefore, that clocks began to be general in England too about the fame period, for we find in Chaucer, who was born in 1328, and died, as is fuppofed, in 1400, the following diftich: *viz.*

> "Full fickerer was his crowing in his loge,
> As is a clock, or any Abbey orloge."

The honourable Daines Barrington (Archeologia, vol. v. p. 415.) is indeed difpofed to believe that clocks were in ufe at the beginning of the fourteenth century, and quotes the following paffage, as a proof, from the Italian poet Dante, who was born in 1265 and died in 1321.

> "Indi come horologio che ne chiami,
> Nel hora che la fpofa d'Idio furge
> Amattinar lo fpofo, perche l'ami."

But we have feen that clepfydræ were called horologia, which had alfo fometimes ftriking mechanifm; therefore the paffage before us will apply with equal propriety to that inftrument. The fame author alfo fuppofes that the clock-houfe, near Weftminfter Hall, was furnifhed with a clock in the fixteenth year of Edward I., or in 1288 (vide Selden's Preface to Hengham), out of a fine impofed on Radulphus de Hengham, chief juftice of the king's bench, but there appears to be more of conjecture than proof in the detail. From the teftimonies which have been here adduced refpecting the origin of a clock, the conclufion to be drawn is, that this machine is neither of fo ancient a date as fome writers fuppofe, nor yet among thofe more recent inventions which are placed in the laft two centuries; and that the inventor is not certainly known. Fer. Berthoud, who has written more volumes on the fubject of clock-work than any other man, concludes his refearches with a belief, founded in ftrong probability, that a clock, fuch as that of Henry de Wick, is not the invention of any one man, but an affemblage of fucceffive inventions, each of which is worthy of a feparate contriver: for inftance—1. Wheel-work was known in the time of Archimedes; 2. the weight applied as a maintaining power had at firft a fly, moft likely fimilar to that of a kitchen jack; 3. the ratchet wheel and click, for winding up a heavy weight without detaching the teeth of the great wheel, was found the next indifpenfable contrivance; 4. the regulation of the fly, depending on the ftate of the air, was abandoned, and a balance fubftituted; 5. an efcapement confequently became neceffary, which, in conjunction with the balance, conftituted a more regular check upon the tendency which a falling weight has to accelerate its velocity, than a fly ufed as a regulator could of itfelf be; 6. the application of a dial-plate and hand, to indicate the hours, was the confequence of the regularity introduced into the going part of the mechanifm; and, laftly, the ftriking portion, to proclaim at a diftance, without the aid of a watching-man, the hour that was indicated, completed the lift of inventions. Such a fucceffion of ingenious contrivances, introduced by different men, to improve upon the firft rude inftrument, is perfectly analogous to the fucceffive improvements which the prefent clock has experienced, at different periods, fince Henry de Wick's clock was conftructed, which is the moft ancient one of which we have a particular defcription.

Defcription of the Ancient Clock made by Henry de Wick.

Going Part.—Fig. 1, of *Plate* VIII. of *Horology*, reprefents, in profile, the movement of this clock, and *fig.* 2, the front view of the fame inftrument: A is a weight, fufpended by a chord, which is folded round a metallic barrel B, the arbor, *a a*, of which has its ends or pivots, *b*, *b*, paffing through fmall circular holes in the plates C C and D D, which, in this ancient clock, were of iron, the former being bent at right angles at the ends, and fcrewed to the latter, inftead of having pillars; thefe plates, when thus attached, conftitute what is called the frame.

The action of gravity of the weight, A, has a natural tendency to fall towards the earth, and to carry along with it the whole mechanifm, but the frame being fixed firmly on a fupport is fuftained in its place; inftead, therefore, of all the mechanifm being pulled from its fituation, the barrel, B, is pulled round to allow the cord to efcape, and would move with an accelerated velocity, according to the laws of falling bodies, if it had not the wheel, F, with inclined teeth, beft feen in *fig.* 5, pinned to it, which is called the ratchet wheel, and which has its motion ftopped by the fmall pointed piece of metal, *c*, called a click, inferting its pointed end into a fpace between two teeth, and kept to its place by a

flender

slender spring, *d*. This spring and also the click are screwed to the wheel G, as may be seen in *figs.* 1, 2, and 5, which is not fastened to the arbor of the barrel, consequently, when the weight pulls downwards, the ratchet wheel pushes the click, and with it the wheel G, but when the weight is taken off, and the ratchet wheel turned backwards, the wheel, G, keeps its position, by reason of the click sliding easily along the sloping sides of the ratchet wheel, which it is allowed to do by being made to move freely on its screw as a stud; this contrivance for moving the wheel, G, when the weight falls, and for leaving it at rest when the weight is raised, is the mechanism both for winding up the weight, which is called the maintaining power, and also for transmitting this power to the wheel, G, when wound up: but, as the suspended weight of this palace clock, of Charles V. of France, was too heavy to be wound up by the strength of one man, the wheel Q, *figs.* 1 and 2, was fixed on the same arbor with the barrel, and the pinion, *n*, was applied to it, to be turned by a handle or key taking hold of its square arbor at P, which additional wheel and pinion formed a kind of crane for elevating the weight, and the click held it in any state of elevation.

The wheel, G G, having the motion of the barrel communicated to it by means of the click, transmitted it to the pinion, *e*, *fig.* 1, and consequently to the wheel, H H, riveted on the same arbor *f f*; this wheel, H H, again transmitted the motion received to a lantern pinion, *g*, and consequently to the wheel, I I, fixed on its arbor, which was called the crown wheel or escapement wheel (roue de rencontre): this last wheel by giving the pallets or short levers, *h*, *i*, each a push alternately by two teeth, at opposite sides of its circumference, and moving in opposite directions, one forward and the other backward, gave a vibratory motion to the vertical arbor, K, moving on two pivots, *l*, *k*; and as the regulator or balance was fixed on this arbor, it was thus made to vibrate backwards and forwards at every push of the crown wheel upon the pallets, which alternate motions of the balance were called vibrations or oscillations, and their frequency was regulated by the small weights, *m*, *m*, better seen in *fig.* 2, placed at their corresponding distances on the arms, L, L, of the balance, by means of little equidistant notches: if the vibrations were too quick the momentum of the balance was increased by removing the small suspended weights farther from the centre of motion, and *vice versâ*. As the balance was necessarily heavy to counterpoise a large maintaining power, a slender cord, M, was suspended from a small cock, T, placed on the large cock, S, that preserved the perpendicular direction of the arbor K, which cord bore the principal weight of the balance, and suffered it to vibrate without the whole friction which its weight would have occasioned on the lower pivot.—The pallets were placed at about 90° from each other on the arbor or verge of the balance, so that when one of them was parting with its tooth of the crown wheel, the other was in a situation to receive the opposite one immediately; this action of the crown wheel upon the pallets, which escaped the teeth alternately, was called, and is still denominated, the escapement, or by abbreviation, 'scapement of the clock; it is by means of it that the large weight is prevented from falling with rapidity to the ground, by receiving a check at every impulse of the wheel of escapement on one or other of the two pallets; and the interval between two successive impulses was regulated by the time of a vibration of the balance, which period we have seen was adjustable. Thus the whole duration of a vibration was the measure of time, and the wheels and pinions were employed, first to transmit the maintaining power in order to overcome the obstacles to motion which the balance met with from friction and resistance of the air; and secondly to number the vibrations and indicate them in a visible form by a hand, O, *fig.* 2, on a dial plate, not given in the figures, as they amounted to hours. The former of these offices of the wheel-work we have already described without attending to the numbers of the teeth into which the wheels and pinions were divided; but to comprehend the nature of the latter office, this consideration must be taken into the account. The escapement wheel, I I, has one tooth completely escaping the pallets at two vibrations of the balance, which we will suppose adjusted to be exactly equal to as many seconds of time; then on this supposition, the escapement wheel of 30 teeth will make one entire revolution in 60", or one minute, as will also its pinion, *g*, of 8, by reason of its being fast on the same arbor; but as this pinion acts with the wheel, H H, of 60 teeth, only 8 of those teeth will pass the pinion in every minute, therefore as often as 8 are contained in 60, so many minutes will this wheel take to revolve in, which are $7\frac{1}{2}$; its pinion, *e*, of 8 also revolves in $7\frac{1}{2}$ minutes, on account of being on the same arbor, which pinion acts with the great wheel G G, so that eight of its teeth pass in $7\frac{1}{2}$ minutes; but its number is 64, or eight times eight, it therefore revolves in eight times $7\frac{1}{2}$ minutes, *i. e.* in one hour exactly: hence as often as the cord is wound round the barrel, so many hours will such a clock continue to go after winding. Now as the wheel, G G, revolves once in every hour, it is evident that the pinion, *d*, on its arbor, which projects through the frame, will turn round also in an hour. Its number of teeth is 8; therefore $8 \times 12 = 96$ is the number of teeth of the dial wheel, N N, which goes round along with the hand, *o*, placed on its arbor, in 12 hours. Thus while the train, as it is called, of wheels and pinions is transmitting the power of the suspended weight forwards to the balance, it is also counting back again the number of vibrations to constitute an hour, and pointing out on the dial plate, by the addition of a hand, each successive hour, as the vibrations accumulate. Should it be asked here, why a large weight is necessary to actuate the wheel-work, the answer is, that the power of it is gradually diminished as it approaches the regulator according to that law of dynamics, by which the force is known to be equal, whether a large weight moves with a small velocity, or a small weight with a proportionate great velocity, if there were no friction in the train, one sixtieth part of the weight, hung on a similar barrel placed on the crown wheel, would have the same effect on the balance, as the large weight itself in its present situation on the hour arbor; but then it would want winding up sixty times in the same period in which it requires only once winding up with a large weight falling with diminished velocity; so that convenience was the object to be attained in fixing upon a large maintaining power.

Clock Part, or *Striking Part*.—The striking, or what is properly called the clock part of the antique piece of mechanism, which we are describing, is, perhaps, the most ancient of any which is transmitted to us, and which therefore deserves a particular detail, especially as the ordinary Dutch clocks retain very nearly the same construction to this day. We cannot give a better idea of this portion of the instrument, than by translating F. Berthoud's account of it, from his "Histoire de la Mesure du Temps," as we have done, with some verbal deviations, in our description of the going part.

In *Plate* VIII. *figs.* 3 and 4 represent the wheel-work of the striking part, adopted in Henry de Wick's clock: A and B, *fig.* 3, are the principal plates, or rather bars of iron; C and D, the connecting parts instead of pillars; the weight F, suspended by the cord, that surrounds the cylinder G, is the maintaining power; and this cylinder has a rachet wheel fixed to it, like that in *fig.* 5, in the going part, and connected with a click faſtened to the wheel, H, *figs.* 3 and 4. for the purpoſe of winding up the weight; for performing which, a handle is put on the ſquare arbor of the pinion *a*, which acts with the remontoir wheel, I, faſtened to the cylinder. Wheel H has eight pins projecting from its plane [illegible], &c. which pins lift ſucceſſively a hammer that ſtrikes againſt the bell, which parts are not repreſented in the plate, but their principle may be readily conceived from the deſcription, which we ſhall hereafter give, of the ſtriking part of a modern clock. Wheel H drives the pinion *d* fixed on the ſame arbor with the wheel K, which again drives the pinion *e*, on the projecting arbor of which is fixed the fly L, the office of which fly is to regulate the interval between each blow of the hammer, which it does by means of the reſiſtance that its revolving wings, or fanners, meet with from the air.

The manner in which the reſpective number of blows of the hammer for each hour is regulated, is an ingenious invention, and is thus effected; the arbor of the firſt wheel, H, is made to project through the frame, ſo as to take a pinion, *f*, of eight leaves, to drive the wheel M of 78 teeth, which number is equal to 1 + 2 + 3 &c. + 12, or whole number of ſtrokes in 12 hours. On the wheel M is fixed another wheel, N, *figs.* 3 and 4, called the *count* wheel, which has 12 notches on the edge, at unequal diſtances, *viz.* at $\frac{1}{78}$, $\frac{2}{78}$, $\frac{3}{78}$, &c. of the circumference, correſponding to the hours 1, 2, 3, &c. to regulate the number of ſtrokes at each hour. Q, *fig.* 4, is a detent fixed on the arbor R of *fig.* 3, with its claw reſting on the edge of the count-wheel N; to which arbor a lever, T, is alſo fixed, reaching to the pins of the 12 hour wheel N of *fig.* 2, and likewiſe a ſhorter lever, V, within the frame directly above a ſingle tooth, *o*, on the arbor of the fly L. Now as the 12 hour wheel revolves by the going part, one of its pins catching the end of the lever T at every hour depreſſes it, and at the ſame time raiſes the claw or catch of the detent from the notch of the count-wheel, and alſo the ſhort lever V from its tooth *o*, by reaſon of the detent, and two levers, being all faſt to the ſame common arbor R; the weight F in this ſituation, makes the wheels run on till another notch of the count-wheel comes to the claw of the detent Q, when it again falls by the gravity of the load P, placed alſo on the ſame common arbor R, and filling the notch ſtops the count-wheel; at the ſame time, the ſmall lever V falls in the way of the tooth *o* of the fly, and arreſts the motion of the wheels within the frame; ſoon after which the fly alſo comes to reſt, partly by the reſiſtance of the air, and partly by a ſpring preſſing on the end of its arbor, round which it can revolve in a detached ſtate, like the fly of the chime mechaniſm, which we have before deſcribed.—The number of ſtrokes which the hammer makes when raiſed by the pins *b*, *c*, &c. depends on the diſtance between the two notches of the count-wheel, on which the claw of the detent reſts at the time. The ſame proceſs is repeated every time that one of the pins of the 12 hour wheel, depreſſes the end of the lever T, and detaches thereby the claw of the detent and tooth *o* of the fly arbor, ſo as to permit the weight F to actuate the wheel-work for the limited time of ſtriking.

We are not informed what are the numbers of teeth in the wheel-work of the ſtriking part contained within the frame, nor is it of much importance, as this movement has no other uſe, than that of regulating the reſpective velocities of the fly and pin wheel H, that raiſes the hammer; but when the wheel M has 78 teeth, as we have ſtated, it is neceſſary that the pinion *f*, that drives it, ſhould have juſt as many leaves as there are pins on the wheel H; otherwiſe one tooth of the wheel M would not correſpond to one ſtroke of the hammer againſt the bell, which is a neceſſary condition; the pinion *f* therefore has eight leaves, correſponding to the eight lifting pins of the wheel H, and 78 ſtrokes are given in a progreſſion increaſing by unity, during each twelve hours, after equal hourly intervals of ſilence.

Hiſtory of the ſucceſſive Improvements in Clocks.

The preceding account of Henry de Wick's rude clock muſt have prepared the reader for a deſcription of the ſucceſſive alterations and improvements which ingenious mechanicians and artiſts have deviſed in the clock during the laſt two centuries; for it muſt have occurred to him in the peruſal, that large iron wheels continually expoſed to the oxiding influence of the atmoſpheric air, in which unequal and ill ſhapen teeth were cut with the inaccuracy of a manual operation, were by no means calculated to tranſmit the maintaining power with perfect regularity to the balance, ſuppoſing it to have been a good regulator; but when it is further conſidered; that the alternate direct puſhes of the balance-wheel againſt the pallets muſt have produced jerks, and deſtroyed or greatly diſturbed the regularity of this moſt eſſential part of the mechaniſm, great accuracy was not to be expected in the indication of time; ſo that, as we ſee, even minutes were deemed too ſmall portions of time to be indicated by ſuch a machine. We find, notwithſtanding, that ſo early as the year 1484, Walther made uſe of a balance-clock for heavenly obſervations, as did the landgrave of Heſſe after him; and ſuch ſeems to have been the utility of the clock, thus early, for aſtronomical purpoſes, that Gemma Friſius propoſed a portable one to be uſed at ſea for aſcertaining the longitude by ſo ſoon as the year 1530. About the year 1560 Tycho Brahé was in poſſeſſion of four clocks, which indicated hours, minutes, and ſeconds, the largeſt of which had only three wheels, one of which was three feet in diameter, and had 1200 teeth in it, a proof that clock-work was then in a very imperfect ſtate. Tycho however obſerved, that there was an irregularity in the going of his clocks, which depended upon the changes in the atmoſphere; but he does not appear to have known how ſuch effect was produced. In the year 1577 Moeſtlin had a clock ſo conſtructed as to make juſt 2528 beats in an hour, 146 of which were counted during the ſun's paſſage over a meridian, or azimuth line, and determined his diameter to be 34′ 13″, ſo that the ſcience of aſtronomy began thus early to be promoted by the aſſiſtance of clock-work; and as clocks firſt promoted the ſtudy of aſtronomy, it will be ſeen by and bye that aſtronomy in its turn gave riſe to ſome of the moſt eſſential improvements in clock-work, and that, as the arts and ſciences were more and more cultivated, improvements in clock-work kept pace with them, and employed the talents of the moſt ingenious men of each ſucceeding age.

One of the firſt additions to the mechaniſm we have before deſcribed was what we call an alarum or larum, ſtill uſed in the Dutch wooden clocks, which contrivance took its origin from the circumſtance of prayers being uſed at ſtated periods in monaſteries by night as well as by day; the fervors of devotion were not found always unfettered by ſleep at the hour proclaimed by the bell, an invention conſequently became neceſſary to rouſe the ſleepy prieſt to his duty by a continued ringing in his ſtunned ears: for a deſcription of which mechaniſm we muſt refer to the article *Thirty-hours* CLOCK *with a Larum*.

It is not quite certain at what time exactly the bulky ſize of the ancient clock was reduced to a ſtate of portability, which muſt have conſtituted a real improvement, as the main ſpring muſt have been invented previouſly; the ſubſtitution of of which for a large heavy body, as a firſt mover, conſtituted a ſecond æra in horology, from which we may date the origin of the fuſee, or mechaniſm for equalizing the variable power of a coiled ſpring; and from which our modern watches and chronometers of great value derive both their form and principle.

F. Berthoud (Hiſtoire de la Meſure du Temps, i. 79.) ſuppoſes that a portable clock muſt have been invented ſome time before the year 1544, which was that in which the Corporation of Maſter Clock-makers at Paris had a ſtatute enacted in their favour by Francis I. to this purpoſe, *viz.* "No one, of whatever ſtation, if he be not admitted a maſter, ſhall make, or cauſe to be made, clocks, alarums, watches, large or ſmall, or any other machine for meaſuring time, within the ſaid town, city, and precinct of Paris, on pain of forfeiture of the ſaid works, and of arbitrary penalty, &c." This ſtatute, however, inſtead of proving the origin of portable clocks, only proves that in the year 1544 they had begun to be commonly made in France, and probably had been introduced from Germany, which country, no doubt, was the nurſe as well as mother of horology. Indeed we have lately been favoured with the ſight and examination of a portable clock, at preſent in the poſſeſſion of Mr. Peckitt of No. 50, Old Compton ſtreet, which, from an inſcription engraven in the Bohemian language, appears to be much older than the ſtatute above quoted: it was made in the year 1525 by Jacob Lech of Prague, and differs in its conſtruction from De Wick's clock, in that it has a ſpiral ſpring, with a fuſee of ſoft metal, and a ſcrew inſtead of notches at the ends of the double levers of the balance, with tapped weights of lead for the adjuſtment to time, with the addition of ſome wheel-work, to ſhew the motions of the ſun and moon, in an engraven ecliptic, and alſo a contrivance to ſtrike one at every hour. The wheels are of iron, and retain certain punched marks of diviſion which prove that they have been cut with a file by hand; and the levers being faſt to the arbor or verge of the pallets, will vibrate either in a horizontal or vertical poſition. A catgut was originally the band of the fuſee; but the introduction of a modern metallic chain unfortunately has deſtroyed nearly three out of the eight ſpiral threads at the ſmaller end, ſo that inſtead of going 48 hours, *viz.* ($8^{thr} \times 6^{h}$), the remaining five threads will allow the piece to go only 30 hours, or $5^{thr} \times 6^{h}$, which it now does, though irregularly, with vibrations of nearly one ſecond each by eſtimation. Beckmann, in his "Hiſtory of Inventions," mentions this clock as having been the property of Mr. Ferguſon, at whoſe ſale the preſent proprietor purchaſed it in the year 1777, and he intends, we underſtand, to bequeath it to the Britiſh Muſeum, where, no doubt, it will be conſidered as a great curioſity. On examination of the wheel-work, we found the moon's train to be $\frac{12}{6} \times \frac{82}{6} = \frac{984}{36}$ of a day $= 27^{d}\ 8^{h}$ for a periodic revolution, and the ſun's $\frac{984}{36} \times \frac{81}{6} = \frac{79704}{216} = 368$ days, the inaccuracies of which trains prove that planetary mechaniſm in clocks had at that period made no great progreſs towards perfection.

But the portable clock of which we have here given a ſhort notice, we have reaſon to believe, was not among the firſt that were made, for at firſt the ſpiral ſpring was folded in a box, the arbor of which had the great wheel on it, and the irregularity of its action was in ſome meaſure equalized by a ſecond ſpring, which, being diſpoſed in a certain curve, oppoſed the principal ſpring when wound up, and acted in the ſame direction with it when its intenſity began to remit; this piece of mechaniſm, which was a German invention, preceded the invention of the fuſee, and was called *ſtack freed*. Berthoud has given a drawing and deſcription of a portable clock, probably by Gourdain, without a fuſee; and ſome of the modern French watch-makers have probably borrowed from it their idea of making a watch go well without a fuſee. For the ſhape and uſe of which equalizer of irregular power, ſee the article FUSEE.

When the ſize and weight of a clock were reduced, the quantity of friction was ſo diminiſhed, as to allow the thread of ſuſpenſion, on the verge of the balance, to be abandoned, which circumſtance gave riſe to a new poſition of the balance, the verge of which was now placed horizontally upon its pivots, which were a little flattened, ſo that the weight might be ſupported by its edge; and this contrivance was called the *knife edge* ſuſpenſion, a ſpecies which F. Berthoud has pronounced ſuperior to the ſuſpenſion with a ſlender ſpring, to which the Engliſh artiſts are much more partial, though it does not appear that their partiality is founded on any thing like impartial experiment.

Such was the ſtate of clock-work when Galileo, the celebrated philoſopher and mathematician to the duke of Florence, obſerved, that two lamps, or other heavy bodies, ſuſpended by ſtrings of the ſame length, made their vibrations in long or ſhort arcs, very nearly, if not exactly, in the ſame ſpace of time; this iſochronal property he publiſhed at Paris in a treatiſe, called "L'Uſage du Cadron ou de l'Horloge phyſique univerſelle," in the year 1639, which explained, in 15 chapters, its uſe in philoſophy, aſtronomy, muſic, phyſic, &c. and though he never applied the pendulum as a regulator to ſuperſede the balance in clocks, yet we may date from his diſcovery a third æra in clock-work, namely, the origin of the pendulum clock, which continues in uſe in our day; the idea of the iſochroniſm of a detached pendulum at leaſt was his, and the inveſtigation of the law, by which bodies fall in free ſpace, was applied by him to determine the lengths of two pendulums, that ſhall vibrate in times that are in a given ratio to each other.

It has been a ſubject of great contention, who had the honour to be the firſt artiſt, or mechanician, who applied a pendulum to clock-work; without pretending to decide the conteſt, which, at this diſtance of time, can be determined only by hiſtorical evidence, we will briefly lay before the public the pretenſions of different men to this invention, and leave the reader to judge, from ſuch facts as we have been able to collect on the ſubject. Bernard, one of the profeſſors of aſtronomy at Oxford in the laſt century, has aſſerted, that the Arabians, beſides having clepſydræ and ſun-dials, made uſe of pendulums in aſtronomy long before this period, as we know Riccioli, Tycho Brahé, Langrenus, Vendelin, Merſenne, Kircher, Hevelius, Mouton, and Galileo himſelf, did in a detached ſtate; but we do not find that any of them uſed it in conjunction with wheel-work. According to Becker (Bailly's Hiſt. of Modern Aſtron.), Juſte Birge, a native of Switzerland, in the year 1552, and who was Rothman's ſucceſſor at the obſervatory at Caſſel, from 1590 to 1597, was the firſt who applied a pendulum to a clock, which application, however, he never publiſhed to the world, that we can learn, and which, therefore, if the fact be true, never benefited the world.

According to profeſſor Venturi (Eſſai ſur les Ouvrages phyſico-mathematiques de Leonard de Vinci), Sanctorius applied a pendulum to clock-work ſome time before the year 1625, in which he publiſhed his "Commentarii in Avicennam," and deſcribed ſeveral inſtruments which he had explained to his auditors 13 years before, in his lectures read at Padua.

Vincentio Galilei, ſon of the famous Galileo, is alſo ſaid

(Exper. de l'Acad. del Cimento) to have made a pendulum clock, suggested by his father's discovery, so early as the year 1649, at Venice; but Christian Huygens, the justly celebrated mathematician and philosopher of Zuylichem, contested the honour of priority of the application with him, which contest gave rise to that excellent treatise on clock-work, "De Horologio Oscillatorio," which laid the foundation of most of the subsequent improvements in horometrical machines, and in which it appears indubitably, that he made, or directed the making of, a pendulum clock before the year 1658. From comparing what has been adduced by these two contending mechanicians, an impartial reasoner is led to conclude, that Vincentio Galilei may have applied, in a rough mechanical way, not made generally known, such a pendulum to clock-work as proved no mean substitute for the balance; but that Huygens applied it in a more scientific and masterly manner, and probably without any knowledge of what his opponent had previously done; hence the honour of the invention, as it has been called, has been generally attributed to Huygens.

But whilst we have studiously avoided entering into a minute discussion of all the proofs that have been adduced in favour of each of these foreigners, to substantiate their respective claims to originality of project, with respect to the pendulum, we should act in opposition to our feelings as Englishmen, as well as to our professions of impartiality, if we did not here avail ourselves of some documents that have recently fallen into our hands, which bear the marks of authenticity, and from which it appears, that neither Vincentio Galilei, nor yet Huygens, was the first who adapted a pendulum to a clock, but that an artist in London, named Richard Harris, invented and made a pendulum clock about eight years before either of them dated their claims; an engraven plate, bearing date "Great Russel Street, Dec. 21, 1798," is at this time hanging in the vestry room of St. Paul's church, Covent Garden, of which the annexed is a verbal copy, *viz.*

"The (new) turret clock, and bells of this church, were made A.D. 1797, by Thomas Grignon, of Great Russel Street, Covent Garden, the son and successor of Thomas Grignon, who, A.D. 1740, brought to perfection what the celebrated Tompion and Graham never effected, *viz.* the horizontal principle in watches, and the dead-beat in clocks, which dead-beat is a part of the mechanism of the turret clock. Thomas Grignon, senior, made the time-piece in the pediment at the east end of this parish church, destroyed by fire A.D. 1795. The clock fixed in the turret of the said (late) church, was the first long pendulum clock in Europe, invented and made by Richard Harris of London, A.D. 1641; although the honour of the invention was assumed by Vincenzio Galilei, A.D. 1649, and also by Huygens in 1657. This plate is here affixed by Thomas Grignon of this parish, the son of the above Thomas Grignon, as a true memorial of praise to those two skilful mechanicians, his father and Richard Harris, who, to the honour of England, embodied their ideas in substantial forms that are most useful to mankind."

In order that the reader may judge for himself, what degree of credit is to be attached to the preceding memorial, the writer of the present article pledges his honour to the public, that the following extract, which, on inquiry, is Mr. Grignon's authority for attributing the invention of the pendulum to Richard Harris, is copied verbatim from a manuscript marginal note, written in page 12 of an old book, at present in his possession, called "Essayes of Natural Experiments made in the Academie del Cimento, under the protection of the most serene prince Leopol, of Tuscany, written in Italian by the secretary of that academy, and translated by Richard Waller, F.R.S. London, 1684."

(*Copy of the Extract.*)

"The great clock belonging to Covent-Garden, has a long pendulum, and was made by Richard Harris of London, in the year 1641, which was eight years before Vincenzio Galilei put his father's observations into practice, as appears by the date 1649.

"The ingenious Mr. Huygens applied the pendulum to a clock in the year 1657, and attributed the invention to himself, which created a dispute between him and Vincent Galileo; this last affirming that he had put it in practice in 1649; and the reason of Richard Harris's not appearing, (which would have decided the controversy,) in all probability was, that he being only a private workman was entirely unacquainted with any dispute which might happen between Vincent Galileo and Mr. Huygens; or he might be dead before the dispute arose, it being sixteen years after he made the said church clock."

The manuscript of which this is an exact copy bears every mark of the antiquity ascribed to it by the present Mr. Grignon, who is reputed to be a man of veracity, and who most positively asserts it to be his father's hand-writing, as indeed it appears to be, when compared with some other of his papers which we have seen. It may not be foreign to the subject to add here, that the late Mr. Grignon, who died on April 4, 1784, aged 71, was a good mathematician as well as an excellent workman, and was patronized by Archibald, duke of Argyle. He was an intimate friend of James Ferguson and other scientific men of his time, and one of the first members of the Society of Arts in London, to which society he presented a regulator in the year 1759, which is yet in one of the rooms at the Adelphi, and which has the improved dead-beat escapement, and very high numbers in the wheel-work to avoid friction, which was another idea of his own. The peculiar properties of this clock, however, seem not to have been noticed by, or even perhaps known to any of the present members of that numerous society, so as to become an object of particular attention. Mr. Grignon, notwithstanding, assures us, that it will keep the same time whether its maintaining power be four or twelve pounds, which property he ascribes principally to his father's improvement of Graham's dead-beat escapement.

From this account of Harris's clock, we confess ourselves disposed to contradict the generally received opinion, asserted by other authors, that Fromantil, the Dutchman, was the first who made pendulum-clocks in England so late as the year 1662; one of which was given by bishop Ward to Gresham College, Oxford. Indeed Dr. Hooke, as great a genius as any we have mentioned, made a pendulum-clock, we find, in 1658, for Dr. Wilkins, afterwards bishop of Chester, which was prior to Fromantil's clocks, and some authors have been disposed to make him the inventor of the pendulum as a regulator.

The pendulum being once applied to clock-movements, was found to be a regulator so much superior to the old balance, that Gemma Frisius's idea of making a marine or nautical time-piece was attempted to be realized by the ingenious Huygens, of which attempt we have already spoken under the word CHRONOMETER, where we entered into a detail of the merits and construction of various pieces of mechanism used for the determination of a ship's longitude. It may not be improper, however, to say further of Huygens' marine-clock, that its pendulum vibrated more slowly as it approached

proached the equator, proving, as Picard has fince afferted from experiments made in 1669, the fhape of the earth to be that of an oblate fpheroid. But Huygens, whofe induftry was equalled only by his ingenuity, foon difcovered that the ifochronal property afcribed to the pendulum by Galileo, was only true in circular arcs, when the length of the arc of vibration remained the fame; for that long circular arcs required fomewhat more time for a vibration than fhort ones, fo that variations in the maintaining power produced variations in the time indicated, by altering the length of the arcs of vibration. This difcovery prefented a ferious difficulty, and gave rife to one of the moft ingenious contrivances ever introduced in the mechanifm of a clock, though practical experience foon proved it to be of little or no ufe; we mean the contrivance of two cycloidal cheeks at the point of fufpenfion confidered as evolutes of a cycloid, round which the thread by which the pendulum was fufpended was bent, and occafioned, as we have before noticed under the word CHRONOMETER, the ball to move in the involute of the faid curve, which Huygens firft demonftrated to be itfelf a cycloid, poffeffing theoretically this peculiar property, amongft others, that a heavy body defcending along it from any given point therein, will defcend to the loweft part in the fame time that any other heavy body will fall from any other higher or lower point thereof; whence it was concluded, that a pendulum, vibrating in fuch a curve, would regulate a clock in the beft poffible manner with any maintaining power whatever. The idea was truly ingenious, and the mechanifm equally fo, as we have faid, in theory; nay, the pendulum really moved in a cycloid by this contrivance, but then the alternate pufhes of the balance-wheel againft the pallets were communicated by means of an intermediate lever, called the fork, (which was another invention of our author) to the pendulum, which additional force fo greatly difturbed the natural power of gravity, that the pendulum attached to clock-work was no longer poffeffed of the ifochronal property which it poffeffes when moving in a cycloid in a detached ftate, with all its weight collected in one point, as the theory fuppofes; befides, the moifture of the atmofphere affected the pendulum's ftring of fufpenfion, and what had not been obferved fufficiently at that time, the metallic rod itfelf elongated with heat, fo that the cycloidal cheeks were at length found to be of no benefit as an auxiliary to the natural pendulum, and have therefore been abandoned.

After the length of a fecond's pendulum was afcertained by Huygens to be 3 feet $8\frac{1}{2}$ lines, old French meafure, and after he had propofed it as an univerfal ftandard of meafure, we find that aftronomers began to afcertain the right afcenfion of the ftars by it, and alfo the equation of time, that Hipparchus had fpoken of long before, which application made it neceffary that there fhould be fome contrivance for winding up the maintaining power of the clock during the time that it continued to go, otherwife the quantity of the earth's rotation, that might take place during the act of winding up, muft have been allowed for by conjecture; hence the endlefs chain with a detached ratchet, was invented for this purpofe by Huygens, which is ftill in ufe, we believe, in fome few aftronomical clocks. The fame author was probably the contriver of our prefent dial-work, for changing the hour into 60 minutes by the addition of another hand at the centre of the clock-face; and a circular pendulum was likewife invented and applied, as he fays, with fuccefs to fome of his clocks, the principle of which was, that as the ball of the pendulum revolved in an horizontal circle, when fufpended by a vertical axis, the centrifugal force and power of gravity fo counteracted each other, as to produce an equable motion, while the arbor revolved without an efcapement. We are not informed why this pendulum has not been imitated.

The next invention worthy of notice in clock-work, was the mechanifm of *repetition*, by means of which the clock is made to obey the pull of a perfon in bed, who, from any caufe, may wifh to know the hour which was laft ftruck; this ingenious contrivance, in a great meafure, has fuperfeded the ufe of the ftriking-work with the count-wheel, and was the invention of Barlow, a London clock-maker, about the latter end of the reign of Charles II. *viz.* in the year 1676.

The noife which this curious piece of mechanifm made in the world, fet feveral ingenious artifts to making repeating apparatus, paricularly Quare, in London, and Julien Le Roy, Collier, Larçay, and Thiout, on the Continent (Machines approuveés, tomes v. and vi.). Nearly about the fame period, we find that the comparifon of the earth's rotation with the regular motion of a pendulum clock, produced a defire to indicate not only *mean* but *equated* time on the dial-plate, by various contrivances, which, by the bye, were by no means calculated to improve the regularity of the going part, but only added to the complexity of the machine, and introduced unneceffary and variable friction. We know not certainly who was the firft to execute the equation work, but, according to Sully, an Englifh clock-maker, who fettled at Paris (Regle artificielle du Temps, ed. 1717), the firft equation clock which is recorded, was fent from London to Charles II. king of Spain, before 1699. This contrivance, which was more curious than ufeful, caufed a great number of attempts to produce the fame effect; father Alexander, a Benedictine, prefented a project of this kind to the Academy of Sciences at Paris, in 1698: Le Bon, a Parifian clock-maker, prefented another, which was much admired, to the fame fociety, in 1717; which was alfo done by Julien Le Roy, in the fame year, at Paris; and to thefe names we may add thofe of Thiout, a curate of St. Cyr, Duchefne, Kriegfeiffen, Enderlin, L'Admiraud, Paffemant, Rivaz, Berthoud, and others, who have beftowed much time on a fubject which requires only the infpection of an equation table, and which, therefore, our Englifh artifts now think an expenfive trifle, fcarcely worth their notice, any further than as a matter of curiofity.

The equation mechanifm naturally led to the practice of making clocks to go a month, three months, and even a year, with one winding up; likewife to the introduction of mechanifm to fhow the fun and moon's rifing, culminating, and fetting, and planetary motions in general. Indeed Oronce Finée, mathematician to the French kings, Francis I. and Henry II., had made a planetary clock fo early as 1553, concerning which, and the theory of the planetary motions, he publifhed a Treatife, at Paris, in 1557; and the automaton of Huygens, made in 1703, was properly a planetary clock, and one of a very ingenious conftruction.

We come next to an important improvement, which, like moft other real improvements in the art of meafuring time accurately, belongs to the Englifh, we mean the introduction of the anchor pallets, which, even Berthoud confeffes, was a contrivance of Clement, a London clock-maker, in the year 1680 (fee Smith's Horological Difquifitions, London, 1698); the advantage of this efcapement, with an horizonal arbor for the fwing-wheel, as it is called, over that of the crown-wheel efcapement, is, that it will admit the efcape to take place with a fmall angle of vibration, fo as to prevent the maintaining power from acting on the pallets a long time by a direct pufh; as was the cafe with the crown-wheel efcapement; befides, a fhort arc of vibration in a circle is so like a cycloid at the lowest point, that a short arc, with a heavy ball on the pendulum, soon began to be adopted generally, to the exclusion of the cycloidal cheeks, which, had they possessed their theoretic property in practice, would now have been of little value with a vibration in short arcs, even if the suspension thread had been strong enough to bear a heavy weight, and at the same time sufficiently flexible. This change in the clock escapement introduced the custom of suspending the pendulum from a cock, by means of a piece of watch spring, which was another important invention of Clement, according to Smith's authority. It may be proper to observe here, that the truly ingenious Dr. Hooke too claimed the reputation of being the inventor of the anchor escapement, and affirmed, says Sully, that he had shown to the Royal Society a pendulum with a similar escapement, soon after the fire of London, in the year 1666, as we have seen, when we treated of *Chronometers*, that he also contested with Huygens and Hantefeuille the honour of having been the inventor of the balance-spring of watches.

But whether Clement or Hooke were the inventor of the anchor escapement, it was soon found that a clock of this construction gained time considerably by an addition to the maintaining power, or, which may be considered as the same thing, by diminishing the weight of the pendulum ball, the cause of which is the recoil, or retrograde motion, occasioned in the swing wheel, which, opposing the natural vibration, shortened the arc in the ascent; the seconds pendulum, with this escapement, was called for the first time, the royal pendulum.

Such was the state of clock mechanism, and such were the alterations and improvements therein, at the conclusion of the seventeenth century, or beginning of the eighteenth, which period constitutes a fourth epoch in the history of clock-making. The expansion of metals by heat had been known ever since the year 1648, but the ingenuity of art had not yet devised a remedy for the alternate elongation and contraction of the pendulum rod in summer and winter respectively, though the use of the clock in astronomy imperiously demanded some compensation: this honour fell to the lot of our celebrated George Graham, who, in the year 1715, succeeded in his attempt to preserve the distance from the point of suspension to the centre of oscillation of a pendulum unaltered, notwithstanding it was exposed to all the variations of temperature incident to our climate; the compensation was produced, as will be more particularly described under the word PENDULUM, by means of mercury enclosed in a cylindrical glass vessel, guarded by a frame, and substituted for the ball of a metallic pendulum rod, so that while the rod of metal, constituting the verge of the pendulum, lengthened downwards, the column of mercury lengthened upwards, which was an original and truly ingenious idea. Pendulums of this construction, when well adjusted, have been found to measure time with a degree of accuracy far beyond what the former pendulum had any pretensions to, for a continued length of time: the principal objection to its general adoption was its liability to break in carriage, or by other accident:—but Graham, feeling the force of this objection, took a wide view of the subject, and, looking round for other resources, suggested the idea of using the opposite expansions of different metals as a means of compensation in a pendulum, which idea was immediately adopted by Harrison, at that time an obscure carpenter in Lincolnshire, at a village called Barton; who, overcoming all the difficulties attending his retired situation, which is the property of a great genius, astonished the world by the production of the grid-iron pendulum; a pendulum which is not liable to the objection of want of portability, and which has till lately been generally adopted in astronomical clocks of the best construction. For its description we must again refer to the article PENDULUM. Still, however, a better escapement than the common anchor escapement was wanting; for it was not sufficient to have obtained an invariable pendulum in point of effective length, while its natural isochronal property, arising from gravity alone, continued to be greatly disturbed; *viz.* while alternate additions and subtractions of force were derived, and that often unequally, through the medium of the train of wheel-work to the escapement, from the maintaining power first, and thence improperly modified to the pendulum itself. Accordingly, we find Graham, about this time, becoming the inventor of the dead-beat escapement, and also Harrison of a silent escapement, which will go without oil; both of which are specimens of great originality of contrivance, as will be seen when we come to describe them in their proper place: the former of them has proved itself of such great utility, that it has been adopted in the generallity of regulators or clocks for astronomical observations, in conjunction with Harrison's grid-iron pendulum, moving with a heavy ball in a small arc of vibration: of this kind is the clock at the Royal Observatory, at Greenwich, of the accuracy of which it has been affirmed, that it seldom gains or loses, on an average, more than one second of time in five days. To avoid the wearing out of the parts most in action, and the influence of friction, the best clocks of this construction, like the one we have just mentioned, have pallet wheels of hardened and polished steel with pallets of ruby or agate, which require little or no oil: this kind of substance, we believe, was first used in time-pieces by a Frenchman, De Baufre, about the year 1704. The pivot holes also are sometimes bushed with jewels, to avoid the production of verdigris, and the clamminess of thickening oil; but the consequent additional expence seems to be hardly compensated by such a refinement as the last.

Harrison was also, as we have seen before, the inventor of the auxiliary spring and additional ratchet on the barrel arbor, which is a much neater way of making the clock go during winding, than that of Huygens by means of an endless chain, or of the forcing elastic bolt, which has been made to slip into a tooth of one of the wheels, and to push it forwards during the act of winding and for some minutes after.

We might now suppose that the clock has arrived at its *ne plus ultra*, with respect to further improvements, but still we find so many successive alterations, if not improvements, in the escapement, and mode of compensating the pendulum's expansion, that to notice all the fanciful minutiæ that have been magnified into importance by different modern artists, would be to write a long volume on the subject. We will, however, out of the great variety of horological contrivances in this century, select those which have originality and utility to recommend them to public notice, and pass in silence, for the present, over the inventions of chimes, organs, cuckows, planetary motions, atmospherical winding-up, mercurial mover, &c. &c. as objects of fancy more than of real use in clock-work. (For the two last see "Machines Approvées.") Among the contrivers of detached and other clock *escapements*, as will hereafter be seen under this word, we may place Grignon, Mudge, Cummins, Nicholson, &c. in London; and on the Continent Julien le Roy, Peter le Roy, Sully, Du Tertre, De Bethune, Le Paute, Amant, Robin, Berthoud, &c. all of whom have merited commendation for ingenious contrivances in their construction of this most scientific part of the clock. The principal inventors of compensation pendulums, (which will be described under the

the word PENDULUM,) after Graham and Harrison, have been, in France, Regnauld, Deparcieux, Julien le Roy, Cassini, and Berthoud; and in England, Ellicot, Cummins, Nicholson, and Troughton, the last of whom has very recently made such a disposition of the grid-iron pendulum, by means of concentric tubes of brass containing within them the rods of iron, as gives it the appearance of an ordinary simple pendulum rod; and his accurate mode of adjusting for temperature by a delicate spirit-level pyrometer, lately invented, bids fair for introducing this elegant pendulum into general use in clocks which profess to be accurate; indeed, we know, that many pendulums of this construction have already been made for observatories both public and private.

We might mention here various curious as well as useful engines, tools, pyrometrical, and other instruments, which owe their origin to the successive improvements in clock-work, but we think the subject of sufficient importance to demand a separate account of these. We must not, however, pass in silence over some other real improvements connected with the pendulum, one of which is, fixing the ball at the centre of oscillation, instead of supporting it by a tapped nut at the lower extremity, the latter of which methods is only useful when a simple substance, such as metal, wood, glass, &c. is used for a rod; for in these cases a species of compensation is effected by the upward expansion of the ball; in some of which cases a pin, passing through a point of the ball between the centre and lower extremity, will be still better. In those constructions where the ball itself is not easily adjustable, a second light ball is made to screw up and down a projecting piece of the rod below the heavy ball, to adjust for time, and sometimes a micrometer-screw is adapted for measuring the quantity of the adjustment; this is an idea, no doubt, borrowed from Huygens, whose clock had a second adjustable weight on the body of the rod to answer the same purpose, which circumstance we omitted to mention before. The improved suspensions, however, have rendered these secondary balls in many clocks superfluous, which requiring the clock to be stopped for their adjustment were inconvenient; in these suspensions the adjustment for rate is made by a micrometer-screw at the cock or top of the pendulum, even while going, to which mechanism also is added a lateral adjustment for putting the pendulum into beat, instead of bending the fork as is practised in ordinary clocks. Lastly, the modern practice of fixing the cock to the solid wall or other steady situation, and allowing the pendulum to find its own perpendicular line before it be fixed in that situation, is among the real improvements of this art, and cannot be too much recommended. But, notwithstanding all these, and doubtless other improvements in the art of clock-making, one desideratum yet remains to be discovered; *viz.* a simple substance that is *not expansible* by heat, for the rod of the pendulum; we think that pyrometrical experiments, on different substances of nature and combinations of art, have not yet been sufficiently extended, and we beg leave to suggest an opinion, for which we are indebted to Mr. Troughton, that tobacco-pipe-clay, or the composition of Wedgewood's thermometer, if properly baked, may prove on trial to afford a very simple rod, at least for a half-seconds pendulum; particularly if a metallic cap, cemented or otherwise fastened to its upper extremity, should be furnished with a knife-edge suspension, which the celebrated Berthoud, as we have said, affirms has less friction than the slip of watch spring; but if the latter be preferred, we presume the compensation for it, and also for the argillaceous rod, if it should require any, may be made by pinning the ball a little below the centre to the lower extremity of the rod, and then the adjustment for time may be as usual at the cock, with lateral screws to close the slit when the adjustment is complete. From the experiments which we have made with wooden pendulums, we find that they are more affected by moisture than by heat, and are therefore not to be depended on.

Turret Clock of the Royal Palace at Hampton Court.

After having given a history of the principal improvements made from time to time in clock-work, we propose to describe, individually, so many clocks of different constructions, in successive order, as will enable the reader to form a competent judgment of their properties and relative merits, which office we undertake with the more pleasure when we reflect that the English language is yet without a book descriptive of the various constructions of a machine, which, in one form or other, is now in the possession of almost every house keeper.

According to Dr. Derham, the oldest English clock extant is in a turret of the royal palace at Hampton, constructed in the year 1540, which time was in the reign of king Henry VIII. by a maker whose initials are N. O. When we consider that this clock contains mechanism for representing the motions of some of the heavenly bodies, and that the celebrated Copernicus was living at the time of its date, and had not published his book "On the Revolutions of the Celestial Orbs;" when we reflect also, that more than a century elapsed after this time before the pendulum was applied as the regulator of clocks, these considerations appear sufficiently interesting, to induce a minute examination of the wheel-work of this ancient clock, particularly of that part of it which constitutes its celestial mechanism.

Fig. 1, of *Plate* X. is the calliper of the wheel-work which produces the celestial motions, taken from Dr. Derham's "Artificial Clock-maker," published in 1714 (third edition), whose account we will first copy in his own words, and then make some observations on the value of the wheel-work. The Hampton Court clock, says the Doctor, "shews the time of the day, and the motion of the sun and moon, through all the degrees of the zodiac, together with the matters depending thereon, as the day of the month, the sun's and moon's places in the zodiac, moon's southing," &c.

"To shew how completely (for that age) the wheel-work is laid under the moving part of the dial-plate, I have given the calliper thereof, which represents the several wheels and pinions only which lie under the dial-plate, and drive the several motions in this manner. In the centre of all, both the dial-plate and its wheel-work are placed on a fixed arbor, which hath a pinion on the end of it, which drives both the solar and lunar motions, by means of a large wheel of 288 teeth turning round upon it once in 24 hours, which large wheel is drawn round by a pinion of 12, fixed on the arbor of the great wheel within the clock, which turneth round once in an hour. The wheel 288 thus turning round in 24 hours, carries about with it the wheel 37, and its pinion of 7 leaves, as also the other prickt (dotted) wheel, and its pinion, on the other side. The pinion 7, of the wheel 37, drives another wheel of 45 teeth, which carries round the moon's ring or circle. On the opposite side the aforesaid pinion 8 drives round the prickt wheel, whose pinion drives a wheel of 29 teeth, whose pinion, of 12 leaves, drives round the wheel 132 that carries the sun and the zodiacal matters."

"These were the numbers of the wheel-work (continues the Doctor) remaining in the year 1711; but the prickt wheel and pinion were taken out formerly by some ignorant workman that was not able otherwise to amend the clock; but

but were supplied, and the whole movement repaired lately, by that skilful artist, Mr. Lang. Bradley, in Fenchurch Street, London." (p. 121, 122.)

This description gives a clear idea how the movements were actuated; but the numbers of the dotted wheel and pinion being unknown, leave the solar movement incomplete, thus $\frac{*}{8} \times \frac{29}{*} \times \frac{132}{12}$, so that the exact value of this original combination of wheels and pinions for the annual motion unfortunately cannot be with certainty known; though there is no difficulty in ascertaining a wheel and pinion to be substituted, to complete the wheel-work for either a solar or a civil year.

The wheel-work for a lunation, however, is entire, namely, $\frac{37}{8} \times \frac{45}{7}$ or $\frac{1665}{56}$ of 24 hours, which will be found to be equal to $29^d\ 17^h\ 34^m\ 17^s.14$, which is too long a period by $4^h\ 50^m\ 14^s.31$. This excess, in the short space of one lunation, it will be remarked, is very considerable; and it will be inferred from hence, either that a synodical revolution of the moon was not at that time well ascertained in England, or that the inventor of the astronomical movement was unable to calculate numbers more accurate to represent it by wheel-work. We are of opinion, notwithstanding, that neither of these was the case, and our reason for such an opinion is founded in these three considerations; first, great ingenuity is shewn in the disposition of the wheel-work, so great indeed, that it will be seen hereafter, that Mr. Ferguson has evidently copied it in the dial-work of his principal astronomical clock; secondly, the calculations have evidently been made for a lunar day, and not for a lunation, because the moon's age is indicated by the difference between the solar and lunar apparent daily motions, that is, by the solar hand pointing to the moveable lunar dial-plate, and not by a lunar index pointing to a graduated fixed plate; and, thirdly, the length of the lunar day was not ascertained with accuracy by any means so remotely as a lunation, on account of a deception that existed in the determination. Let us examine these considerations a little more closely; as the large wheel of 288, which revolves in the space of 24 hours, carries both the solar and lunar movements along with it, except the pinion of 8, which remains always immoveable in the centre, it follows, that, because this great wheel revolves from west to east, the wheel of 37 borne by it, and connected with the fixed pinion, will revolve in the same direction the space of 8 teeth out of 37 in every 24 hours; also the pinion of 7, fixed on the centre of the wheel 37, will, by the same connection, be carried $\frac{8}{37}$ of 7 teeth in the same time, but the second wheel of 45 will revolve in a contrary direction, or from east to west in each 24 hours, the space $\frac{8}{37}$ of $\frac{7}{45}$ parts of a solar day, which, reduced into a simple fraction, is $\frac{56}{1665}$ of 24 hours, or 48.432432, &c. minutes, so that the falling back of the wheel of 45 in every revolution of the large wheel occasions the moon's daily space on the dial-plate to be equal to 48.432432 minutes on the contiguous solar face of 24 hours, and, if we divide the whole of 24 hours, or 1440 minutes, by this quantity, we shall have $\frac{1440}{48.432432} = 29^d\ 17^h\ 34^m\ 17^s.14$ for the lunation, as before.

In order now to see how large the day's space for the moon's age ought to be on the moon's plate, we must divide 1440, the minutes in a day, by 29.53058, the days in a lunation, and the quotient 48.76301 will be the number of the minutes that the moon's plate ought to lose, with respect to the solar index, in a natural day, which quantity differs from what the wheel-work effected only .33057, or very nearly ⅓d of a minute's motion in every 24 hours, which would be deemed very inconsiderable at a time when the clock itself must have been without such a regulator as would make it go truly for any length of time; the inventor, therefore might not think it necessary to calculate a more accurate movement.

But there might be another cause of error in the calculation arising from the assumed data; it appears, as we have intimated, that for a considerable time after the period in question, though the length of a lunation was known pretty accurately, yet the length of an exact lunar day was not properly apprehended; even Benjamin Martin among other astronomical writers (Institution of Clock-work, vol. ii. p. 412.), who had lunar tables before him, has inconsiderately but erroneously asserted, that the moon passes the meridian on each day at a mean rate about $48\frac{7}{10}$ minutes later than on the preceding day; it is true, indeed, that the difference between the sun's and moon's daily mean motions in the ecliptic is $12°\ 11'\ 27''$, which space answers very nearly to $48\frac{3}{4}$ of time, but then, as we have already seen, this is the distance between these two heavenly bodies at the end of a solar day after new moon, and not at the instant when the moon transits the meridian the first time after, as has been falsely concluded; for during the time that the earth is revolving on its axis the space of $12°\ 11'\ 27''$ or $48\frac{3}{4}$ minutes of time, the moon continues her advance from the sun, and gets as much farther as corresponds to 1.643 minutes more; and lastly another small advance is made whilst the earth is revolving this last space; and so on till the moon is found on the meridian: the aggregate of the moon's daily advance from the sun and of all the successive proportional parts may be thus ascertained at one operation; because a synodical revolution of the moon is performed in 29.53058 days, and because the moon passes the meridian less frequently by once than the sun does in that time, let 1440 be divided by 28.53058, and the result will give the lunar day equal $50^m.472$ or 50 minutes and 28.32 seconds. Mr. Ferguson, however, has discriminated between a lunar day, and the time answering to the moon's daily motion added to a solar day, one being a corrected and the other an incorrect period; in consequence of which we find the annexed note in page 116 of his "Tables and Tracts," *viz.* "It is generally believed that the moon revolves from the meridian to the meridian again in 24 hours 48 minutes, but that is a mistake: for if she did, there would be 30 complete days from change to change."

We repeat, therefore, that a misapprehension of this nature was very likely to be productive of an error in the calculation of a movement which was intended to represent the moon's meridian passages: and let it be recollected, that what has been here said respecting the two lunar periods $48^m.76301$, and $50^m.472$, will be serviceable in ascertaining the moon's age and the tides at any place; the former, being the moon's daily motion in solar time, applies to calculations of the moon's age; and the latter, being the exact length of a lunar day, applies to the ascertaining of the tides, which distinction, we think, is not generally made.

After the writer of the present article had made the preceding calculations and observations on the original construction of the astronomical clock at Hampton Court, he felt an inclination to inspect the present clock, that he might know what the solar movement is, which Bradley is said to have substituted, when a wheel and pinion of the original movement were lost; accordingly, on the 8th of May 1802 he embraced an opportunity which occurred, of gaining permission to ascend to the lofty situation in which this clock is placed, which enterprize was attended with some personal danger; but it proved on a minute and careful examination, that the whole of both the annual and lunar movements are different from the original ones recorded by Dr. Derham.

The lunar movement is $\frac{59}{10}+\frac{45}{9}=29\frac{1}{2}$ days and the annual one $\frac{73}{12}+\frac{42}{7}+\frac{150}{15}=365$ exactly. The prefent central pinion is a double one confifting of a 10 and a 12, fixed as the former one of 8 is defcribed to have been, and pinned together; they are made of box, as are alfo the pinions of 7 and 9, to prevent their cankering, or oxiding, as it is now called, and both the trains are arranged as already defcribed. The wheel of 42 is made of brafs: but the reft, being very large, are made of iron. The great wheel of 288, which connects the clock-work with the aftronomical movements, appears to be the only portion of the original work, both by its marks of antiquity and the number of its teeth, which are cut on the inner edge of its circular part; there are two crofs bars riveted to this indented rim to carry the heavenly movements, and as there is no counterpoife to thefe, it was fufpected at the time that their rifing and falling weight would alternately accelerate and retard the going of the clock, which is connected with it by means of an horizontal arbor about 3 yards long by eftimation: accordingly, on inquiry, it turned out that the time of the day indicated is fometimes 5 minutes or more too back, and again as much too forward on the fame day, every day, which circumftance had not before been accounted for. Indeed our author had made a memorandum, before he faw this clock, merely from confidering its conftruction in Dr. Derham's account, that moft probably this would be the cafe, unlefs there fhould be fome counterpoife.

The infcription " L. Bradly, 1711," was marked on the frame of the going part of the clock, which has evidently been new, either all of it at that time, or fome part of it fince, fo that what the original regulator was, does not appear, nor are the initials " N. O." to be found at prefent. There are three barrels and weights, one for the going part which has a very heavy long pendulum; one for the ftriking part; and one for ftriking the quarters: the prefent efcapement is a pair of pallets acting alternately into pins projecting from the plane of a wheel with an horizontal arbor, which kind is now pretty common in England, and, according to Berthoud, was invented by M. Amant, a clock-maker of Paris, late in the eighteenth century. (See ESCAPEMENT.)

In Grofe's Antiquities it is faid that this clock, confidered as an aftronomical clock, was invented by Tompion; but this account cannot be true, becaufe that famous artift lived in Dr. Derham's time, a century and half after the original conftruction; he may in all probability have been employed in making fome of the alterations either in the aftronomical or going part, which circumftance has given rife to this account.

The hand and divided circles are in the following order on the face, *viz.*

1. or inmoft fmall circle—twice XII for ☾'s fouthing:
2. Moon's age $29\frac{1}{2}$:
3. Ecliptic with figns and days of the month:
4. Sun and hour hand revolving in 24 hours:
5. 24 hours marked I. II. &c.

The moon's phafe is fhewn by a circular hole cut on the hour index covering more or lefs of a blackened plate placed under it on the lunar dial.

The going and ftriking parts of the clock before us have nothing particular in them to require our further notice.

A Thirty-hours Clock, with a 'Larum and Count-wheel ftriking Work.

An ordinary 30-hours houfehold clock has ufually a feconds pendulum, 39.14 inches long, in the latitude of London, as meafured from the point of fufpenfion to the centre of ofcillation, according to a mean of five determinations, and is contained in a cafe of wood of correfponding length refting on the floor of the room where it is placed; its going and ftriking parts are actuated by two feparate ponderous bodies, the cords or chains of which go refpectively round two diftinct pullies, with pins inferted into their grooves, to hold the cords or chains from flipping in a detached ftate, without taking the pullies along with them; and in the act of winding up every morning, or every evening, as may be the cuftom, each ponderous body, ufed for actuating the wheel work, is drawn up feparately and fucceffively; the ftriking mechanifm in moft of the modern clocks is of the kind defcribed hereafter and feen in *Plate* XII. known by the name of the rack and fnail ftriking part; but as the older clocks and fome few of the modern ones are made with the count-wheel ftriking mechanifm, we propofe to defcribe, in the firft place, a clock with ftriking mechanifm of this kind in its moft improved ftate, together with an alarum, or 'larum, for roufing a perfon from fleep at a given hour, and alfo a fimple method of making the clock go while it is under winding. *Plate* IX. of *Horology* fhows a perfpective view of a clock of this kind in *fig.* 1, where the covering parts are removed, fo as to allow an exhibition of all the parts of the mechanifm in their refpective fituations, which, we believe, has never been properly done before. The frame of this clock is nearly a cube made of fix plates of brafs, with four pillars at the corners connecting the top and bottom plates, and the bell is mounted over the frame, as reprefented in the figure; there are befides, within the frame, two pair of crofs bars of brafs, one pair holding the going part, and the other holding, feparately from the going part, the ftriking part of the mechanifm; all which are too plainly feen to require particular reference to the drawing. In a common 30-hours clock that indicates feconds, the centre wheel arbor ufually carries the minute hand, and revolves in an hour, and with pinions of 8 this wheel has 64 teeth, and the fecond wheel 60, with a fwing wheel of 30; but with pinions of 6 the centre wheel has 48 teeth, and the fecond wheel only 45, with a fimilar fwing wheel for the common anchor pallets; but the clock before us does not fhew feconds, and confequently has higher numbers in its train, and a pendulum fhorter than a feconds pendulum: the firft wheel, *a*, on which the pulley for winding up the going part is fixed faft without a ratchet in this conftruction, for a reafon to be explained by and bye, is affumed as revolving in two hours in order that the fall of the fufpended weight may not be fo great as it would have been if it had revolved once in an hour; this firft wheel of the train has 80 teeth, and drives the pinion of 8 on the arbor of the fecond wheel, *b*, which has alfo 80 teeth, impelling a fecond pinion of 8 on the arbor of the fwing wheel, *c*, which has 45 teeth; the fwing wheel therefore makes 100 revolutions $\left(\frac{80}{8}\times\frac{80}{8}\right)$ while the firft wheel revolves once; *i. e.* it revolves once in 50 minutes, and therefore is not proper for carrying a feconds hand; but the 45 teeth of the fwing wheel do not all completely efcape the pallets of the anchor

anchor in less than 90 (45 × 2) vibrations of the pendulum; hence 50 × 90 = 4500 are the vibrations per hour, and as the lengths of all pendulums are inversely to each other as the squares of their vibrations per hour, the pendulum before us must necessarily be 20 inches long, for as the square of 4500 : the square of 3600 :: $39^{in.}14 : 20^{in.}$, very nearly. The pallets are of the recoil kind (see ESCAPEMENT), and have an arbor of great length, with a crank in the middle of it nearly, to avoid the fly of the striking part which comes through an aperture in the top plate; the inner end of the pallets arbor has its pivot inserted into a piece of metal, *d*, on the top plate, and the outer end of the same has its pivot passing through a cock, *e*, on the same plate, which cock also bears the pendulum by a slip of watch main-spring; the pendulum receives its impulse from the crutch, not seen, attached to the protruding portion of the said pivot. What we have so far described constitutes what is called the going part, sometimes also called the watch part of the clock, from its watching the lapse of time. The first wheel, *a*, which revolves once in two hours, is not placed in the centre, but a little below, and has its strong arbor passing through the cross partition bar, *ff*, of the interior frame work, and receiving a wheel of 40 teeth, and also a pinion, *h*, of ten leaves, which are attached together and inserted on this arbor by friction; the wheel of 40, which, we have seen, revolves in two hours, drives a concealed pinion with a long tube, called the cannon pinion, the place and size of which are ascertained by dots at *k*; on the tube of this pinion, which has 20 teeth, and which therefore revolves in an hour, is placed the minute hand, *n*, the end of the tube being squared to admit the square aperture of the hand; the pinion of ten leaves, which also revolves in two hours, drives the wheel, *i*, of 60 teeth in twelve hours, the tube of which admits on its circular part the hour hand, *m*, which consequently revolves in 12 hours $\left(2 \times \frac{60}{10}\right)$; this work is denominated the dial-work, being that which regulates the relative velocities of the two hands as seen in *fig.* 3. The next portion that offers itself for description is the 'larum portion, which has an immediate connection with the dial-work, and has the time of its going off limited thereby. On the tube of the 12-hours wheel, *i*, is placed loose, or at least so tight only as friction will fix it, the small plate, *o*, pointed to by the tail of the hour hand, *m*, which small plate has 12 hours engraven on it, and a pin inserted into it behind, which comes in the way of the lever *p* every 12 hours; this pin is put into a certain situation with respect to the hour of 12, and the end of the lever, *p*, also, in order that the pin may catch the said lever at a certain hour placed under the tail of the hour hand at any time previously to the hour intended; the consequence is, that when the 12-hour wheel has revolved far enough to present the pin of the small 'larum dial borne by it to the end of the lever *p*, this lever is elevated a little, and as its arbor, *q*, has its pivots running in the interior frame work of the going part, a second lever, *r*, on the same common arbor, is also at the same time elevated from the pin, *t*, of an escapement crown wheel, *s*, better seen detached in *fig.* 2, at which instant the small weight of the 'larum pulls the pulley on the back of the escapement wheel, *s*, of the 'larum, and gives it a rotatory motion as long as the weight continues to fall. The escapement wheel here mentioned has coarse teeth of the serrated kind, which act with two pallets on the perpendicular arbor *v*, in the same way that the pallets of a common watch act, except that the latter are on a horizontal arbor, and have their frequency regulated by the vibrations of the balance; whereas here there is no regulator, but the pallets go and come alternately as fast as the impelling weight can force them to move; on the top of the perpendicular arbor of these pallets is fixed a hammer with two faces within the bell, represented by dots, which moving backward and forward from one interior side of the bell to the other, with the force communicated to the pallets by the pallet-wheel, make a reiterated noise, the intensity and continuance of which are sufficient to disturb the repose of a sound sleeper. When the weight has drawn up all the cord, it is only necessary to pull it up again, and the lever, *r*, acts as a detent with the pin, *t*, of the pallet-wheel, till the pin of the 'larum dial, set to any given hour, shall again detach it, when the same continued noise will be resumed.

The last portion of the clock is the striking portion, which also has a connection with the dial-work; the wheel, *g*, which revolves in the space of two hours, has two pins at the distance of a semicircle from each other, behind the wheel as seen in the figure; one or the other of these two pins at the end of each hour seises the end 1 of a tail piece attached to the long horizontal arbor 2 3, which reaches the whole depth of the two internal frames; this long arbor has another bar 4, or detent, which reaches far enough to fall in the way of a pin in the wheel 7, or warning wheel, so as to arrest the motion of the striking movement when in its quiescent position. Parallel to the long arbor, and above it, is another but shorter arbor 5, turning by its pivots in the interior frame of the striking part; this short arbor 5 has a bent lever 6 by which it may be raised by the contact of the detent 4 of the long arbor 2 3, and also two catches or detents 7 and 8, all fixed at right angles to the axis of motion; the detent 7 falls into a notch made in a hoop placed fast to the wheel marked 13, thence called the hoop-wheel or detent-wheel sometimes, which revolves once at every blow of the hammer, and the second catch 8 falls successively into 12 notches cut at unequal distances on the edge of plate 11, called the locking plate, which is fixed fast to the wheel marked 12, called the count-wheel, because its teeth count the stroke-spaces between the notches of the locking-plate that are placed respectively at $\frac{1}{78}$, $\frac{2}{78}$, $\frac{3}{78}$, &c. of the circumference of the plate from each other, as explained when we described the ancient clock of Henry de Wick. The wheel 9, first actuated by the cord or chain passing round the third pulley fastened to it, has 12 pins for raising the tail-piece 10, of the hammer, the arbor, *l*, of which is seen in the figure; the spring of the hammer tail is concealed from view, but the shaft of the hammer is seen passing through an opening in the top plate at 16, and the head of the hammer is represented within the bell, where it strikes, by a dotted design above 16. The pin-wheel or striking-wheel 9 has 60 teeth, and drives a pinion of 10 leaves on the arbor of the hoop-wheel 13, behind the cross piece of the frame work; the hoop-wheel has 70 teeth driving a pinion of 7 leaves on the remote end of the arbor of the warning wheel 7, of 56 teeth; which wheel again impels the pinion 14, of 7 leaves, on the arbor of the fly, one half of which is seen through an opening in the top plate at 15. On that end of the arbor of the pin-wheel which passes through the back part of the frame-work is inserted a pinion of 12 leaves, called the pinion of report, driving the counting wheel 12 of 78 teeth. The action of the striking part is thus:—

One of the pins in the two-hour wheel, *g*, first lifts the tail 1, of the long lever 2 3, and with it the detent 4, the warning wheel 7 is not yet at liberty, but begins to revolve the instant that this detent has raised the curved arm 6 over it, which arm raises with it both the catches or detents 7 and 8, that leave the hoop-wheel 13, and also the count-wheel 12, under-

12, under the command of the ſuſpended weight; the motion of the wheel 7, however, does not proceed far till its detent 4 is raiſed into the way of its pin, and the motion of it is arreſted; the noiſe of this temporary motion of wheel 7 is called the warning, and the wheel itſelf the warning-wheel; preſently the pin of the 2-hours wheel, *g*, drops from the end of the tail 1 of the arbor 2 3, and this tail as well as detent 4 reſume their quieſcent poſition; during the temporary motion of the warning wheel 7, the hoop-wheel, and alſo the locking-plate attached to the count-wheel, had moved far enough to take the notches from the claws of their reſpective catches or detents 7 and 8, the moment, therefore, that the detent 4 takes its quieſcent poſition, the warning-wheel is again at liberty, as are alſo the hoop-wheel and count-wheel; the whole movement, conſequently, now proceeds, and the pin-wheel raiſes the hammer tail as often as the pins meet with it, until the detent 8 meets with a notch to receive it into the locking-plate, at which inſtant all motion is at an end, and the detent 7 of the hoop falls alſo into its notch, and holds the whole movement firmly in a quieſcent ſtate, till the ſecond pin of wheel *g* again detaches the detents, and renews the ſame proceſs; which happens at the concluſion of every hour.

From this account of the movement of the ſtriking part, and of the other auxiliary parts of this mechaniſm, it is eaſy to apprehend the reaſon of the numbers of teeth fixed upon in their different wheels and pinions; for firſt, becauſe there are 12 pins in the ſtriking or pin wheel, it is neceſſary that the pinion of report on the ſame protruding arbor ſhould have 12 leaves, in order that every tooth of the count-wheel, which counts a ſtroke of the hammer, ſhould have its motion correſponding with that of the pins reſpectively; but in twelve hours there are 78 ſtrokes, therefore 78 teeth in the count-wheel, one of which meaſures the firſt interval on the locking plate; two of which the ſecond; three, the third, and ſo on till the laſt ſpace between the notches is meaſured by twelve teeth of this wheel; again, as the pin-wheel has 60 teeth and twelve pins, each pin is removed from the next $\frac{60}{12} = 5$ teeth; if the hoop-wheel, or detent-wheel were neceſſarily obliged to have an exact revolution at every ſtroke of the hammer, the pinion on its arbor driven by the pin-wheel muſt neceſſarily have five leaves only; but when the teeth are not laid very deep into one another, the play will allow the hoop-wheel to have only one revolution in two ſtrokes, which is the caſe before us, where the pinion has ten leaves; the pin-wheel, however, might very well have had 96 teeth, and the pinion in queſtion 8 leaves, and then there would have been an entire revolution of the hoop-wheel at each ſtroke. We have ſeen that the count-wheel revolves once in 12 hours and that the pin-wheel revolves in $\frac{78}{12}$ of this time, or makes $6\frac{1}{2}$ turns; but if the number of pins had been 13, and the pinion of report alſo 13, the time of a revolution of theſe would have been $\frac{78}{13}$ of 12 hours, or one in two hours, which is the caſe with the great wheel of the going part, and the two movements would, in that caſe, have been more uniform with reſpect to the calculations of continuance. It is of but little importance what the numbers of teeth be in the two remaining pinions and warning wheel, as they only regulate the velocity of the fly, provided the teeth are numerous enough to act without much friction.

As we mean not to introduce any other clock with the count-wheel mechaniſm after the preſent one, it may be proper to notice here, that when this kind of ſtriking work is uſed in an eight-days clock, or other clock of longer continuance than 30 hours, another wheel and pinion, called in ſuch caſe the great wheel and its pinion, muſt be placed on the end of the barrel, or fuſee, accordingly as a weight or ſpring is uſed for the maintaining power; and the number of teeth of this additional wheel will depend partly on the number of leaves of the pinion and partly on the number of coils of the cord or chain on the barrel, or fuſee, as the caſe may be; which never can be difficult to determine when it is known in what time the pin-wheel revolves, and what the continuance of the clock is required to be; for inſtance, if the pin-wheel revolves with 13 pins in two hours, $\frac{72}{12}$ will be the wheel and pinion to make the barrel or fuſee turn once in 12 hours, and 16 turns will be ſufficient for a continuance of eight days.

The manner in which the clock in queſtion may be placed to go well, is ſhown in *fig.* 3, where A is a bracket fixed to a ſolid wall, to hold the frame containing the works, which are here ſuppoſed to be without a caſe; the face or dial requires no explanation after what we have ſaid of the ſmall innermoſt circle or 'larum dial; nor have we any particular remarks to make on the pendulum, or its rod, in this clock, which profeſſes not to meaſure time alike under the variations of atmoſpheric temperature; but the manner in which one ſuſpended weight impels both the going and ſtriking movements, the former even while winding, is ingenious and deſerves attention. Huygens long ago propoſed and indeed actually uſed an endleſs cord with a detached ratchet, ſo applied that one half of the weight continued always to impel the going movement of his clock, and a detached ratchet gathered up the expended portion of the cord once in 24 hours. (See Clock-*work*.) The preſent contrivance is evidently borrowed from his invention, but its application ſerves two diſtinct purpoſes, one half of the weight impels the going part, and the other half the ſtriking part of our preſent clock, in the manner following;—The pulley of the going part we have ſaid is fixed faſt to the arbor of the great wheel and always revolves along with it, but the pulley of the ſtriking part, like the pulley of the 'larum, has a rachet formed of a click taking hold of one of the croſſes of the pin-wheel, ſo that it will move back without this wheel, but not forwards; the cord, which has its ends nicely united, goes over both pullies, firſt over the ſtriking pulley, as Huygens's does over the detached ratchet, and down the loweſt plate of the clock frame; it then paſſes under the running pulley, *a*, which has the weight hung to it, and up again over the going pulley; thirdly, it comes down again through the ring of lead *b*, which is only a dead weight to ſtretch the cord over the pulley of the ſtriking part; and, fourthly, aſcends again over the ſtriking pulley, where the ends meet; the clock is wound up by pulling the cord, *c*, downwards, till the principal weight is raiſed to the bottom of the bracket, while one of the cords of the running pulley continues to act with half of the whole weight on the pulley of the going part the whole time; ſo that this power, when duly drawn up, is not only equivalent to both the movements, but is perpetual, as well as invariable in its intenſity.

Eight-days portable Clock with repeating Mechaniſm.

A portable eight-days clock differs from an ordinary 24-hours clock principally in five reſpects: in the firſt place, it is actuated by a ſpring; ſecondly, it has a ſhorter pendulum; thirdly, it has conſequently a higher train; fourthly, it requires a fuſee; and, laſtly, it has frequently a crown-wheel eſcapement; in ſhort, it may be conſidered as a watch on an enlarged

enlarged fcale, except that it has ufually the ftriking mechanifm, which is introduced in the repeating watches only. In the clock, which we propofe here to defcribe, we have fubftituted the fwing-wheel with an ifochronal efcapement, for the crown-wheel efcapement, which we are of opinion ought to be banifhed from all clocks and watches entirely, as being too much the flave of the maintaining power. It will not be neceffary to render our defcription of the clock before us very long, as we mean to make it the fubject of analyfis under our fubfequent article CLOCK-*movement*.

Plate XI. of *Horology* prefents a perfpective view of a portable eight-days clock, defigned and callipered agreeably to the numbers and directions given in the article juft mentioned, which conftruction we have preferred defcribing here, in order that the reader may there fee our reafons for every part of the mechanifm, if he wifhes for fuch explanation: let it however be underftood, that we by no means hold out the prefent clock as a model for others to follow, but give it as one of the hundred different varieties or more that might be devifed to anfwer the fame purpofe.

Plate XII. exhibits the dial-work and ftriking part, including the repeating mechanifm of the fame clock, which we fhall defcribe in its turn.

Fig. 1, of *Plate* XI. expofes to view the interior face of the back or pillar plate A A A A, and the wheel-work contained within the frame; B, B, B, B, B, are five pillars fcrewed into the back plate, and tapped at their projecting ends to receive five fixing fcrews, when the front plate is put in its place to complete the frame: there are two barrels with main-fprings, C and D, of which C is for the going part, and is clofed with its cap; but D, which is the barrel for the ftriking part, is left open to fhow the coils of the main-fpring contained in it. There are alfo two fufees, E and F, attached to their refpective great wheels; E the fufee of the going part, and F that of the ftriking part. G is the centre or hour wheel of 64 teeth placed partly behind the great wheel of 96, by which its pinion of 8 is actuated; hence the fufee revolves in $\frac{96}{8}$ of an hour, or once in 12 hours, fo that the 16 fpiral grooves, filled by the gut, allow the continuance to be juft eight days. The fecond wheel H, of 60 teeth, has its pinion of eight impelled by the centre wheel, and in its turn impels the pinion of 8 on the arbor of the third wheel of the train, I, which is here alfo the efcapement wheel; the revolutions therefore of the arbor of wheel I are $\frac{64}{8} \times \frac{60}{8} = 60$, while the hour-wheel revolves once; confequently this arbor, which revolves in $\frac{1}{60}$ of an hour, is proper for carrying the feconds-hand round in a minute. The efcapement-wheel has 60 teeth, and the pendulum vibrates twice in every fecond; but one tooth does not efcape the pallets of the anchor K, until two vibrations have been completed; confequently 60 teeth efcape, *i. e.* the efcapement-wheel makes one revolution in 120 vibrations, or in the fpace of one minute: hence the clock before us indicates half-feconds. The fquare ends of the two fufees are oppofite two holes in the clock-face, at each fide of the centre of the circles of indication, (which are too well known to need defcription), but a little below it, and the fame handle fits both fquares: L is a jointed lever fixed to the interior fide of the front plate called the guard-gut, or fimply the guard, the ufe of which is to prevent the chain or gut from doing more than juft fill the fixteen grooves of the fufee in winding; M is a fpring alfo faft to the interior fide of the front plate, which preffes the lever L towards the middle of the fufee, and keeps it there till the chain or gut, meeting with it, drives it back again, in the act of winding, fo far till the claw *o* is prefented to the beak or catch of the end piece N, which then ftops the further motion of the fufee and limits the quantum of chain to be wound up. Thefe pieces L and M conftituting the guard, being attached to the front plate, are taken off with it, when the frame is difmounted, but we have put them into their places in a detached ftate in our figure, to fhow more evidently the nature of their office. O is the arbor of the warning piece, which will be defcribed in its place prefently. The wheels P, Q, and R, with their refpective pinions, conftitute the movement of the ftriking part, and the fanner S regulates the velocity with which they move. The wheel P has eight pins which lift the crofs piece *t*, of the arbor T, eight times in each revolution of the wheel P; thefe elevations of the piece *t* occafion fo many portions of a revolution of the arbor T, which arbor has its pivot projecting to V, behind the frame, and carrying on its fquared projection the hammer V, *fig.* 2; the hammer is confequently raifed every time a pin of wheel P moves the piece *t*; W is a long and ftrong fpring, called the hammer-tail-fpring, attached to the back plate of the frame, and preffing with its upper extremity under the crofs pin, paffing through a hole in the arbor T, near the face of the back plate; fo that when the hammer is raifed at any time, the fpring W urges it back again with a fmart blow, and makes it ftrike the bell behind the frame, which is concealed from the fight in our figure; but left the blow fhould be too ftrong, a counter fpring, U, is fixed to the contiguous pillar, which breaks the violence of the blow, and makes the hammer return fmartly to its place when the blow is made; this fpring, U, alfo ferves as a guard, in cafe a ftroke of the hammer fhould be made when the bell is taken off at any time. The fufee F is provided with a guard fimilar to that of the fufee E; and the vane of the fly or fanner S is kept to the arbor, on which it is placed, by the friction of a preffing fpring, fo that it will go round either with or without the arbor, the latter of which is the cafe only after the ftriking has ceafed, till the momentum of the fly has been annihilated by the refiftance of the air.

Fig. 3, is a portion of the top of the exterior face of the back plate of the frame, conftituting the fufpenfion of the pendulum: *a* is a bridge, or double cock, in which the projecting pivot of the pallet's arbor is fupported; *b* is a fmall cock over this, or may form a part of the fame, the protruding part of which is flit with a faw, to allow the flip of watch main-fpring, *f f*, to pafs; by which the pendulum rod is fufpended; and *c* is a thumb-fcrew to clofe the flit, and clamp the piece of fpring when the true length of the pendulum is afcertained; the upper end of the fpring, *f f*, is borne by the bearing piece *d* above the frame, to which it is ufually made faft by a pin paffing through the piece *d*, and a hole in a piece of brafs pinned to the extreme end of the fpring; the apparatus for raifing and lowering the piece *d* is better feen in *Plate* XII. to which the reader is now defired to turn for the remainder of the defcription; only let him bear in mind that the effective length of the pendulum is meafured from the inferior edge of cock *b*, in *Plate* XI. to the centre of ofcillation of the bob, and that the quantum of this meafure is adjufted by the elevation or depreffion of the piece *d*, while the flit of the ftationary cock *b* is not clofed by the thumb-fcrew *c*; which adjuftment may be made while the clock is going, provided the flit be again clofed by the thumb-fcrew, otherwife the effective length of the pendulum will be meafured from the piece *d*, and will remain the fame whether this piece be raifed or depreffed.

The

The bearing piece *d*, *Plate* XII. is the remote end of a tranſverſe lever, *c d*, moveable like the teleſcopic tube of a tranſit-inſtrument on two pivots, *a b*, of an axis ſupported by two ſmall cocks, *a* and *b*, clearly ſeen in the figure, ſo that when the pivots are ſtrong and without play in their holes, it is evident that the end *d* can have no lateral ſhake, provided the bar *c d* has no ſpring, *i.e.* provided it be ſtrong; alſo when the interior end *c* is fixed with reſpect to elevation, the exterior bearing end muſt be alſo fixed; the contrivance therefore for elevating or depreſſing the end *d* in the body of the clock caſe at any time may be as well applied to the end *c* in the front of the frame; for a depreſſion of one end of the lever *c d* always produces a correſponding elevation of the other, and *vice verſâ*, ſuppoſing the axis exactly in the middle; but when the axis is out of the middle of the lever, an elevation or depreſſion of either end is in proportion to its diſtance from the axis of motion directly. At *e* is a circular plate of braſs, better ſeen detached in *fig.* 4, called the *riſe* and *fall*, with an arbor ſquared at the projecting extremity, oppoſite a perforation on the face or dial of the clock, to receive a key of regulation; this circular plate, which is pivoted into the cock *f* attached to the front plate of the frame, has a ſpiral aperture through which a round pin in the end of the lever, *c d*, paſſes ſo as juſt to go in without ſhake; hence, whenever the plate *e* is turned by the key one entire revolution, the pin of the lever, which paſſes through the ſpiral aperture, aſcends or deſcends from one end of the ſpiral to the other, and at the ſame time depreſſes or raiſes the bearing end, *d*, a proportionable quantity and with it the bob of the pendulum, as may now be eaſily apprehended; the condition, therefore, with reſpect to the regulation, is, that one turn of the plate, *e*, ſhall effect as great a change in the length of the pendulum, as ſhall be requiſite to bring the clock to a true rate, or keep it ſo when adjuſted, where the pendulum has a compenſation for temperature, or is made of a ſubſtance that alters its dimenſions but little with the variations of temperature of the atmoſphere. In ordinary clocks of this conſtruction, with a ſimple metallic rod for the pendulum, the ſlit may be ſo nearly cloſed at all times as juſt to allow the thin ſpring of ſuſpenſion to paſs, in which caſe the frequent adjuſtments for rate may be made without opening the caſe; but when the pendulum is of any of the beſt compenſating kinds, it will be better to cloſe the ſlit by the thumb ſcrew *c* in *Plate* XI. after the adjuſtment for rate is completed.

Thoſe parts of *Plate* XI. which are viſible in *Plate* XII. are marked with the ſame letters over again, and therefore need not be again deſcribed, but will be of ſervice to elucidate the relative poſitions of thoſe parts, now that the frame is exhibited as mounted. We will begin our deſcription of the ſtriking and repeating work, with the arbor of the centre wheel, G, the end of which is ſeen within at the projecting end of the ſquared part of the tube, or cannon, of the pinion ſeen in *fig.* 2, called the cannon pinion; the tube of this pinion is put tight on the arbor of the hour wheel, which we have alſo named the centre wheel, and has a ſpring placed on the hour wheel arbor, preſſing its poſterior ſurface ſo as to force it forwards againſt the croſs-pin that keeps the hands on; this action of the ſpring occaſions ſo much friction, that though the tube is carried round by the hour arbor, yet it is capable of being moved round, by its hand placed on the ſquare end, independently of this arbor, for the purpoſe of ſetting the hand to the requiſite minute in the divided circle of 60 ſpaces, uſually figured with the Arabic characters: the cannon pinion, as it is called, has 40 teeth, and impels a ſimilar pinion, *g*, round alſo in an hour; this pinion, *g*, which is called the pinion of report, has a pinion of 6 on its arbor, and is pivoted into the cock, *h*, ſo that the ſmall pinion of 6 alſo revolves in an hour; this pinion of 6 again impels the wheel *i* of 72 teeth in $\frac{72}{6}$ of an hour, *i.e.* in 12 hours; this 12-hour wheel has alſo a tube, ſurrounding the tube of the cannon pinion, but in ſuch a way, that a third tube, attached to the bridge, *k*, and ſeen in a detached ſtate in *fig.* 5, is interpoſed between the ſaid two tubes of the cannon pinion and 12 hour wheel; the uſe of which third fixed tube, is to prevent the friction that would neceſſarily take place, if the two revolving tubes had been in contact, and had preſſed on one another, while their velocities are to each other as 12 to 1: on the exterior tube of the 12-hour wheel, the hour hand is inſerted, which indicates the hour among the Roman figures; and it is obvious that whenever the minute hand carries the cannon pinion round, the pinion of report, *g*, alſo moves the ſame quantity, and by means of the ſmall pinion of 6, the wheel *i* at the ſame time muſt move $\frac{1}{12}$ of the ſame ſpace, and conſequently the two hands are ſo connected, that one cannot move without the other, ſuppoſing them both to be faſt to their reſpective tubes; but the hour hand is put on the round part of its tube, and kept to it by mere friction, and therefore may be put to any hour without carrying the minute hand round many revolutions; and yet when once placed right, it preſerves its relative velocity, as though it were more firmly attached to its tube. I is the arbor of the ſeconds-hand, which we have ſeen revolves in a minute, and which meaſures the 120th part in its divided ſmall circle, on the face of the clock, at ſo many vibrations of the pendulum, or at ſo many half-ſeconds. To the 12-hour wheel, *i*, is pinned faſt an indented ſpiral piece of metal, called the ſnail, the ſhell of which it reſembles in ſome meaſure, which ſnail conſequently revolves likewiſe in 12 hours; the indentations appear to the eye to be irregular, as to their relative extents, but each ſubtends an angle of $30° \left(\frac{360°}{12}\right)$ ſo that one indentation, whether near to the centre of motion, or remote from it, is exactly the meaſure of an hour's motion of the 12-hour wheel. The ſteel piece, *m n*, is called a rack from the teeth on the croſs-piece, *m*, the lower croſs-piece of which is called the rack-tail; this rack is moveable on a pin or ſtud at the lower angular point, near which the horſe-ſhoe ſpring, *o*, called the rack-tail-ſpring, preſſes to keep a pin on the remote end of this tail, againſt that indentation of the ſnail, which happens to be contiguous to it; this pin is hid from the ſight, but the place may be ſeen on the extremity of the tail where it is inſerted. On the lever between *m* and *n*, is a bend to prevent its touching the winding arbor F of the fuſee, belonging to the ſtriking part; alſo at *m* is a ſtrong ſteel pin, projecting from the rack. Above the rack is a horizontal ſteel bar, *p q r*, moveable round a ſtud at *r*, which is called the hawk's-bill, from the bill or angular piece at *q*, that catches the teeth of the rack. The piece *s* is fixed to the protruding pivot of wheel Q, *Plate* XI. near its lower extremity, and revolving with it gathers up a tooth of the rack at each revolution, on which account it is called the *gathering pallet*, the catch of the hawk's bill having a contrary ſlope, gives way in the mean time, and comes back again by its own gravity. The pinion of the pin-wheel, P, which has 64 teeth and eight pins, has eight leaves, and therefore revolves once every time that the hammer of the bell is lifted; but we have ſaid that its gathering pallet takes up a tooth of the rack at each revolution of its arbor, conſequently a tooth of the rack is gathered up at every ſtroke of the hammer, when the ſtriking part is in motion. The angular piece, *t u v*, moveable round an arbor, denoted by O, in *Plate* XI. is called the *warning-piece*; its lower end, *v*, falls in the way of a pin in the ſmall hour-wheel, *g*, and its bent end, *t*, paſſes through an aperture, *w*, in the front plate of the frame, and is preſented to the pin in one of the croſſes of the wheel R, of the ſtriking movement within the plate, ſo as to reſtrain the motion of this movement when in its quieſcent ſituation. The action of the different parts may be thus explained; whenever the hawk's-bill, *q*, is lifted from the teeth of the rack, the ſpring, *o*, preſſing againſt a pin near its tail, makes it fall back till it meets with ſome obſtacle to arreſt its motion, that obſtacle would be the pin, *x*, in the front plate, if there were no other interpoſed before it had fallen ſo far back, but if the ſnail is in any other poſition than that, wherein its neareſt indentation towards the centre is contiguous to the pin of the rack-tail, the tail-pin of the rack will fall upon the edge of the ſnail before the rack has fallen back to the pin, *x*, and all the teeth of the rack will not paſs the catch of the hawk's-bill in this caſe, but juſt ſo many as there are indentations or ſteps counted from the remote angular point of the ſnail to the ſtep on which the tail pin reſts; in the preſent poſition, in the plate, the tail-pin is reſting on the ſtep ſix of the ſnail, which denotes that ſix ſtrokes will be given by the hammer, or that ſix teeth of the rack are to be gathered up by as many revolutions of the hawk's-bill; but we ſee that only five teeth remain to be gathered up of the rack; hence we know that the clock has ſtruck one out of ſix, and is in the act of ſtriking; accordingly, we ſee that the pin in the hour-wheel, *g*, has juſt raiſed the warning-piece and permitted it to go again; the clock will therefore now continue to ſtrike till the upper end of the gathering pallet, *s*, falls on the projecting pin, *m*, of the rack, which will be as ſoon as the laſt tooth of the rack is drawn up to the hawk's-bill, in which ſituation the wheel, Q, cannot revolve any farther till another hour has elapſed. After another hour is paſt, the pin of the wheel, *g*, will elevate the warning-piece, *v*, the bent end, *t*, of which will firſt be raiſed out of the way of the pin of the wheel R, and the fly will run on a revolution or two, with a whiſtling noiſe, *i. e.* the clock will *give warning;* but the end, *p*, of the hawk's-bill has not yet been raiſed far enough by the preſſure of the end, *t*, of the warning-piece, to make the catch, *q*, clear the teeth of the rack, therefore the rack cannot yet fall back; preſently, however, the hawk's-bill is lifted high enough by the pin of the pinion of report, *g*, which has a ſlow motion; the rack falls back till its tail-pin reſts on ſtep ſeven nearer the centre, which has now arrived at the point of contact, and therefore ſeven teeth of the rack paſs the catch, *q*, in the fall of the rack, and the hour of ſeven is now ſtruck before the tail of the gathering pallet, *s*, falls again on the pin, *m*, of the rack, and ſtops the ſtriking; at the ſame time the bend of the warning-piece catches the pin of the wheel R, and ſtops the fly; and in this way any number of hours will be ſtruck by the hammer on the bell that the ſnail regulates, which we have ſaid revolves once in every 12 hours; and if any other cauſe than the pin of the hour-wheel, *g*, ſhould lift the warning-piece within the hour, counting from warning to warning, the ſame number of ſtrokes will be repeated, though it ſhould be a hundred times or more. To convert this ſtriking mechaniſm into repeating mechaniſm, therefore, it is only neceſſary to place a lever, *y*, to revolve round a ſtud on the front plate of the frame at the point *y*, with a ſlender ſpring, *z*, over it to bring it back to its original ſituation, when the end placed under the warning-piece is elevated by depreſſing the exterior end, which may be done by pulling a ſtring down which is tied to a hole in this end, as repreſented in the figure; and as often as the ſtring is pulled, ſo often will the clock repeat the ſtrokes of the current hour. There is yet remaining the three armed piece, 1 2 3, undeſcribed, called *ſtrike* or *ſilent*, the uſe of which is explained by its name; this piece is differently made in different clocks; in the clock before us it is moveable on a ſocket, riveted to the end, 3, of one of its arms, round a ſtud in the front plate of the frame, and as the ſocket has ſcarcely any ſhake, the other two ends, 1 and 2, move always in the ſame plane; at the end marked 1, is a pin projecting above the upper circumference of the face or dial of the clock, ſo that it may be moved to the right or left at pleaſure, when the glaſs-door is open; the end marked 2, has a ſlope, like a wedge, on that ſide which is next to the plane of the frame-plate, and the end of the arbor, O, in *Plate* XI. of the warning-piece, projects ſo far as to touch the inclined plane; this arbor of the warning-piece has ſome ſhake, in the direction of its length, within the frame, and its poſterior pivot paſſes between the prongs of a forked ſpring, X, which, reſting againſt the ſhoulder of the pivot, puſhes it cloſe to the interior ſide of the front plate of the frame, where a ſimilar ſhoulder ſtops it; when the pin, at 1, is puſhed to the right, the wedge of the end, 2, puſhes the arbor back, notwithſtanding the forked ſpring, X, juſt deſcribed, and the end, *v*, of the warning-piece, being carried with its arbor nearer to the frame than it otherwiſe would be, falls in the way of the pin of the hour-wheel, *g*, and the clock conſequently ſtrikes the hour regulated by the ſnail; but when the pin, at 1, of the ſtrike or ſilent, is puſhed to the left, the end, 2, is withdrawn from the pivot of the arbor on which the warning-piece is faſt, the ſpring, X, in the frame puſhes it forward ſo far, that the end, *v*, of this warning-piece is clear of the pin of the hour-wheel, *g*, which wheel therefore continues to revolve from hour to hour in a ſtate completely detached from the mechaniſm of the ſtriking part, which we have been deſcribing. Sometimes there is a hand moveable in a ſmall circle in the dial, which anſwers the ſame purpoſe as the pin at 1; (See CLOCK-*work*,) but this is generally the caſe when there is no circle for the ſeconds, or when there is ſome other circle to which it is intended to correſpond, for the ſake of uniformity, which is generally attended to in the dial-work of every clock.

Laſtly, the four holes in the front plate denoted by the letters Z, Z, Z, Z, are the holes in which the pillars of the dial, or face, are inſerted and pinned within the frame by metalic pins going acroſs the ends that paſs through the plate of the frame; ſo that the face is thus firmly attached to the frame, and then the frame to the caſe, which preſerves the wheel-work from duſt, and the touch of ſuch perſons as might otherwiſe ſatisfy their curioſity at the expence of ſome of the more delicate parts of the workmanſhip. Indeed, many of the ornamental portable clocks have caſes of glaſs, with various devices, ſuch as are calculated to recommend them to the fancy rather than the judgment of their purchaſers, who wiſh to adorn thereby their chimney-pieces. In the formation of theſe ornamental caſes, ſpar of different colours, or moulu, and various other ſuperb materials are uſed, agreeably to the taſte of the artiſt who is employed in ſuch manufactory.

A portable clock, ſuch as we have here deſcribed, is eaſily converted into a clock with a long caſe, and a ſuſpended weight for the maintaining power, by ſubſtituting a cylindrical barrel for the fuſee on the arbor of the great wheel, on which barrel the chain is wound, inſtead of being made to ſurround the fuſee; for, as a ſuſpended load acts at all times with the ſame power, it is neceſſary that the barrel ſhould have the ſame diameter at every part of it. Of this conſtruction are the eight days houſehold clocks in general uſe.

use. Also by introducing a wheel and pinion between the great and centre wheels, the clock may be made to go a month or more, and by introducing two such wheels and pinions, it may be made to go a year at one winding up, with a maintaining power proportionably great.

Eight-days portable Clock, with Chimes and repeating Mechanism.

Under our article CHIMES, we gave a description of the chime-barrel, hammers, and bells of a chime-clock, in a detached state, but referred to our present article for their connection with the striking part of the clock, which could not there be sufficiently explained; as we have now shown the manner in which the modern striking part is constructed, and have also explained the nature of its action, we propose to resume the subject of chimes, for the explaining of which in the best manner, we have thought it necessary to describe here at full length, a portable chime-clock with a short pendulum, for which purpose we have introduced two separate views in *Plates* XVI. and XVII. of *Horology*, which, we trust, will enable us to make all the mechanism, complex as it may appear, sufficiently intelligible to any one who has read and understands the structure of the eight-days clock that has been just described. *Plate* XVI. is a representation of the three movements of a chime-clock, when the front plate of the frame is taken off, the eye being placed perpendicularly over the mechanism when viewed; we have retained the same letters of reference as we used in *Plate* XI., as far as they will go, and have supplied the deficiency from the Greek alphabet, which are used for the movement of the chimes, so that the reader will see, by a *coup d'oeil,* the arrangement of the movements, even without the help of a description, if he recollects the parts of the clock described in *Plate* XI. A, A, A, A, stand at the four corners of the back plate of the frame, on the interior surface; B, B, B, B, are the places of the four pillars; C the spring barrel of the going part; D that of the striking part, and α that of the chime portion; E is the great wheel and fusee of the going part, F those of the striking part, and β those of the chime part; N in each the catch of the guards respectively; G, H, and I, are the wheels which, with their respective pinions, constitute the train of the going part, of which H is the contrate wheel, and I the balance wheel, with its lower pivot resting on the small cock or potence K; the pallets cannot be well seen in this plate, but are visible in *Plate* XVII.; P, Q, and R, are the wheels of the striking movement, having each a pinion on its arbor, and S is the pinion of the fly seen at S in *Plate* XVII. The wheel P has the eight pins for lifting the hammer, the arbor and levers of which are at T; the arbor of Q carries as before the gathering pallet for drawing up the rack of the striking part, and R has the pin for catching the bent end of the warning piece; W is the hammer tail spring, and U the counter spring, which are somewhat differently placed here from what they are in *Plate* XI., but act in a similar manner. The wheels marked with the Greek characters $\gamma, \delta, \varepsilon, \zeta$, are those of the chime movement, with their respective pinions; δ is the wheel on the arbor or axis of the barrel, which has the lifting pins for moving the hammer tails when they strike the bells, as has been already explained under our article CHIMES of a *clock*; θ is placed near the hammers, ι on the bell of smallest diameter, and $\varkappa$ at the springs which bring the hammers back after each blow, and hold them in a situation to be caught by the pins of the revolving barrel.

Let us turn now to *Plate* XVII., where we have a perspective view of the whole frame and mechanism before the front plate, with the same letters of reference, as far as they go, as in *Plate* XII., and also as in *Plate* XVI., and where the Arabic figures are put to the mechanism of the chimes that connects them with both the going and striking parts of the clock. In this plate, which is intended to explain the ordinary chime-work of a clock, the parts of the mechanism which effect this purpose are so disposed as to be nearly all seen in their respective places of action. A, A, are placed on the back plate of the frame; B, B, B, B, are the four pillars of the frame; C, D, and α, are three ratchet wheels for adjusting and preserving the intensities of their respective main-springs, and are placed before the front plate on the squares of their barrel arbors, as in any other portable or spring clock; E, F, and β, are the arbors of the three fusees for the key that winds them up; L and L are the parts of the two guards which are attached to the front plate, on the interior side, out of sight, the situation and action of which were explained under *Plate* XI., and the end of the third guard is hid by the snail. K is the bridge of the dial-work, concealed from sight, such as is seen at the bottom of *Plate* XII., in *fig.* 3; I is the crown-wheel and pallets, to the verges of which the crutch of the pendulum is fastened behind the frame; and S is the fly of the striking part, held by a small spring crossing the middle of its arbor near S, by simple friction. The cannon pinion is hid from sight behind the 12-hour wheel *i*; but the pinion that acts with it, of the same number of teeth, is seen at *g*, which is called the pinion of report, and has a pinion of 6 on its arbor pivoted into the cock *h*, and driving the 12-hour wheel of 72 teeth, as in the preceding clock; the snail, however, of the striking part, is not here on the 12-hour wheel as before, but is attached to a star, or wheel with 12 pointed teeth, at *l*, one of which teeth is actuated each hour by a pin in the cannon pinion, and the foot, *f*, with a slender spring, *e*, pressing against its leg, the heel of which is placed between the two nearest teeth of the star, not only prevents their backward or forward motion during the lapse of each hour, but also yielding to the impulse given by the pin of the cannon-pinion at the end of each hour, allows the tooth to pass the heel, and then returns to its original situation by the force of the spring *e*, at the same time pushing on the star the exact space of one interval, so that when the star moves at all, it must necessarily move just one twelfth part, and remain in that situation together with its snail, for the space of a whole hour before it is moved again, which is an essential condition where the striking part repeats the hour; otherwise the following instead of the preceding hour might be struck by the clock during each latter half-hour of the day. The tail of the warning piece does not here reach to the pin in the pinion of report as in our former striking work, explained in *Plate* XII., but has the chime-mechanism interposed; in consequence of which arrangement the chimes play first, and then set the clock a striking when they have ceased, at the end of every hour; for this purpose two separate racks with their respective springs, catches, and gathering pallets, &c. are necessary in this machine, which may have their respective offices thus explained: The pinion of report, *g*, goes round in an hour, as we have seen before, and has 4 pins which raise the cross lever, 1, of the hammer, 1, 2, every quarter of an hour, a little before its completion; at the same time that the cross lever, 1, is lowered, the end, 2, of the hammer is depressed, and its tail-piece in contact with the spring, 3, is raised, by reason of its being placed behind the stud which is at the centre of motion; the spring, 3, consequently is raised also from its state of rest, so that when the pin of the pinion of report lets go the lever, 1, this spring, 3, pressing back the hammer-tail, makes its head, 2, strike a

piece of

projecting pin near the claw of the detent or catch, 7, after which it falls back again by its own weight; this stroke of the hammer is powerful enough to drive the claw of catch 7 from the teeth of the chime-rack, 4, which therefore immediately falls back, by the force of its spring, 6, pressing on its projecting end beyond the stud, round which its motion is performed, until its tail, 5, falls on the nearest of the four steps of the small snail of the quarters attached to the pinion of report; in this fall as many teeth of the chime-rack pass the claw of the catch as there are steps in the small snail, counted from its remote angular point to the end of the tail-piece of this rack; the greatest fall of the rack is the space of four teeth, when its tail rests on the step nearest the centre of the snail for the first quarter of an hour, and when its lever falls back against the pin, 11, in the front plate of the frame; in the mean time the supporting bar, 8, moveable on a stud near its lower extremity, having been forced back by the long tail of the gathering pallet, 10, of the chime movement, now returns by the action of its spring, 9, pressing its tail-piece below the centre of motion, and presents its head to a second pin in the catch, 7, nearer its centre of motion, contiguous to the figure 7, so that when the catch, 7, falls back by its own weight after it has been struck by the hammer, 2, its second pin falls on the head of the support, 8, where it remains until the rack of the chimes has its tail placed on the step of the small snail; the chime movement, being at liberty as soon as the tail of the gathering pallet, 10, falls from a pin behind the chime-racks, not seen in the drawing, runs on, and presently the said tail of the pallet pushing against the inner side of the support, 8, disengages the second pin of the catch 7, the claw of which now falls again into the teeth of the rack, and holds the rack while the pallet has drawn it home again, *i. e.* till the tail of this pallet falls on the concealed pin on the back of the chime-rack, the chime-barrel in the mean time revolving and raising the hammer-tails of the eight concentric bells fixed on a common arbor at 1, and supported by a bar attached to the front plate of the frame. This process is repeated three times at the quarters 1, 2, and 3; but when the hour is completed nearly, the fourth process does not stop here; for as the chime-snail now permits the rack belonging to it to fall back by its spring, 6, the space of four teeth, the pin in the left hand end of this rack strikes the tail, *p*, of the hawk's-bill, *q r p*, moveable on a stud at *r*, and thus raises the catch- or bill, *q*, from the teeth of the striking rack, which now falls back as far as its snail, *l*, will allow its tail, *n*, to come towards its centre; when the hawk's-bill is lifted in this manner it pushes up the bent end, *t*, of the warning-piece from the pin of the wheel, R, in the frame, (*Plate* XVI.) and the fly makes two or three revolutions or more, which motion produces the noise of warning, but the little spring, 13, immediately pushes the warning-piece down again into the way of the pin of wheel R, the motion of which is thus presently stopped: the chimes of the hour are now going on while the four teeth of its rack are in the act of being drawn home, and when the fourth tooth of this rack is brought back, the chime-pallet falls on the concealed pin of the rack behind it, and nearly at the same time the pin of the rack in front, which pushed down the tail, *p*, of the hawk's-bill, now raises the tail, *v*, of the warning-piece, *t v*, and consequently depresses the end, *t*, of the same so far, that the pin of the wheel R is again free, and the striking of the clock goes on as in the usual striking part, till the hour regulated by the 12-hour snail is counted by the proper number of strokes; after which the tail of the gathering pallet, *s*, of the hours falls on its resting pin behind the hour rack, *m u*; it being a matter of no importance on which face of the rack this pin is fixed; nor yet on which side of the bill, *q*, the gathering pallet is placed, provided there be the proper number of teeth in the rack to be drawn up by the pallet. The four holes, *a*, *b*, *c*, *d*, are to receive the four pillars of the dial; the horizontal lever, *y*, taking the pin of the catch 7, may have its tail, *z*, pulled by a string coming through the case, to make the chimes repeat, and the hour also at any time during the first quarter after striking; and, lastly, the pin of the lever 14 15, or strike and silent, by being pushed to the right or left, will bring the heel of the part 15 to a pin in the middle of the hammer lever, 2, or remove it therefrom accordingly as the chimes and striking are to be in use, or the contrary. After what we have already said about trains, we think it not necessary to particularise the numbers of teeth in the wheel-work.

A Clock without Dial-work, by Dr. Franklin.

When clocks had begun to be common, and a variety of complicated contrivances had been introduced into the different constructions, it was at length deemed desirable to simplify the mechanism; and various attempts have been made to construct a clock with as few wheels and pinions as possible. The late Dr. Franklin, and the late Mr. J. Ferguson both succeeded in diminishing the usual number of wheels and pinions to three of the former and two of the latter, notwithstanding hours, minutes, and seconds, were all indicated by their contrivances; we propose to describe them in succession, and shall begin with Dr. Franklin's first, as being prior in point of time. *Fig.* 1, of *Plate* XVIII, of *Horology*, will explain so much of Dr. Franklin's clock, in question, as is necessary for conveying a suitable idea of its construction. The face, or dial plate, is perfectly represented, and the dotted circles denote the wheels and pinions in the frame behind the face, on a supposition that the face and front plate of the frame are transparent; which mode of representation not only places every wheel and pinion in its own place, but shows their respective diameters as well as if a second figure had been used for this purpose, as has hitherto been usual, when this clock has been described by other writers. The great wheel, A, of 160 teeth, goes round, by means of the cord with a suspended weight surrounding a pulley attached to it, in four hours; this wheel drives a pinion, B, of ten leaves, in $\frac{10}{160}$ of four hours, or one quarter of an hour; on the arbor of this pinion is the second wheel, C, of 120 teeth, actuating a second pinion, D, of 8, in $\frac{8}{120}$ of a quarter of an hour, which is one minute, and together with it, on the same arbor, the third wheel, E, of 30 teeth, in the same time; this third wheel is the usual swing-wheel of an ordinary 30-hours clock, and has a seconds pendulum, suspended in the usual way from a cock, by a piece of the main-spring of a watch. These are all the wheels and pinions made use of in the clock. The face is occupied by a spiral line, as seen in the figure, and has the hours denoted by the Roman characters, which count from XII, in the order I, II, III, &c. as the spiral goes, placed at intervals of a quadrant from each other; these hours, as well as the 60 minutes, placed four times over in a surrounding circle and denoted by the Arabic characters, are pointed to by a hand, P, placed by friction on the round part of the protruding arbor of the great wheel, A, that revolves in four hours. In the present situation of this hand, the time indicated is forty minutes past one of the three hours which it has last passed. *viz.* XII, IIII, or VIII, and it is presumed that a mistake of four hours can hardly happen whenever the clock is examined. The small hand at D indicates seconds in the usual way, and therefore requires no explanation. There can be no doubt but that a clock thus constructed will measure time as well as any other clock with a similar pendulum, provided it be well made. The objections which have

have been alleged against this construction are, that it is possible a person awaking in the night, and examining such a clock, may mistake his time four hours very easily; and that that it will require being drawn up by its cord once every day, unless, indeed, the fall of its suspended weight should be made much greater than is usual, or even convenient, in the generality of houses. The writer of the present article had some years ago a clock, constructed nearly similar to the present one, but its great wheel revolved once in every three hours, which allowed larger minute spaces in the surrounding circle, and required an additional spiral line; for the Roman figures were four deep at each third part of the circle; its use was to keep in motion the system of Jupiter and his four satellites, which it did very well; an endless cord, with a detached ratchet, being applied to produce continual motion during winding as well as at other times. We do not learn, however, that Dr. Franklin's clock has been frequently copied.

A Clock with only three Wheels and two Pinions, by Mr. J. Ferguson.

We have said that Mr. J. Ferguson also contrived a clock to show hours, minutes, and seconds, with only three wheels and two pinions; his principal object was to obviate the objections we have stated to Dr. Franklin's clock; *fig.* 2 of *Plate* XVIII. gives a similar representation of Mr. Ferguson's clock, as *fig.* 1 does of Dr. Franklin's: the great wheel, A, of 120, revolves in 12 hours attached to the pulley, round which the cord of the weight is stretched; this wheel drives the pinion, B, of 10 leaves, in $\frac{10}{120}$ of 12 hours, or in an exact hour, which is the value of this fraction; the second wheel C, which revolves also in an hour, and which has also 120 teeth, drives the second pinion D, of 6 leaves, in $\frac{6}{120}$ of an hour, or in three minutes; consequently the pallet-wheel of 90 teeth, placed on the arbor of this latter pinion, revolves also in three minutes; the pallets of the anchor escapement, which act with this wheel, give an impulse to a seconds pendulum at each vibration, as is usual when the swing-wheel has only 30 teeth. The hours are marked in Roman characters, on a circular plate that is inserted by friction, on the arbor of the 12-hour or great wheel, about three of which hour figures appear always through an aperture cut through the dial below the pinion B: and a fleur-de-lis, designed on the dial, serves as a hand to point to the hour to be indicated. We see no reason why a circle, a little smaller than the plate of the hours, might not have been marked with the Roman characters on the dial itself, within the circle of minutes, with a hand placed on the arbor of the 12-hour wheel to point to it as usual, which method is certainly more simple, inasmuch as that the circular small plate would have been dispensed with and also the aperture in the dial. There is also another circular plate, divided into 60 three times over, and marked with the Arabic figures, placed by friction on the arbor of the three minute or pallet-wheel F, which is pointed to by another fleur-de-lis on the dial, as seen through another aperture of one third of a circle in length; this large plate, borne by the pivots of the pallet-wheel, must have been very injurious to the performance of the clock before us, where the power is diminished in the ratio of 720 : 3, supposing the pallet wheel no bigger in diameter than the pulley, and that independently of friction; the inertia of so much matter as the seconds plate must contain, to be overcome at the return of each vibration, must have required a large maintaining power; an objection of which the inventor himself acknowledges the existence; this objection, however, might very easily have been obviated, for a circle as large as the divided plate might have been drawn on the upper half of the dial, and would have admitted of similar divisions and figures to which a hand, borne by the pallet-wheel arbor, would have pointed, and indicated the seconds as truly as they are at present. The inventor, not aware of so simple a resource, proposes to get rid of the force of the objection by omitting the seconds altogether, as being of no real service except in astronomical clocks; but why attempt the introduction of seconds at all, when studying simplicity, if they are of no use? Mr. Ferguson has also allowed another objection to his construction, from which Dr. Franklin's was exempt, namely, that when the minute hand is at any time adjusted, it does not alter the hour plate, which must have a separate rectification, for effecting which conveniently he had 12 holes drilled in the small 12-hour plate at equal distances, to receive the end of a pin whenever the hour-plate required adjustment; the seconds plate must also have been subject to a similar inconvenience. Mr. Ferguson has himself candidly stated one other objection to his clock, that seems to afford a better proof of his candour than of his judgment in clock-work, which is, that he supposes the total arc of vibration of the pendulum must be too small with such diminutive teeth as the highly numbered pallet-wheel afforded, and seems to have thought that a large arc is better than a small one, by reason of the greater momentum of the pendulum, notwithstanding he mentions a cycloidal arc as that in which all lengths are equally isochronal: the fact however is, as is now universally allowed and proved in practice, that a small arc near the point of the pendulum's quiescence approximates the nearest of any other part of a circular vibration to a cycloidal one, and that the momentum, which is not acquired by velocity, may and ought to be made up by the weight of the ball, moving in nearly as small an arc as the escapement will admit, to sustain a continuance of the vibration.

A Clock for exhibiting the apparent daily Motions of the Sun and Moon, and State of the Tides, &c. by Mr. J. Ferguson.

Among the other ingenious contrivances, described in Mr. Ferguson's "Select mechanical Exercises," is the clock of which we have just given the title, the simplicity of which has recommended it to the notice of various writers and compilers of dictionaries, and induces us to give it a place in our collection. *Fig.* 3. of *Plate* XVIII. is a reduced copy of the dial of the clock under our present consideration, *fig.* 4. the dial-work, or wheels and pinion connected with the going part of a common 30-hours, or eight days clock, and regulating the motions of the different hands, plates, and contrivances for representing the ebbing and flowing of the tide at any given place. The pinion of 19 leaves, in *fig.* 4, is attached to an arbor which revolves in eight hours, by its connection with the wheel-work within the frame, which revolution may be effected by a wheel of 64, taking into a pinion of eight leaves on the centre wheel arbor; then, as three times eight are 24, three times 19 are 57; the wheel of 57 consequently revolves in 24 hours, with its centre in the centre of the dial; a second wheel of 59 teeth (*viz.* $29\frac{1}{2} \times 2$) is also actuated by the same pinion of 19 in $\frac{59}{19}$ of 8 hours, which time is $24^h\ 50^m\ 526$, or $24^h\ 50^m\ 31^s.58$; this wheel is of precisely the same diameter as the wheel of 57 teeth; and these two wheels, which are all that are necessary for producing the relative aspects on the dial, may be called, that of 57 the *solar*, and that

that of 59 teeth the *lunar* wheel. The lunar wheel, which lies next to the clock frame, has a solid arbor, but the solar wheel, which covers it, has a tube just fitting this arbor, and turning on it without shake; the tube is shorter than the arbor and carries the small circular plate represented by *fig.* 5, that has the 24 hours in Roman characters, and within these the 29½ days spaces of the moon's age in Arabic figures: all equally divided; the attached piece, S, is the sun's representative, which thus revolves from the upper XII. in *fig.* 3, to the same again in 24 solar hours. On the face of this small revolving dial is put a darkened ring, gradually increasing in breadth half way round, and as gradually decreasing the other half way. Over this revolving plate of 24 hours and 29½ days is placed another small plate (marked twice with the words *high water*, and as often with the words *low water*, also with *moon's age*, &c. as seen in *fig.* 3.) upon the arbor of the lunar wheel, so as to be adjustable on its round part by friction merely; this lunar plate has an aperture near its circumference, through which appear about five hours on the solar hour plate, and also a small circular hole, within the former, as it regards the centre of motion; this plate has, moreover, the figure of an ellipse darkened on it, which is nearly covered by a smaller circular plate, with concentric circles, borne by a supporting wire attached to it at one end, and at the other, when bent a little, to the principal dial-plate near the lower XII., as seen in the figure. The use of the small circular hole in the lunar plate is to show the phase of the moon in any part of its synodic revolution; for when in the situation F, *fig.* 5, as it regards the solar plate, no part of the darkened ring appears; which phænomenon denotes full moon a little short of the fifteenth day's age; when it is at N, the dark part of the solar plate or ring covers it entirely at 29½ days age, which position denotes new moon, and at 90° from these situations at both sides, one half is dark and the other half light, which aspects denote the quadratures. The sun, S, attached to the solar plate is the index for solar time marked on the large hour circle of the principal dial, and the moon, M, pointing to the same, indicates the 24th parts of the earth's rotations, as they relate to the moon, which may be called so many lunar hours; 24 of which by this mechanism, we have seen, is upwards of 50½ solar minutes longer than 24 solar hours. From the small circle of the moon is carried a straight wire over the hours of the solar plate, to indicate the mean time of the moon's mean passage over the meridian on any day of her age; and at the space of 2½ hours behind is another similar one, to point out the time of a mean high water at London Bridge, which might be set to a distance, behind or before, corresponding to any other place on the globe, that has two tides in somewhat less than 25 hours. The stationary small plate in the centre is intended to represent the earth, and the dot, L, between the fiftieth and sixtieth parallel of latitude, represents London, with respect to which place the position of the ellipse or tide-piece is altering its position visibly every hour, agreeably to the words marked on the lunar plate. On the back of this lunar plate is likewise another ellipse of solid brass D, placed concentrically, which, revolving with it, lifts the lever E, moveable on a stud at F, when either of the ends comes in contact; but when the sides are presented the said lever falls below the horizontal position; when this lever, F, is thus raised and lowered, twice in each lunar day, it carries with it the attached plate, H, above it, when kept in a perpendicular position by the four friction rollers, R, R, R, R, which plate has the sea painted on it, as seen in *fig* 3, over the dial at H. The representation of the phænomena depending on the relative positions of the sun and moon thus simply effected, affords a pleasing object for the eye at a trifling expence; but we are not to expect great accuracy when we consider how many equations are required to reduce the mean places of those two luminaries, particularly of the latter, to the true apparent places. Mr. Ferguson made this mechanism so as to be capable of being actuated by a watch on the fusee arbor of which a pinion of 20 was placed to drive a wheel of 40 round, on the arbor of which 40 was fixed the pinion of 19 that has been described as revolving in 8 hours, which it would do in this case, provided the fusee itself revolve, as is usual in common watches, in the space of four hours.

There is, however, an inaccuracy in the numbers of the wheel-work adopted in the dial-work of this clock, which would render it too imperfect to be used for a considerable length of time without a new rectification, even provided the motions of the sun and moon, or, more properly speaking, of the earth and moon, were quite equable, as the construction supposes, which inaccuracy may thus be explained; as the pinion of 19 drives both the wheels of 57 and 59, when the former has performed a revolution in a solar day, the latter falls two teeth short of a revolution, which it completes not until two teeth of the second revolution of the wheel 57 have been again impelled, so that in every 24 hours the little moon loses $\frac{2}{59}$ of its revolution, which is a part of a relative retrograde motion, as it regards any point, for instance the upper hour XII. in the solar plate; so that as often as 2 are contained in 59, so many day-spaces must there be on the solar plate, figured in a retrograde direction, as the figures regard the principal plate; but the value of $\frac{59}{2}$ is 29½ exactly, which number of days measures the lunation according to these wheels exactly; there is, therefore, a monthly error of $44^m\ 3^s$ almost, which will amount to nearly an entire day in the short space of about 32 lunations.

But there is, moreover, a practical objection to the two wheels, 57 and 59, being both driven by the same pinion of 19, which is, that being of the same diameter, the distance between their teeth is not the same in both, one being $\frac{1}{57}$, and the other $\frac{1}{59}$ of a semicircle, supposing their teeth and spaces to be respectively equal to one another, but if both wheels are cut in the cutting-engine by the same cutter, the inequality will fall in the teeth entirely; in either case the action of one of the wheels must be bad if the other is properly proportioned, and periodic jerks will be the consequence, which, in wheel-work going by a clock or watch movement, ought to be avoided. Whether or not Mr. Ferguson had the dial of the Hampton-Court clock in his eye when he contrived the simple mechanism of this clock, we will not undertake to affirm, but we think it extremely probable that he had, particularly as he has copied the position of the annual train in another of his clocks, as we shall have occasion to shew, under our article DIAL-*work*. Being in the habit of calculating numbers proper for representing given periods of time in clocks, watches, orreries, &c. we have turned our thoughts towards the improvement of this clock, as well as of other pieces of mechanism, so far as relates to accuracy, and beg leave to lay before the reader the alteration that has occurred to us, for rendering the clock before us more perfect than it is in the state we have described it.

When describing the Hampton-Court clock we endeavoured to prove that when the moon's age is indicated by the difference of the velocities of the two hands, moving in the same direction, and representing the sun and moon, the latter ought to pass the XII. o'clock point, on each day $50^m.473$ nearly later than on the preceding day; but by

 Mr.

Mr. Ferguſon's calculations we ſee the daily retrogradation is $50^m.526$, and the difference .053 amounts to an entire day's motion in a little more than 952 days, or ſomewhat upwards of 32 lunations, as we have ſtated. What therefore we want, in this caſe, is a couple of diviſible numbers that ſhall be to each other very nearly in the ratio of 24^h to $24^h\ 50^m.473$, which numbers, by a peculiar arithmetical proceſs, become familiar to us by practice, we have determined to be 2368 : 2451. Theſe are the neareſt poſſible numbers that can be got without aſcending higher in the ſcale of continual ratios, and are luckily capable of reduction into compoſite numbers thus; 2368 taken as a product is equal to 74×32 and $2451 = 57 \times 43$; therefore the train $\frac{43}{74} \times \frac{57}{32}$ will be the wheel-work required; the ſolar wheel of 74 teeth being made to revolve with a tube as an arbor in 24 hours, by the clock-movement, muſt impel the wheel of 43 placed on a ſtud, or otherwiſe on the front plate of the frame, at one ſide of it, and this wheel of 43 muſt have the next driver, 32, pinned to it, to impel the laſt wheel, 57, or lunar wheel, placed on a ſolid arbor, concentrically behind the ſolar wheel, according to Mr. Ferguſon's poſition, and the dials and other deſigns of the clock face may remain preciſely as deſcribed; ſo that inſtead of the pinion of 19 impelling two unequal wheels at once, we ſhall have a pair of ſmall wheels pinned together, one impelled by, and the other impelling its fellow, where the motion muſt be taken from an arbor of 12 hours, carrying a wheel of 37 to actuate the 74 in 24 hours, inſtead of from one of eight hours, as Mr. Ferguſon propoſed; which mode is equally practicable. As a proof of the accuracy of our calculation, we have by direct proportion as 2368 : 2451 :: $24^h : 24^h\ 50^m.4729729$, &c.; hence the deviation from the data is here only .0000271 of a minute in each lunar day, which will not amount to an error of an entire day in leſs than 1,862,472 ſuch days, and therefore may be aſſumed as no bad ſubſtitute for the truth itſelf; ſeeing the clock will never be expected to go ſo long without cleaning or ſtoppage from ſome external cauſe.

Should it occur to the reader that 32 lunations conſtitute a period long enough for the clock of Mr. Ferguſon to go, before a new rectification, we beg leave to ſuggeſt to him, that in the ſpace of a lunar day there are two tides and two ebbs, conſequently an error of three-quarters of an hour in each lunation will place the tide-plate, H, three hours wrong in the ſpace of about four months, and in nearly eight months an high-water will be changed into low-water, and the reverſe in the next eight months, which is certainly an indiſpenſable error.

That the clock-maker may not be at a loſs how to apply the remedy we have propoſed for the inaccuracy of Mr. Ferguſon's ſolar and lunar wheels, we ſhall conclude our deſcription of the clock before us with an account of the exact dimenſions of the parts propoſed to be ſubſtituted. If we take the wheel of communication of 37 teeth at 12 per inch, meaſured at the pitch line, its geometrical diameter will be .98 or $\frac{98}{100}$ of an inch, and its practical diameter, with the addendum for the ends of the teeth, 1.04, as may be ſeen by inſpection in our Table of Diameters, under the article Clock-*making*; the wheel of 74 being double will have its geometrical diameter equal to 1.96, and its practical one 2.02; the fellow of this laſt or ſolar wheel has its geometrical diameter by the ſame proportion, 1.14, and its practical one 1.20; the diſtance of the ſtud from the centre of motion of the ſolar and lunar wheels, muſt neceſſarily be the ſum of the geometrical radii of theſe two laſt wheels, namely $\overline{1.96 + 1.14} \div 2$ which is $= 1.55$; again the ſum of the geometrical radii of the remaining two wheels, 32 and 57, muſt be alſo equal to 1.55, in order that the centres of motion of the ſolar and lunar wheels may exactly coincide; but a wheel of a geometrical diameter, equal to $\overline{1.55 \times 2}$ or 3.10 inches and of $\overline{32 + 57}$ or 89 teeth, will have only about 9 teeth per inch, according to our table, and the practical diameters of wheels 32 and 57, by the ſame, will be reſpectively 1.21 and 2.1. The calliper ſuitable for theſe proportions and dimenſions is given, of half their full ſize, in *fig.* 2, of *Plate* X. which needs no further explanation, except that the wheels, 43 and 32, are ſo nearly of a ſize that one circle repreſents both, as pinned together, and revolving with a contemporary motion round a ſtud or ſcrew in their centre, going into the front plate of the clock-frame. The ſmall wheel of 32 acts deeper into the teeth of its fellow than the 43, by reaſon of having larger teeth than the other, though the wheel is of the ſame ſize.

Equation Clock by Enderlin, ſhewing alſo the relative Situations of the Sun and Moon, &c.

In our hiſtory of the ſucceſſive improvements in clocks, we have mentioned the names of various ingenious men who contrived mechaniſm for exhibiting on the dial of a clock both mean and apparent time, and conſequently the equation of time, which is the difference between theſe; to give drawings and deſcriptions of all the different methods of producing ſuch an effect, would be like throwing ammunition at a dead mark; but to gratify the wiſhes of the curious, in a certain degree, we propoſe to ſelect a clock of this kind, made on the continent by Enderlin, which appears to us to merit a deſcription better than moſt of the others.

Fig. 1, of *Plate* XXIV. of *Horology*, exhibits the plan of the mechaniſm which conſtitutes the equation-portion of Enderlin's clock (See Traité de Thiout, p. 252, *Pl.* XXV.) and *fig.* 2, is an exact repreſentation of the dial and hands; we will begin with *fig.* 1, or poſterior plane of the dial, where the motion is communicated from the wheels within the frame, and proceed, in the order of the communication of this motion, through the different parts of this figure. The ſmall wheel Q, of 24 teeth, borrows its motion from the movement of the ſtriking part, in order that the going part may not be impeded by cumberſome additions; this wheel is not repreſented as a contrate wheel in the original, which we have copied on a reduced ſcale, but would act better if it were; it impels the ſmall wheel R, of 32 teeth, with a vertical arbor, held to its poſition by a ſmall cock, T, on the front plate of the frame, which arbor has a bend and compound joint, below T, and a ſecond ſimilar cock above, that keeps the lower half of the arbor in its poſition, while the upper and lower ends, or pivots, bear in their reſpective cocks, which it is not neceſſary to inſert in the figure; this arbor has a ſingle endleſs ſcrew, S, on the middle of the inclined half, actuating a large wheel A, of 487 teeth, and alſo a pinion *a*, of 24 leaves, at the lower extremity, actuating a ſmall wheel V, of 32 teeth, and making this revolve, we are told, in 24 hours. From theſe data we can now calculate the periods of the other wheels that have been mentioned; if V revolves in 24 hours, *a* revolves in $\frac{24}{32}$ of that time, namely, in 18 hours, and with it the bent arbor R T S *a*; alſo the ſmall wheel, Q, revolves in $\frac{24}{32}$ of 18 hours, or in $13^h\ 30^m$, by means of its connection with the ſtriking part, which may eaſily be effected by proper numbers in the teeth of the connecting wheel and pinion; likewiſe the large wheel A, of 487 teeth, revolves in $\frac{487}{1}$ of 18^h, which time reduced, is 8766 hours, or $365^d\ 6^h$; this wheel,

wheel, therefore, is called the *annual* wheel. The wheel X, with 62 inclined teeth, and the wheel Z, with 90 teeth, revolve feparately round one common centre 5, and are impelled, the former by a fingle tooth on the 24 hours arbor of the fmall wheel V, and the latter by another fingle endlefs fcrew Y; this fcrew Y has a pinion 6, of 21 leaves, on its upper end, impelled by the pinion *a* of 24 in $\frac{2}{3}\frac{1}{4}$ of 18 hours, which period is $59^d\ 1^h\ 30^m$ or the fum of two lunations, where each is $29^d\ 12^h\ 45^m$; wheel X, we have faid, has 62 teeth, one of which is impelled every 24 hours, therefore an entire revolution of this wheel, if the motion were continued, would be performed in 62 days; but it will be feen by and bye, that it never is permitted to make more than one half of a revolution, and frequently not fo much, before it is made to retrograde at one jump to its original fituation, from which it had been moved by the fingle tooth or pallet at V. Into the plane of the annual wheel A, are inferted 12 pins, at fuch diftances from each other, in a concentric circle, as are determined by the number of days in the correfponding months, which are fuppofed to lie refpectively between the faid pins, fo as to regulate the interpofed fpaces. Thefe pins might be denominated the pins of January, February, &c. in fucceffion, as they follow one another at the regulated diftances of $\frac{31}{365}$, $\frac{28}{365}$, &c. On the centre of the faid annual wheel, is alfo fixed the centre of a piece of metal, B, fhaped by an oblong curve, continually varying its radius of curvature half round, and in a fimilar way back again, which curve is denominated the *equation* curve, from the office it has to perform, which we will recur to prefently. Round the centre 5 of the two wheels X and Z, is moveable the lever 5 6, with a claw at 6, and a tail 5 3, refting on a pin in the click 2 7 8, which click is moveable round a point at 7; a fecond lever 10, has alfo its tail refting by a pin at 3, on the tailpiece of the click, while its inclined end 10 falls in the way of the pins of the months in the annual wheel, by means of the preffure of a flender fpring near the centre of its motion. The effect produced by thefe levers and click may be thus defcribed; the pallet at V continues, by its daily motion, to gather up a tooth of X every 24 hours, and the click 2, fliding over the inclined fide of the contiguous tooth, lays hold of it when paft, and keeps it faft till the next day, when the fame operation is repeated, the two levers in the mean time remaining quiefcent; this daily procefs goes on till one of the month pins of the annual wheel, meeting with the end of the lever 10, depreffes it; at the time this occurrence takes place, the tail of this lever pufhes, by means of its pin of contact, the tail 3 of the click back, and with it the fang of the click, which now quits the tooth it before held; the wheel X being now detached from the click and pallet V, and having a piece of watch main-fpring coiled round its centre, one end attached to it and the other to a ftud, is pulled fuddenly back to the fituation in which it was before it was gathered up by the pallet; and the hand D, *fig.* 2, being connected with this wheel, returns with it and recommences its motion from the beginning of the graduations of the double femicircle A B C, which is divided on the middle line, but figured alternately above and below, to prevent the figures from being crowded. The femicircle at D in *fig.* 2, is divided into $29\frac{1}{2}$ equal fpaces; and a portion of the dial is cut away, as reprefented by the dark portion, and full phafe of the moon, which conftitute a portion of the front face of wheel Z, of 90 teeth, which wheel we have faid revolves half round in $29^d\ 12^h\ 45^m$; this dark lunar plate has a mark as an index over the moon, which difappears the moment that a fimilar one at the oppofite point of the plate's circumference begins to appear; alfo another moon, at prefent hid from fight, begins to appear at one day's fpace of her age, as foon as the prefent one difappears at the fpace $29\frac{1}{2}$, and fo on alternately throughout the year. The graduations of the moon's age are on the principal dial. The anterior plane of the annual wheel has the fun's place in the ecliptic, the months, with their divifions into days, and fun's rifing and fetting in time correfponding to each day, marked on it, which readings appear through the blackened apertures of the dial, above the double femicircle of the days indicated by the hand D, and under the hours and minutes of the large circle, as reprefented in *fig.* 2.

When the wheel X, in *fig.* 1, has returned to its original fituation, the pallet at V goes on, and when it has made half of a revolution it meets with the end of the lever 6, and preffing againft it, difengages the tail 3 from the click 2, which prevented this click from falling into a notch of the wheel X, while this wheel retrograded; but now the click refumes its office, and the wheel of the months proceeds by a daily progrefs of one tooth: in the prefent fituation of the different hands and of the annual wheel, the day is the 5th of November, the moon's age almoft 15, being full moon, the fun-rife, $7^h\ 5^m$, A. M. fun-fet, $4^h\ 54^m$, P. M. and the fun's place 12° in Scorpio. The annual wheel, we have feen, revolves in $365\frac{1}{4}$ days exactly, therefore the fractional portion of a day will amount to unity every fourth year, and will require that February fhould have 29 days in each leap year; a provifion is here made for effecting this purpofe which fhews confiderable ingenuity; a piece of brafs of the fhape of 15 16 17 18, reprefented by dots chiefly, becaufe nearly hid behind the annual wheel, as now viewed in *fig.* 1, is moveable on the point 15, and has marked on the concealed flat part the 4 years fucceffively, *viz.* leap year, and 1, 2, and 3, after, which are brought annually in fucceffion to the aperture of the dial above VI. in *fig.* 2, by the annual wheel: the procefs is thus; the ftar 20 with eight angular points, has two of its points carried forwards by pins in the annual wheel, one of which acts on the night of the laft day of December, and the other in ordinary years at the end of the 28th of February; the ftar has a metallic leg, called by the French *un fautoir*, preffed by a flender fpring in fuch a way, that the heel falls into a notch of the ftar, the ufe of which is, to limit the quantity the ftar fhall move if it is moved at all; for when any following point of the ftar forces the leg forwards till it paffes the heel, the fpring then pufhes the heel in again, and forces the faid point forwards a little farther, till it ftops under the foot, and till the next following point of the ftar refts againft the back part of the leg where the motion is arrefted: a fnail with four fteps is faft to the ftar, and regulates the pofition of the piece 15 16 17 18 by fupporting the end 18 of this piece, which projects towards the fnail; hence it is eafy to apprehend, that numbers 1, 2, 3, or leap year, will appear in the aperture of the dial, accordingly as ftep 1, ftep 2, &c. of the fnail is prefented to the refting point 18 of the plate with the four years marked on its anterior face. This contrivance, however, does not yet account for the 29th of February every fourth year: the additional mechanifm for this purpofe is the rack without teeth, marked 11, moveable on the centre of the annual wheel, but under it in *fig.* 1, with a concealed fpring (dotted) preffing againft its concealed and dotted bar, fo as to make it reft on a fecond fnail behind the ftar; for as the lever 10 for the monthly pins is carried by this rack, the faid lever may be made to meet the pins or recede from them, or any one of them, the quantity correfponding to a day, or more if it were required; thus the concealed fnail, which has a contrary fpiral, removes the pin anfwering to the laft day of February fo far from the correfponding

ponding pin in the annual wheel, that the hand D, in *fig.* 2, has arrived at the 29th division or day-space, before the click is detached by the lever 10, and thus February has 29 days every fourth year. It may be proper to obferve here, that the fourth ftep of the fnail feen on the ftar has an inclined plane to allow the end 18 of the four years plate to afcend it without being fet faft, after a revolution has been completed. Hitherto we have faid nothing about the equation portion ufually but improperly defcribed firft, which we have deferred becaufe it depends on the motion of the annual wheel. On the point D, in *fig.* 1, the rack, E, moves, while its tail, C, refts on the circumference of the equation curve, as it makes its annual revolution; at O is a fmall box with a fpring, which keeps the cord 15 always ftretched; this cord furrounds a pulley on the plane of a concealed wheel N, under K, but not attached to it, with which wheel, N, the rack acts and is kept always refting on the equation curve in every fituation of the annual wheel; the pinion, I, revolves by the going part of the clock in 60 minutes, and carries the equable hand of the minutes, now pointing to 46 minutes in *fig.* 2; by the pinion I, which has 30 leaves, the wheel K of 60 teeth is driven; which in its turn drives another pinion, L, of 30 leaves; fo that L revolves in an hour as though it acted immediately with I; to L is attached a wheel, H, of 48 teeth, which actuates a fimilar wheel, F, and this again a third fimilar wheel, G, the tube of which furrounds the arbor of I, and carries the hand with a little fun on its pointing to 30^m in the dial, *fig.* 2, which hand moves irregularly, and may be called the *equation hand;* its irregularity is thus produced; the wheel N, below K, is pinned to a bar which is not feen, but which bears the wheel H, and pinion L; and as the teeth of the rack are acting with the wheel N, the concealed bar, here fpoken of, is made to move alternately towards I and 15, as the radius of the equation varies during the year; this motion of the bearing bar makes the pinion L fometimes advance, and fometimes retrograde a few teeth, independently of the motion it receives from the revolution of K, and this additional motion, produced by the rack to the bar on which L refts, is alfo communicated to the wheel H in confequence of its connection with L, and hence to both the fimilar wheels connected with it, F and G, the latter of which gives the faid addition and retrogradation alternately to the equation hand borne by it. The motion conftituting the equation, here fpoken of, would be produced if the wheel K did not revolve at all, and therefore is derived entirely from the equation curve, which curve has its fhape afcertained from a table of the equation of time. In the pofition of the two minute hands the diftance between them is 16^m, which is the quantity of equation fubtractive at the end of the firft week of November. The pinion of fix or eight leaves attached to F, drives the hour wheel of 72 or 96 teeth not given here, which bears on its tube the hour hand pointing between II. and III. which hand therefore participates of the equated motion, and correfponds to the equation minute hand; the minute hand for mean time is ufed to fhew, by its diftance from the other hand, the quantity of the equation at any given time. The feconds are for mean time, and therefore correfpond with the minute hand of mean time. Between the fmall wheel Q, which we have feen revolves in 24 hours, and the dial, is a fmall circular dial-plate feen through an aperture below 40^m in *fig.* 2, the ufe of which is, to regulate the annual wheel, by a key inferted in the hole at 40^m on the fquare of the arbor of the wheel Q, agreeably to the hour of the day indicated by the clock, otherwife the monthly pins might not happen to detach the click of the ratchet-wheel that carries the month hand, D, at the exact termination of the month. Laftly, between the wheels I and G, is placed a fmall fpiral fpring, to prevent a fhake in the hand carried by G, which the play in the teeth might otherwife have occafioned. This mechanifm, as we have faid, is very ingenious, and moft of the other equation clocks have a fimilar equation curve, without an allowance for leap year.

We have recently underftood that Quare, of London, was the firft inventor of an equation clock, but we do not vouch for our authority.

An Aftronomical Clock, by Mr. Thos. Reid of Edinburgh.

It has been ufual, among horological writers, to call all thofe clocks indifcriminately *aftronomical*, which are ufed in obfervatories for afcertaining the right afcenfions of the ftars, whether the time indicated is folar or fidereal, and alfo thofe clocks which reprefent the motions of fome or all of the heavenly bodies, by appropriate wheel-work fuperadded to the ufual train: thefe two kinds of clocks, however, are of a very oppofite nature, one of them rejecting every appendage that does not contribute to accuracy in the meafurement of time, under all the changes of atmofpheric temperature, and the other being loaded with cumberfome additional mechanifm, calculated to produce great irregularities of motion in the going train, befides being deftitute of compenfation mechanifm for the effects of heat and cold. They are, indeed, equally the produce of much ingenuity; but one is contrived and executed with the greateft care for ufe, while the other is defigned, calculated, and conftructed for mere curiofity: one is as fuperior in its meafurement of time to a common clock, as a chronometer is to an ordinary watch; but the other may be confidered, in general, as holding a rank, in this refpect, as much below a common clock: we feel ourfelves, therefore, juftified in giving diftinguifhing names to two machines, which, however they may be claffed in one genus, are of very different fpecies; the clock which is ufed in aftronomical obfervations we fhall call an *aftronomical* clock; but the clock which exhibits the relative pofitions of the heavenly bodies, or of any of them, we fhall call a *planetary* clock; of which kind is that which we have partially defcribed as being in the palace at Hampton Court, and of which kind are moft of Mr. J. Ferguson's more complex clocks. Sometimes clocks are made on the principle to which we propofe to give the appellation of aftronomical, which yet are not ufed in obfervatories, but kept at the clock-makers, with the view of being made a ftandard by which to judge of the rate of other clocks and watches not yet brought to time; thefe are ufually denominated regulators, but when they have good compenfating pendulums and the beft efcapements, they differ not from aftronomical clocks in any thing but the name, which is borrowed from the ufe to which they are put of regulating the time by which the common clocks are to have their rate of going adjufted.

We might have prefented the public with a great variety of aftronomical clocks, each differing from the others in fome particular peculiar to itfelf; but if we give the defcriptions of a couple, all the other conftructions, or the greateft part of them, will be eafily apprehended from our articles ESCAPEMENT and PENDULUM, which are as much the characteriftic parts of an aftronomical clock, as the efcapement and balance are of a chronometer, which machine has been already defcribed.

Plate XXII. of *Horology*, exhibits, in different points of view, an aftronomical clock, made by Mr. Thomas Reid, of Edinburgh, of which his brother, who refides in Clerkenwell, London, obligingly permitted our draftfman to take the requifite drawings for rendering all the effential parts intelligible. *Fig.* 1, is a view of the movement, with the eye placed perpendicularly over it, and the front plate of the

 frame

frame taken off; and *fig.* 2, is the whole frame detached from the cafe and viewed laterally, which pofition may be confidered as a fection, the other being the plan of the works; thefe two figures are laid down on a fcale of one third of the original fize; *fig.* 3, is an enlarged reprefentation of the pallets and efcapement wheel, on a fcale of one half the real fize, and in a detached ftate; *fig.* 4, fhows the back of the great wheel of 120 teeth, together with the fmall ratchet and auxiliary fpring and detent in a detached ftate, of one third the real fize; *fig.* 5, exhibits the gridiron, or compenfating pendulum, with its cock and other parts of fufpenfion, of one eighth part of the real fize; and *fig.* 6, gives an enlarged view of the part that receives the crutch immediately above the fuperior end of the gridiron portion of the pendulum; we fhall defcribe thefe fix figures in the order by which we have here enumerated them.

A A, in *figs.* 1 and 2, ftand at the fuperior end of the frame plates, above the pillars, which are omitted in the fecond figure, that the efcapement wheel may not be concealed thereby; B, in both figures, is the cylindrical barrel for the cord C, of the weight, which conftitutes the maintaining power; the wheels and pinions are denoted by the numbers of their teeth thus; 120 is the great wheel revolving in twelve hours; 10 is the pinion driven by it on the central arbor; the fmalleft, 96, is the centre wheel; 12, the pinion on the fecond wheel-arbor, which arbor has alfo the fecond wheel of the train, marked 90, impelling another pinion of 12 on the arbor of the third or efcapement wheel of 30 teeth; the other two wheels of 96 each, revolving alike in 12 hours, are inftead of dial-work. The fmall ratchet wheel has 40 teeth, and the large one or perpetual ratchet 200, that the teeth of its circumference may be numerous enough to catch the detent G, *figs.* 1 and 4, without allowing the intenfity of the auxiliary fpring, H, to be remitted; but the exact number of teeth is of no importance, provided they be both numerous and ftrong enough to anfwer the defired purpofe; the number is here mentioned to fhow that the wheel has been cut in an engine which divided it into 200 equal ferrated teeth. The fpring, which is here a fubftitute for the maintaining power, during the time of winding up the clock, has its extreme ends brought nearer together than was the cafe with the auxiliary fpring of the chronometers which we have above defcribed, but the office performed is precifely the fame, the only difference is in the mode of application; here one end of the auxiliary fpring is attached to the great wheel, and the other preffing againft the fide of one of the croffes of the great ratchet, or perpetual ratchet, and when the two ends of the fpring are brought nearly together, their effort to feparate becomes a temporary fubftitute for the maintaining power. The hour hand revolves in 12 hours along with the arbor of the great wheel of 120 teeth, on which it is placed by fimple friction without a fquare; the long hand E, *fig.* 2, fhows minutes from the arbor of the centre wheel, on a circle of 60 furrounding all the hands; and the third hand F, fhows feconds on the arbor of the pallet wheel; this hand has a very fmall recoil on account of the faces of the pallets not being portions of concentric circles. The pallets have each a piece of agate to fuperfede the ufe of oil, and are of the ifochronal kind, acting with teeth of a peculiar fhape, both of which will be more particularly defcribed under the article ESCAPEMENT: the two agates are retained in the hollow parts of the anchor of the pallets by three fcrews applying to each, two of which are vifible in each pallet in the enlarged *fig.* 3; and the two vertical lines below the wheel of this figure reprefent, one of them, the pofition of the pendulum correfponding to the prefent fituation of the pallets; and the other, which is drawn a little afide, the fituation of the fame at the inftant of efcaping; which with other particulars of this efcapement will be more minutely detailed hereafter, according to our recent reference. The frame is mounted by four pillars, fituated near the four corners of the two plates, at the fmall circles in *fig.* 1; and is firmly attached to the bracket or bearing piece L, *fig.* 2, at the fuperior part of the cafe, by the connecting cocks, K and K, fcrewed both to the frame and piece L. Though there is no dial-work in this clock, yet there are four little cocks, *a*, *b*, *c*, and *d*, on the front plate of the frame, the ufe of which is to make the wheels and pinions fall as nearly as can be at the middle of their refpective arbors, fo that there may not be more preffure at one pivot than at the oppofite one of any arbor; a refinement which few other makers have attended to in their conftructions. The French clock-makers have given an appropriate name to each end of the arbor, depending on the diftance of the pivot from the wheel it bears, one end being called the *tige*, and the other the *tigeron*. The author of this conftruction attaches, and very properly, fome importance to the pofition in which the great wheel and cord of fufpenfion are placed, with refpect to the centre pinion; it may be feen from an infpection of *fig.* 1, that the weight fufpended by the cord C, refting on the acting tooth of the great wheel, does not prefs fo much on the pivots as it would do if placed at the oppofite fide of the barrel: for in one cafe the preffure on the pivots may be faid to be halved, but in the other doubled; fuppofing the barrel and wheel to be to each other as 1 : 2; befides, an uniformity of appearance is thus preferved in the three circles of the dial, which, we have not before faid, is attached to the frame by pillars, two of which are feen in *fig.* 2, at *e* and *f*.

The pivots of all the arbors are made cylindrical, and act in conical holes in the cocks before, and in the plate behind, which holes have the fmaller ends continued through the metal, at the back faces of which is prefented the conical point of a piece of fteel, to each fixed to the cock in fuch a way, that a drop of fine oil lies between it and the pivot, detained by its cohefive attraction in the form of a fpherule: this contrivance keeps the oil in its place better than counterfunk holes would do, and preferves it from impurities longer; the fteel pieces at the pivots entering the pillar plate, are feen at *g*, *h*, and *i*.

Fig. 4, requires no further explanation than we have given of the great wheel and perpetual ratchet in *fig.* 1, except that the under-fide is here prefented to view, and that the fame letters of reference apply to both figures. *Fig.* 5, is a reprefentation of the gridiron pendulum, which we have faid was invented by J. Harrifon; the dimenfions in the drawing are on a fcale of one eighth of the real fize of all the parts. The two obtufe angled cocks, *a* and *a*, braced with crofs pieces near the top are firmly attached to the bearing part or bracket, L, in *fig.* 1, which has a portion taken out between L and L, in *fig.* 5, for the pendulum to vibrate in, but which cannot be feen in the pofition in *fig.* 1, where the cocks are on a larger fcale, and where one of them is hid by the other, which appears as a ftraight vertical piece of metal above M; which M denotes the edge of the pendulum in this figure: on the fuperior ends of the two cocks is made an angular notch called a Y, the top of which it refembles, in which the pivots of a tranverfe piece of fteel, *b*, reft; this tranfverfe piece has a central fquare hole that receives a little rod by which the pendulum is fufpended by a flip of watch main-fpring, tapered a little downwards; the three pins, one above the tranfverfe piece, *b*, and the other two at the oppofite ends of the flip of fpring, may all be feen in the figure without more particular reference; the rod attached to the upper end of the gridiron is of fteel, and has an oblong hole

hole with a pair of agates fixed in it, ſo as to form the ſides of the oblong hole, ſeen on a larger ſcale in a detached ſtate in *fig.* 6; the uſe of this long aperture is to receive the pin of the crutch, carried by the arbor of the pallets, as ſeen at N, in *fig.* 2. By this method of ſuſpending a pendulum, the ball has liberty to find its own perpendicular ſituation without twiſting the ſlender ſpring of ſuſpenſion, and the tranſverſe piece, *b*, having ſhoulders to keep it ſteady within the frame compoſed of the cocks, *a* and *a*, prevents any motion or ſhake that might otherwiſe be occaſioned by the vibrations of a heavy pendulum; alſo the pendulum may be put into exact beat, by forming the ſhoulders of the tranſverſe piece, *b*, ſo exactly at each ſide of the centre, that the crutch may not require to be bent; and if a ſlight deviation from true beat be obſerved when the cocks are mounted *pro tempore*, a ſlight lateral motion in them, before final fixing, will rectify the beat; or the poſition of the agates of the crutch pin might be reſorted to for adjuſting a very minute deviation from true beat; or, laſtly, an adjuſtment of the bearing part, L, might be recurred to; but we think it is of importance not to alter the central ſituation of the oblong aperture where the crutch-pin acts, leſt this pin ſhould not impreſs its force to a point perpendicularly over the centre of gravity of the pendulum, and ſhould thereby produce a vacillation in the vibrations, which would be injurious to the exactitude of their obedience to the laws of gravity. The compenſation for heat and cold, and adjuſtments for time and temperature of this gridiron pendulum, may be explained thus; as we have not room to put in the letters of reference between the bars of the gridiron portion, we propoſe to call the rod attached to the ſpring of ſuſpenſion 1, which is the middle rod of the nine parallel ones; the two contiguous rods, one at each ſide of N°. 1, we ſhall deſignate by the figures 2 and 2, reſpectively; the two next in order to the right and left from N°. 1, we ſhall call 3 and 3; in like manner the two next at each ſide, correſponding to each other, we ſhall name 4 and 4; and the two extreme ones, 5 and 5, reſpectively; this mode of deſcription will ſhorten the circumlocution we muſt otherwiſe have been obliged to uſe: N°. 1, we have already ſaid, is a ſteel rod proceeding downwards from the point of ſuſpenſion; it has a ſhort croſs-piece, to which are faſtened the inferior ends of the rods, 2 and 2, which are of braſs, and conſequently more expanſible than ſteel; theſe rods, which may be conſidered as one ſo far as relates to their expanſion, proceed upwards to another croſs-piece ſomewhat longer than the firſt, to which their upper ends are faſtened: again another pair of rods, 3 and 3, of ſteel are faſtened to this ſecond croſs-piece near its extremities, ſo as to include the three former rods, and deſcend down paſt the ends of the firſt croſs-piece into a third croſs-piece, below the firſt, to which third piece they are united: this third piece alſo ſupports another pair of braſs rods, 4 and 4, which aſcend to the uppermoſt or fourth croſs-piece of the gridiron, to which they are alſo attached; and, laſtly, another pair of ſteel rods attached to the extreme ends of this fourth croſs-piece, ſo as to include all the former ones, deſcend to the loweſt or fifth croſs-piece, to which they are attached, and by which the gridiron frame is completed. The effect of the expanſion of the deſcending rod, 1, is to lower the firſt croſs-piece; but the effect of the expanſion of the two aſcending rods, 2 and 2, is to elevate the ſecond croſs-piece more; the effect produced by the pair, 3 and 3, as this effect relates to the third croſs-piece, is ſimilar to the effect of rod 1, on the firſt croſs-piece; alſo the effect of the pair of braſs rods, 4 and 4, on the fourth croſs-piece, is ſimilar to that of bar 2 and 2, on the ſecond croſs-piece; and, laſtly, the effect of the pair, 5 and 5, of ſteel bars on the height of the fifth or laſt croſs-piece, is analogous to the effect produced by the pair, 3 and 3, on the third croſs-piece, as above deſcribed: the total effects of the deſcending and aſcending bars are ſtated to be thus in the clock before us: *viz.*

Expanſion downwards by rod 1, =	1
Do. - - by rods 3 and 3, =	1
Do. - - by rods 5 and 5, =	1
Total =	3
Expanſion upwards by rods 2 and 2, =	1.56
Do. - - by rods 4 and 4, =	1.56
Total =	3.12

Hence the difference between the total elevation and total depreſſion of the ball, which is ſuſpended by the loweſt croſs-piece, is $\frac{12}{100}$ which quantity of exceſs of the aſcending bars is taken as an equivalent for the downward expanſion of the ſpring of ſuſpenſion, and that part of the ſteel rod, 1, which is above the gridiron portion; and if this quantity on trial ſhould be found to be an exact balance, the compenſation of the pendulum will be perfect, and the centre of oſcillation of the whole pendulum will continue unchanged as it regards the point of ſuſpenſion under all the variations of temperature. Whenever it is found that the calculation for the reſpective lengths of the expanſion bars has been erroneous, or the materials imperfect, the adjuſtment for temperature muſt be made by altering the ſituation of the firſt croſs-piece, ſo as to lengthen or ſhorten the pair of braſs bars, 2 and 2, as they regard the ſteel bar 1; it is better to make the braſs ſomewhat too long than too ſhort for the ſteel bars, becauſe this croſs-piece can be raiſed when it cannot be lowered beyond a certain limit depending on the proximity of the third croſs-piece; and if that limit ſhould be found too circumſcribed, the croſs-piece above, which has four bars faſt to it, muſt neceſſarily be lowered, which will be attended with ſome trouble.

The adjuſtment for time is made by means of a nut with a milled head, under the ball of the pendulum, the ſocket of which nut, is tapped to ſuit the thread of the ſhort rod attached to the loweſt croſs-piece of the gridiron frame by which the ball is borne, ſo that the ball reſts not with its inferior edge on the nut itſelf as in ordinary clocks, but has a pin in its centre which reſts on the upper end of the nut's ſocket, and which ſlides in a ſlit made in the bearing rod above and below, as well as at the centre of the ball for the ſake of allowing an aſcending and deſcending motion of the inſerted pin borne by the central hole of the ball. The uſe of this contrivance is to prevent any effect on the pendulum produced in general by the upward expanſion of the ball itſelf, for the ball being circular, will in this caſe expand from the bearing pin in the centre, alike upwards and downwards, as well as in a lateral direction to the right and left. Strictly ſpeaking, however, the bearing pin to have its true ſituation for preventing all effect from the expanſion of a large ball, ought to be placed in ſuch a ſituation as ſhall have a regard to the centre of oſcillation of the pendulum conjointly with the weight and dimenſions of the ball, which, in ſo complex a pendulum, conſtitutes a difficult problem to ſolve in all the variety of caſes likely to ariſe in practice.

This pendulum has a weight of 9 pounds, and the clock goes eight days with a weight of $16\frac{1}{2}$ pounds, falling 4 feet 10 inches in this ſpace of time.

We

We are informed by Mr. Reid's brother, that the arc of escapement in each excursion is two degrees, and that the remaining portion of the said excursion is one degree; hence the whole arc of vibration is just 6° with the weight already mentioned. The peculiar property of this escapement, as will be seen in another place, is, that whatever be the maintaining power, or the total arc of vibration, the partial recoil which it has renders all the vibrations isochronal.

It is scarcely necessary to add, that an astronomical clock, like a chronometer, ought to have all its adjustments made with great care, in order that some dependence may be placed on its rate of going under all circumstances.

An astronomical Clock, with Troughton's Pendulum.

Each astronomical clock has usually some part or parts peculiar to itself; the clock, which we are now about to describe, differs from the preceding one in various particulars, but principally in the structure of its escapement, pendulum, suspension, and pivot holes. *Plate* XXIII. explains the works, and *Plate* XXVII. the pendulum and suspension of the clock before us: we will first describe *Plate* XXIII. *Fig.* 1, is a view of the movement, with the front plate removed, and the eye perpendicularly over the centre, which therefore may be called the plan of the movement; *fig.* 2, is a section, or side view of the frame, containing the movement, a part of the suspension and pendulum, and the dial-work, face, and hands; *fig.* 3, is a front view of the front plate of the frame, as seen with the hands and dial off; and *fig.* 4, is the escapement-wheel and pallets of the dead beat kind. In *figs.* 1 and 2, A is the great wheel with 120 teeth, and a perpetual ratchet of the same number of teeth, similar to the one described in the going fusee of Brockbank's chronometer, which great wheel impels the centre pinion, *a*, of twelve leaves in an hour; the arbor of this pinion carries the minute hand, or large hand seen in *fig.* 3, moving from the centre of the dial; B is the centre-wheel, of 96 teeth, on the same arbor, drivingthe pinion, *b*, of 12 leaves; and C is the second wheel of the train, with 90 teeth, urging the pinion *c*, of 12 leaves, on the arbor of the pallet or escapement-wheel D, which, as usual, has 30 teeth; this wheel revolves in $\frac{12}{96} \times \frac{12}{90}$ of an hour, which is exactly one minute, and therefore carries the hand of the seconds, or small hand, seen in *fig.* 3, above the minute hand. For a particular account of the dead-beat escapement, we beg leave to refer to the article ESCAPEMENT, a description of which in this place would lead us out of our purpose; *e* and *f* are two cocks on the pillar-plate or back plate, into which the arbor, *g*, of the guard-gut, *h*, is pivoted; and *i* is the spring of the guard: below D, in *fig.* 2, is the arbor of the detent of the perpetual ratchet; and below *g* in the same figure is the arbor of the small dial-plate, and its wheel *k*, seen on the frame in *fig.* 3, by a front view; this wheel has 192 teeth, and borrows its motion from a pinion of 8 leaves on the arbor of the centre wheel, these numbers of teeth being to each other as 24 to 1; they are the only dial-work this clock has got; the dial-wheel might have had a hand like the centre wheel, but it would have had its motion retrograde, on which account a light plate, equally poised, and neatly engraved, is put on behind the principal dial instead of it, and the hours are read through a circular aperture made in the large dial, and a fleur-de-lis on the front of this large dial serves as a stationary hand for indicating the hour on the revolving plate, which makes a revolution in a day. At *l*, on the arbor of the centre wheel, behind the dial, is a lever for counterpoising the minute hand, which, being long, of course has a sensible weight, that would act alternately with and against the maintaining power as reduced at this arbor, if there were no such counterpoise. The four black circles, at the four corners of *fig.* 1, are the four pillars pointing to the eye, and near the centre wheel is the fifth; their corresponding outer ends are seen in similar situations, with their fastening screws in *fig.* 3; the other four black circles, within the pillars in *fig.* 3, are the holes for receiving the pillars of the large dial, or face of the clock, two of which pilars, *m* and *n*, are seen in *fig.* 2, and also the edge of the dial *o p*. The frame is screwed to E, the bearing part of the case, by two screws passing through this piece and entering the lower pillars of the frame, one of which screws is seen in *fig.* 2, at F, and the other is on the opposite side. The pivots of the pallet's verge, of the pallet-wheel arbor, and of the second-wheel arbor, all run in jewelled holes in the small cocks, 1, 2, and 3, respectively in *figs.* 2 and 3, and the piece 4, in *fig.* 3, covers the end of the detent-arbor pivot. This clock, which was made by the Brockbanks, and which is the property of Mr. Ed. Troughton, is finished in a very superior stile of workmanship; and though for many years it has been regulated by a pendulum composed of a glass tube and bulb containing quicksilver, which was Troughton's improvement on Graham's quicksilver pendulum, yet its performance has at least equalled, if not surpassed, in accuracy and steadiness of rate, the going of any other clock that has been constructed; if we may credit the report of an individual every way qualified to judge not only of its absolute but comparative excellence: the pendulum, however, which is here made a part of this clock, is of recent invention, and we have great reason to believe will shortly supersede all the other compensation pendulums that have preceded it, on account of its possessing the following properties almost exclusively: first, it has all the advantages of opposite expansions which the common gridiron pendulum possesses; secondly, the arrangement of the metallic parts gives it the simplicity in appearance of a single rod, as well as a diminished resistance of the air in its vibrations; thirdly, it has great strength without much weight above the ball; fourthly, its centre of oscillation, compared with the centre of the ball, or with the centre of gravity, may consequently be very nearly determined; fifthly, the motions of the compensating parts upwards and downwards are not effected by jerks, but are progressive and steady, while yet the parts are sufficiently braced to preserve their relative situations and figures; sixthly, the compensation not only includes the spring of suspension, and is adjustable for temperature, but has its adjustment for temperature made, independently of the rate of going, by a new pyrometer of great sensibility, and free from the usual objections against pyrometers; seventhly, it is capable of being put into beat without altering the shape of the crutch, or of any other part; and, lastly, it is capable of adjustment for rate even while going. It would have been more consistent with our general plan to have given an account of the pendulum in question under the word PENDULUM, but as that article is a remote one, the reader will doubtless have no objection to have the description here. The common gridiron pendulum has already been described in our preceding section, and its mode of compensation explained; therefore we need not use much circumlocution in our present detail. *Fig.* 1, of *Plate* XXVII. of *Horology*, shews a front view of the pendulum as suspended by a board or plug attached to a solid wall; and *fig.* 2 is a side view of the same: *fig.* 3, which represents pretty nearly the common gridiron pendulum, is a representation of the compound part of the pendulum with the rods placed to the right and left of the central one, for the sake of being all seen, instead of being arranged round it, as they ought to be agreeably to the circular section below, which is the true arrangement, but which is not so easy to be apprehended by mere verbal

verbal defcription, as we prefume it will be from the prefent, though unnatural, figure. The middle rod, reaching to the fufpenfion, is of fteel, which, as before, we will call 1, defcending to the crofs-piece *a*, which is a circular plate perforated with a central and four other holes, as feen in the fubjoined fection; under the central hole of this circular piece the rod 1 is pinned; then inftead of a pair of brafs rods afcending contiguous to, and at each fide of, this central fteel rod, as ufual, a brafs tube has its lower extremity faft to the circumference of this fmall plate *a*, and afcends within a fecond larger tube to another fimilar circular plate *b*, with five holes likewife, to which it is attached in like manner; the two brafs tubes are fo clofe together, that they appear as one, except that the inner one is darker than the other in the figure; to the plate *b*, above the afcending inner brafs tube, are faftened two fteel rods, which we will here denominate 2 and 2, appearing contiguous to the rod 1 in the figure, but actually at the fame diftance as the next pair denominated 3 and 3, which pairs ftand at right angles to one another, as feen in the fection under the figure; the pair of fteel rods, 2 and 2, having defcended from *b*, pafs through a pair of the holes of *a*, and are pinned under a tranfverfe circular piece, *c*, that has only four holes in it; to the circumference of this piece, *c*, is made faft the outer brafs tube that hides all the rods and other tube, and that afcends to a fourth circular piece, *d*, which forms an end-piece to the large tube, to which it is fcrewed faft; laftly, the pair of fteel rods, 3 and 3, are made faft to the end-piece *d*, and defcend through the other pair of holes of the three pieces, *b*, *a*, *c*, to a fifth crofs-piece, *e*, under which it is pinned, and by the central hole of which the ball of the pendulum is hung at its centre, or nearly fo. This fubftitution of two brafs tubes for four brafs rods, together with their end-pieces, and the mode of arranging the fine fteel rods within the tubes, afford all the properties united which we have previoufly mentioned; and it is eafy to fee that fhortening either the rods of fteel, or the brafs tubes, will alter the ratio of the refpective aggregates of their length, fo as to increafe or diminifh the effect of the oppofite expanfions, till they exactly balance one another, when a delicate and very exact meafure is taken from the point of fufpenfion to the centre of ofcillation: this meafure is taken with great eafe and accuracy by the new pyrometer which we have feen ufed, but which has not yet been publicly defcribed, and the principle of which we do not feel ourfelves at prefent authorifed to announce; when the author has gone through all his pyrometrical experiments, moft probably he will lay before the public the conftruction and the experiments at prefent in hand, both of which, no doubt, will prove interefting. Indeed we can now venture to refer the reader to our article PYROMETER for the information we have fpoken of, prefuming upon the experienced liberality of the author. Above the end-piece, *d*, of the outer brafs tube is a fmall tube of the fame metal furrounding the fteel rod that afcends to the fufpenfion fpring, the ufe of which is to receive the fork of the crutch and to guard the fteel from the oxiding influence of the air, as well as, it is probable, the other rods will be preferved, by being enclofed in the brafs tubes. If we can difcover any thing like the fhadow of an objection to this ftructure of the compenfation-pendulum, it is, that the included fteel rods not being expofed to the air, may not be fo foon affected by atmofpheric changes of temperature as the brafs tubes; but we can hardly perfuade ourfelves that the difference will ever be fo fenfible as to affect the rate of going of the clock, feeing all the parts are very contiguous to one another throughout the whole length, and muft confequently affect one another's temperature, by that general contiguity, at all times.

Figs. 4, 5, and 7, are views of detached parts of the fufpenfion, and *figs*. 8 and 9 of the crutch, all which we come now to explain, as effential appendages of the pendulum. We have already faid, that E, in *fig*. 2, *Plate* XXIII. is the bracket on which the frame is fixed; to this bracket the brafs triangular frame G is fcrewed faft, different views of which may be feen in *figs*. 1, 2, and 5, of *Plate* XXVII., as well as in *fig*. 2, *Plate* XXIII., in the laft of which the fcale is larger than the others: at the top of this frame is a milled nut, and under it a micrometer head, *a*, in *figs*. 1, 2, and 3, of *Plate* XXVII., with 22 divifions on the circumference of the micrometer head to fuit the finenefs of the threads of the fcrew, by which the adjuftment for rate is made; below the divided head is a fquare piece of metal, *c*, in *fig*. 4, which in *figs*. 1 and 2 is concealed within a tube having a fquare hole, feen at *c*, in *fig*. 5, feparately; to the fuperior end of this tube with a fquare hole is an index made faft, pointing to the divided head, feen alfo in *fig*. 5, which figure 5, is a detached view, on a larger fcale, of the part *b* in *fig*. 2; at the lower end of the fquare piece *c*, in *fig*. 4, is the piece of watch main-fpring, called the fpring of fufpenfion, to which the middle fteel rod of the pendulum is pinned; that part of the piece *c*, which receives the nut and divided head, being tapped, draws the pendulum up and down when the divided head refts on the frame G, and is turned in a proper direction; the cock *b*, with its tube *c*, is fhewn as detached from the frame G, in *fig*. 5, but the manner in which this cock is attached to the frame, may be feen from the fittings; the dove-tailed piece, *d*, when detached from the cock *b*, enters the dove-tail of the cock G from *d* behind, above G, before the faftening fcrews attach it to the cock *b*, while the cock refts on the fhoulder of the frame G. *Fig*. 7, is a front view of the cock *b*, in *fig*. 5, and is on an enlarged fcale, as compared with the fame in *fig*. 1; *b* in this *fig*. 7, is a thumb-fcrew, which draws the two pieces, *e* and *f*, together, between which the fufpenfion fpring is clamped, after the adjuftment for rate is finifhed; fo that in fact, the lower edge of thefe two clamping pieces, *e* and *f*, may be called the point of fufpenfion, as it relates to the diftance from the centre of ofcillation of the pendulum; and is, therefore, the point from which the effective length of the pendulum ought to be meafured; the fcrew over *e*, which holds this piece to the tube, *c*, is in an oblong hole which allows the piece, *e*, to move without the faid tube. *Fig*. 6, is a front view of the frame top, when *fig*. 7, is taken off, the piece, *d*, in the cock, as fhown in *fig*. 5, is here fhown in its place inferted into the oblong dove-tailed hole of the frame, G, together with the two fcrew-holes at each fide of the letter, *d*; when the cock in *fig*. 7, is placed fo as to cover the fliding-piece, *d*, in *fig*. 6, and is fcrewed faft to this piece by two fcrews from behind the frame, it is evident that, when one of the two lateral preffing-fcrews, *s* and *s*, is turned forward and the other back, the fliding-piece, *d*, and with it the whole cock in *fig*. 7, will move from right to left, or the contrary, as the cafe may be, and confequently the pendulum, borne by this cock, as in *fig*. 1, will have a lateral adjuftment, to bring the clock into exact beat without the rough treatment of bending the crutch, which is often done in other clocks; when the fcrews are all faft, however, the cock is as fteady, as though it had neither the vertical nor horizontal adjuftment; and as the pin at the lower end of the fquare piece, *c*, *fig*. 4, is fmaller than the hole in the upper end of the fufpenfion-fpring, the pendulum finds its own vertical pofition before it is clamped, as well as if it were to be fufpended by Y's and a horizontal axis, that admit not of adjuftment for rate while the clock is going. *Fig*. 8, is the crutch, attached by the fuperior end to the verge of the pallets,

pallets, as seen behind the frame, in *fig.* 2, of *Plate* XXIII. where its fork embraces the brass tube on the upper end of the pendulum, as seen in *fig.* 9, of our present plate; in Mr. Reid's clock, we have seen, a solid part of the fork entered an oblong hole in the pendulum, which hole was formed of two jewels to avoid friction; it may not appear to the reader at first why there should be friction in this hole; but if he considers that the bent end of the crutch moves in a portion of a circle of smaller radius than the perforated part of the pendulum does, he will perceive that the crutch-pin must necessarily ascend in this hole during the excursion of the pendulum, and the more, the further the pendulum swings; to avoid the ascent of the forked part of our present crutch, it is not firmly attached, as in general, to the lower end of the vertical part of the crutch, but the crutch is first bent into the form of an L reversed, when viewed as in the plate, and then a pin is inserted into the remote end, *a*, of the bent part to become a centre of motion for the lever of the fork, which has a small tube moving round the pin so as to keep it in the same plane always, as seen in *fig.* 9; in *fig.* 8, the curve of the fork is in the same plane, facing the eye, as its lever; by means of this contrivance the fork, which holds the top of the pendulum-rod fast, moves in the same radius of curvature with it, and though it rises and descends alternately, as it regards the point, *a*, round which it has an unrestrained motion, yet it continues to clasp the same part of the rod, and never slides from its hold, thereby avoiding all friction, except the insensible quantity at the point of motion, *a*. The ball of the pendulum is of the lenticular shape, but a little flattened at the circumference to allow it to hold more lead, and to be heavier than it otherwise would be. A small portion of a circle is attached to the frame below the ball of the pendulum, at 48 inches from the point of suspension, and a pointer demitted from the ball shows the number of tenths of an inch contained in the whole arc of vibration: this clock will go eight days, with a power of 3 lb. $1\frac{1}{2}$ oz. avoirdupois, falling six inches per day; its arc of escapement, on the scale, is 2.2 inches, and the total arc of vibration usually, when the clock is clean, 3.4 inches; which numbers may be converted into degrees and minutes, thus: the circumference of a circle, of 48 inches radius, is very nearly 151 inches; therefore say, as 151 in. : 360° :: 3.4 in. : 8° 6′, the whole arc of vibration; also as 151 in. : 360° :: 2.2 in. : 5° 14′, the whole arc of escapement; hence each whole excursion is 4° 3′, and each arc of action on the pallets in that excursion 2° 37′, in the clock before us: which quantities are to each other very nearly as 17 to 11. We do not profess to say that this is the best ratio to be adopted in practice between the arc of excursion and the arc of action on the pallets, because we believe that the experiments hitherto made on dead-beat escapements, to determine the best slopes of the faces of the pallets, have not been numerous enough to warrant a conclusion on this point, which, notwithstanding, we think of great importance, and recommend to the notice of clock-makers. Mr. Nicholson, the author of the "Journal of Philosophy," &c. once informed us, in conversation, that his seconds pendulum clock with a dead-beat escapement, having its curves nicely formed in a lathe, does not vary its daily rate more than a second per day, when the maintaining power is increased as much as four or five times, or more, which we believe, is not usually the case with dead-beat escapements; we are not, however, at present informed of the exact quantity of the arc of action on the pallets, on which most probably the isochronal property chiefly depends, though we were at the same time informed that the suspension-spring is tapered from the top downwards, in a way that aids the longer vibration by quickening them. The subject is worthy of minute investigation, particularly as Berthoud has asserted, that in his experiments he always found his clocks retard with the dead-beat escapement by the addition of weight to the maintaining power, and *vice-versâ*, which was his reason for contriving his isochronal pallets. The experimentalist, however, ought to bear in mind, that both the length of the arc of action and the modification of the impulse vary with the slope of the pallet's faces in the escapement in question.

Clock-*maker*. If we were to define the word clock-maker agreeably to the derivation of the term, we should simply say that it means a man who makes clocks, and this definition, at one period of the art, would have been sufficient for our purpose; but since clocks have become so common as to be considered as articles of household furniture, the art of making them has not been confined, as at first, to one department of mechanics, but has gradually ramified into various branches, so distinct from one another, that the maker of one part is frequently unacquainted with the operations requisite for the manipulations of another, equally essential. Since the time that clocks became an article of our manufactories, requiring various tools and engines for facilitating their construction, the subdivision of the art into various departments was a natural consequence, which has been found to contribute to expedition, and consequently to cheapness; and, for the same reason that a tailor has no need to understand either spinning, weaving, or dying, a finisher of a clock has now no occasion to cast or cut his wheels himself, much less to make his springs or enamel his dial-plate. From custom, however, that man is called a clock-maker, who finishes or puts together the different constituent parts of a clock when made, and who has his profit from the sale of the machine; though the makers, more properly speaking, are the workmen employed in making the frame and contained wheel-work. The different operations may, indeed, be most of them performed by one workman, when the construction is intended to be peculiar, or the works of superior accuracy, but in general the different departments of the art may be separately enumerated, agreeably to the subjoined order, *viz.*

1. The brass-founder casts the wheels, plates, pillars, and faces, according to approved models:
2. The spring-maker forges, shapes, and tempers the main-springs, to any required strength or dimensions:
3. The making of the weights, to be used as maintaining powers of the balls, or bobs, and hands, may be considered as one branch:
4. The man who keeps a cutting-engine and a fusee-engine, cuts the wheels and pinions, and forms the grooves on the fusee or barrel, accordingly as a spring or suspended weight is used as a maintaining power:
5. The movement-maker mounts the frame, makes the wheels, pinions, detents, &c. and places them in the frame, agreeably to the proposed calliper.
6. The clock-smith forges the steel pieces for the arbors, pinions, pallets, rack, hammer, detents, &c.:
7. The bell-founder casts the bell, or bells when the clock has chimes:
8. The enameller prepares the ground of the dial, or face, for receiving the colour of the figures, and gets the painter to lay on the figures, agreeably to the calliper, with or without a circle for the seconds:
9. When the face is not of real enamel, a japanner, or imitative enameller, prepares and finishes the dial:
10. When the face is brass silvered, an engraver usually prepares, and sometimes also silvers it:

11. A

11. A jeweller is employed for the pallets and pivot-holes of the beſt aſtronomical clocks and regulators :

12. The gilder is frequently employed for preparing the ornamental parts of the caſe :

13. The glazier is applied to for the door of the ſuperior part of the caſe, when a ſeconds pendulum is uſed, and for the principal door ſometimes, when the clock has a ſhort pendulum :

14. The cabinet maker is reſorted to, uſually, for the caſe of the clock ; and ſometimes alſo the carver :

15. The chain or cat-gut maker is indiſpenſably neceſſary :

16. Recently the tubular compenſation-pendulum has been made and adjuſted, by the mathematical inſtrument-maker, as being a portion that requires great preciſion :

17. Laſtly, the finiſher, or, as he is otherwiſe called, the *maker*, poliſhes the teeth and ſteel parts, finiſhes the pivots, verifies the engagement, adjuſts the eſcapement, limits the arc of vibration by adjuſting the maintaining power to the weight of the ball, regulates the adjuſtments for beat and rate, finiſhes the ſtriking and repeating parts, and puts the whole machine into a ſtate ready for ſale.

CLOCK-*makers, Company of.* See COMPANY.

CLOCK-*making.* Clock-making, or the art of making clocks, ſeems not to hold that rank among the mechanical arts, which its connection with the ſciences, particularly that of aſtronomy, and alſo which the many ingenious improvements it has undergone by the help of ſcientific men, entitle us to expect. The cuſtom of working by piece-meal from eſtabliſhed models, which, it muſt be allowed, contributes greatly to expedition and cheapneſs, has, no doubt, conduced to exclude calculations and geometrical principles from the workſhops of the preſent day : whence it ariſes, that if we wiſh to be introduced to the workman who has had the greateſt ſhare in the conſtruction of our beſt clocks. we muſt often ſubmit to be conducted up ſome narrow paſſage of our metropolis, and to mount into a dirty attic, where we find illiterate ingenuity cloſely employed in earning a mere pittance, compared with the price which is put on the finiſhed machine by the vender of more eaſy circumſtances, though the latter has had little more trouble in the conſtruction than to order his name to be inſerted before it is placed for public notice in his bow-window. The practical departments of this art being thus frequently confined to the obſcurity of a garret, it is no wonder that a dexterity at performing certain manual operations, ſuch as hammering, filing, drilling, turning, ſoldering, tempering, poliſhing, &c. ſhould be conſidered as the perfection of the art, and that the reaſon is frequently not underſtood by the workman himſelf, and ſeldom by his employer, why the numbers of his wheels and pinions, and the ſhape, ſize, and diſpoſition of the different portions of his mechaniſm, are deemed preferable to others which he might have adopted as eaſily, if, in his apprenticeſhip, he had been ſo inſtructed. Indeed we have not in the Engliſh language any regular inſtructions for all the ſucceſſive portions of work to be performed in the conſtruction of a good clock, which want is much to be regretted ; for, until the clock-maker by profeſſion can proceed in his work on ſcientific principles, he muſt be content to be a mere ſlave of imitation in an art, which is capable of affording him genuine pleaſure, from the opportunities it affords, of calling in ſcience to his aid in every ſtep that he takes, through an infinite variety of practical conſtructions. It would tranſcend the limits preſcribed to our plan, ſhould we enter into a detail of all the minutiæ of the art, but as none of our predeceſſors have given the mechanician any information on this intereſting ſubject, we will give a ſuccinct account of the principal operations, as they preſent themſelves in ſucceſſion, which, if it may not afford the expert and informed workman much inſtruction, will, we preſume, gratify the curioſity of the inquiſitive mind, as far as the detail goes.

The firſt requiſite to be determined, is the kind of machine to be made choice of ; *viz.* whether the clock is to be portable or fixed ; how long it ſhall go at one winding up ; whether its maintaining power ſhall be a ſuſpended weight, or a ſpring ; what kind of a dial plate or face it ſhall have for the indication of time ; what ſhall be the nature of its eſcapement ; of what materials its pendulum ſhall be compoſed ; what ſhall be the time of a vibration ; and whether or not it ſhall have the ſtriking work : all theſe and ſimilar determinations, muſt be made before the work is put into hand. We will ſuppoſe that a portable eight-days clock, with a half-ſeconds pendulum, and a ſpring for a maintaining power, is fixed upon as the inſtrument to be made, which we will take as an example, on account of the variety of the parts which ſuch an inſtrument conſiſts of ; and, to render the account more complete, we will ſuppoſe that it be required to go whilſt it is wound up, and that, for the ſake of accuracy, it have the dead-beat eſcapement, and a compenſation pendulum ; the laſt of which is not very uſual in a portable clock.

The going Part of an Eight-days Clock.

1. *Calculation.* Having determined upon the kind of clock to be made, the firſt thing to be done, and that in which the clock-maker is generally deficient, is, to calculate the movement, or proper number of teeth in the wheels, and of leaves in the pinions, of the going part of the mechaniſm. Dr. Derham, in his "Artificial Clock-maker," has treated this ſubject at conſiderable length, and has laid down rules which have tended more to puzzle than aſſiſt the workman in the choice of his numbers ; he propoſes to take at random a certain number of vibrations per hour for a pendulum of an aſſumed length, to repreſent his train, and then to find the factors or numbers, which, uſed as multipliers, ſhall give the requiſite product, or nearly ſo ; after which each factor is repreſented by a ratio of two optional numbers, to conſtitute a wheel and its pinion. We will not follow the Doctor through his proceſſes here, but merely obſerve, that, by calculating his whole movement at one operation from an aſſumed number of vibrations, he has introduced a variety of ſuch trains into portable clocks and watches, as make a vibration of the ſhort pendulum, and an oſcillation of the balance, no exact fraction of a ſecond ; in ſhort he has begun at the wrong end of the buſineſs ; has firſt fixed on the length of his pendulum in inches, without conſidering exactly the number of vibrations it would make, and then calculated a train that would ſo nearly ſuit it, that the adjuſtment for time by the bob, would compenſate the defect of the numbers ; the conſequence has been, that the exact value of a vibration in a portable clock, and of an oſcillation in an ordinary watch, has hitherto been diſregarded in the conſtruction. On the contrary, we recommend to the clock-maker, firſt to fix upon his number of vibrations per ſecond, and then to calculate the true length of his pendulum, and exact value of his train agreeably to the number of vibrations per ſecond that he previouſly determined. The moſt ſimple way of calculating the numbers proper for the movement of any clock, intended to ſhow ſeconds, is, by dividing it into three portions, and then by calculating the wheels and pinions for each ſeparate portion, by a ſeparate calculation, beginning at the bottom of the train ; thus, we firſt fix upon the pinion of the hour arbor to be, ſuppoſe 8, which is a good practical number ; and as our piece is to go eight days, we will make the

the fuſee to revolve in 12 hours, which conſtruction will require the great wheel on its arbor to be 8×12, or 96, becauſe the pinion of 8 revolves, with the minute hand on its projecting pivot, in one hour; hence if we divide 192, the number of hours in eight days, by 12, the time of one revolution of the great wheel, the quotient 16 will be the number of effective ſpiral grooves neceſſary to be cut on the circumference of the fuſee, in order that the piece may go juſt eight days. This portion of the movement is not, however, called a part of the train, but only determines, as has been ſaid, the time that the clock ſhall continue to go after each winding up of the maintaining power; and it is eaſy to conceive, that if a fuſee or a barrel, with 24 turns of the catgut or chain, were placed on the hour arbor, the clock would go a natural day without the large wheel; and alſo, that if an intermediate wheel and pinion were placed on the arbor between the hour arbor and the great wheel, the time of going might be prolonged to 10, 12, or even 20 times eight days, but then the maintaining power muſt be proportionably increaſed, which circumſtance renders ſuch a conſtruction by no means deſirable in a regulator, particularly as the auxiliary ſpring now in uſe will keep the piece in motion during the act of winding up.

The remaining portion of the movement is properly called the *train*, including thoſe wheels and pinions only, which are uſed for counting the vibrations made in an hour; the train is moſt eaſily aſcertained by two calculations, one for the two wheels and two pinions which multiply the minutes into ſeconds, and the other for that wheel and pinion, or thoſe wheels and pinions, which ſubdivide the ſeconds into vibrations; the former of theſe two portions of the train, like the firſt portion of the movement, or portion for the period of continuance, is the ſame for all clocks, let the time of vibration be what it may, a circumſtance not uſually conſidered; the ratio of velocity to be gained by the pinion on the arbor of the ſeconds hand, compared with the wheel on the arbor of the minutes hand, is required to be 60 : 1; which effect might be produced by one wheel of 300 teeth, and a pinion of 5 leaves, as is done in ſome of the ornamental French pieces; but the ſize of the wheel is cumberſome, therefore a pair of wheels, with a pair of pinions, one conſtituting a ratio or vulgar fraction equal in value to 8, and the other equal to $7\frac{1}{2}$, making $8 \times 7\frac{1}{2} = 60$, or any other two numbers making a ſimilar product, will produce the ſame effect with fewer teeth; for if the pinions be each 8, the wheels, in this caſe, will be reſpectively 64 and 60, the compound ratio $\frac{8}{64} \times \frac{8}{60}$ being equal to the ſimple $\frac{1}{60}$; and, by the ſame proceſs, if pinions of 10 had been choſen, the wheels would have been $8 \times 10 = 80$, and $10 \times 7\frac{1}{2} = 75$, which numbers would indeed have leſs friction than the preceding ones, by reaſon of their teeth acting at leſs depth, the diameters of the wheels remaining the ſame, and would moreover be capable of acting more behind than before the line joining the centres of the wheel and pinion; in like manner, pinions of 6 would require wheels of 48 and 45, and pinions of 12 wheels of 96 and 90, as may be ſeen in *Table* II. in our ſubſequent article, denominated CLOCK-*movement*.

The laſt portion of the movement, or ſecond portion of the train, for a half-ſeconds pendulum, will require only one wheel of 60 teeth on the ſeconds arbor, properly ſhaped for the eſcapement; for as one tooth in the dead-beat and common anchor eſcapements eſcapes completely at two vibrations of the pendulum, 60 teeth will eſcape, that is, a whole revolution of the ſeconds hand will be made, in 120 vibrations; if, however, the pendulum had been required to vibrate ſeconds, the wheel in queſtion, called uſually the ſwing wheel, in oppoſition to the crown-wheel, which requires another eſcapement, would have demanded only 30 teeth for that purpoſe; and if three vibrations had been fixed upon, the number to correſpond muſt have been 90, otherwiſe there muſt have been a wheel and pinion of the value of 3, like $\frac{8}{24}$, or $\frac{10}{30}$, in addition to the uſual ſwing-wheel of 30; or, which is the ſame thing, a wheel and pinion of the value of 6, like $\frac{8}{48}$, or $\frac{10}{60}$, muſt have been introduced between the ſeconds arbor and a pallet, or ſwing-wheel of 15. (See *Table* III. under CLOCK-*movement*.) Thus all the variety in the calculation of trains, where ſeconds are indicated, is confined, as we have intimated, to the laſt portion of the movement, and the calculation itſelf is ſo ſimple, that the mere altering of the numbers of the pallet-wheel will convert a clock with a ſeconds pendulum into one with half-ſeconds, and *vice verſâ*.

2. *Notation of the Numbers.* The calculation of numbers ſuitable for an eight-days clock with a half-ſeconds pendulum being thus readily obtained by three ſimple operations, which may be had by mere inſpection from the three tables contained in the article CLOCK-*movement*, the whole may be repreſented, and its value eſtimated again by a compound fraction thus: *viz.* $\frac{8}{96}$ of $\left.\frac{8}{64} \times \frac{8}{60}\right|$ of $\frac{1}{60 \times 2}$ of 12 hours, or, which is the ſame thing in effect, thus, $\frac{8}{96} \times \frac{8}{64} \times \frac{8}{60} \times \frac{1}{60 \times 2} = \frac{512}{44236800} = \frac{1}{64800}$ of 12^h, or 86400 vibrations in 12 hours, which is the time of a revolution of the fuſee, and great wheel, 96, on its arbor, and therefore $\frac{86400}{12}$, or 7200 vibrations, each of half a ſecond in duration, in one hour, conſtitute the value of this train. This mode of notation gives the value better than any other perhaps that has been adopted; but the poſition of the wheels and pinions will be better underſtood from the ordinary mechanical method of writing them down; thus:

Great wheel 96
  Pin. 8—64 hour wheel
    Pin. 8 —60 ſecond wheel
      Pin. 8—60 ſwing wheel
        2 pallets.

Indeed it is difficult to write down the movement by any one notation that ſhall expreſs, at the ſame time, both the value and poſition of the wheel-work, on which account we recommend to the workman to write down his numbers by both forms, taking care in the method, by compound ratios, to put all the drivers under the line of diviſion, and all the driven ones above; ſo that when an aſcending movement is repreſented, the wheels may be the denominators, and when a deſcending one, the pinions. In our mode of calculation, from the bottom of the train, the notation muſt be, as we have made it, aſcending.

3. *Proportioning.* The calculation of proper numbers being made and noted down, the next ſtage of the work is proportioning the diameters of the wheels and of their reſpective pinions, ſo as to tranſmit the maintaining power from the fuſee, or barrel in an ordinary 30 hours clock, to the pallets, and thence to the pendulum, to compenſate the loſs of motion which, when unaided, it would ſuſtain from friction and the reſiſtance of the air. If a wheel and pinion were to be made like two rollers, preſſing their edges againſt one another,

other, to produce a communication of rotatory motion, their diameters might and ought to be in geometrical proportion directly as their calculated numbers of teeth; but the force of the maintaining power would be too great to be ſuſtained by mere friction at the points of contact of ſuch rolling wheels and pinions; they have therefore been neceſſarily indented, and their teeth mutually inſerted ſo far into their correſponding ſpaces, as to prevent the revolution of one wheel or pinion without a correſponding motion produced in the next adjoining, which would not be the caſe with rollers, if a conſiderable force impelled them at one end of the train, and at the ſame time a retarding force oppoſed them at the other; for their ſurfaces, at the point of greateſt oppoſition to free motion, would mutually rub without effecting a communication of rotary motion beyond ſuch point. If now we call the points of contact of the two rollers, made in geometrical proportion to each other, or, in other words, the points where they pitch againſt one another, the pitch-line, and conceive a number of projecting little levers, or teeth, fixed at proper intervals from each other at theſe points of contact, in the circular pitch line of each roller, we ſhall have a true idea of two wheels properly proportioned to act together, which, when of unequal diameters, will not now be in geometrical proportion to each other, by reaſon of an equal lever, or length of tooth, being added to each ſeparately, after they were in exact geometrical proportion; moreover, it will be eaſily apprehended that the deviation from their original proportion, in the ſtate of rollers, will be the greater, the greater their diſparity of numbers. Hence it will be readily conceived, that the due proportioning of wheels and pinions is an important object in clock-making, for, ſuppoſing the teeth reſpectively of the true epicycloidal forms, inveſtigated under CLOCK-*movement*, unleſs the reſpective ſizes be properly adjuſted, the tranſmiſſion of the maintaining power, and communication of motion, will both be unequable, and the mechaniſm ſubject to rapid deſtruction. The uſual mode of proportioning, or ſizing wheels and pinions, as it is often called, is, firſt to make both a little too big for the propoſed calliper, and then, having rounded all the teeth of the pinion and a few of the correſponding wheels, to diminiſh the latter in the lathe, or turning frame, gradually, until, by ſucceſſive trials in the clock-frame, they are found to act at a proper depth, when placed in the pivot-holes previouſly made; this vulgar mode we reprobate, as calculated to deſtroy the due practical proportions, and hope to ſee it baniſhed from the workſhops by the general adoption of a better method, which we have now to propoſe.

In proportioning wheels and pinions, after the numbers of their teeth are determined upon, two particulars are to be attended to, the coarſeneſs or ſolidity and the ſhape of the tooth; the former may be expreſſed by the number of teeth per inch in the circumference of the wheel; and the latter by the denomination epicycloidal: if a tooth were rounded in a circular ſhape, which we by no means recommend, the pitch-line would be conſidered as at one half the breadth of the tooth from the extreme edge; but when it is rounded, as we have recommended in our article CLOCK-*movement*, in an epicycloidal ſhape, or as the workmen call it, the *bay-leaf* form, Hatton has found, from numerous experiments, that the depth, or diſtance of the pitch-line from the circumference, will generally be $\frac{3}{4}$ of the breadth of the tooth in any wheel or pinion; and as the epicycloidal is the beſt ſhape for the regular tranſmiſſion of force and velocity, we will adopt it as the beſt for practice. We have juſt ſaid that when an epicycloidal-tooth is uſed, the diſtance of the pitch line from the end of the tooth is equal to $\frac{3}{4}$ of its breadth, and if we ſuppoſe the tooth and ſpace cut to be reciprocally equal, we ſhall have the true acting diameter of any wheel or pinion greater than the geometrical diameter, which Camus calls alſo the primitive diameter, by $\frac{3}{4}$ of a tooth or ſpace, on each ſide of the centre, or $1\frac{1}{2}$ in the whole diameter; let now a ſpace or a tooth be called a *meaſure*, and there will be double the number of meaſures as teeth in any wheel; alſo let theſe meaſures of the circumference be reduced into meaſures of the diameter by the uſual ratio, of $3.1416 : 1$, and then $1\frac{1}{2}$ added to ſuch geometrical meaſures of the diameter will give the proper acting diameter, which may be expreſſed in inches and parts when the meaſures per inch are known. For inſtance, let our great wheel and its pinion $\frac{8}{96}$ be taken at 12 teeth per inch at the pitch-line, which may in practice be more or leſs, according to the thickneſs of the metal compared with the maintaining power as modified at the wheel's circumference; the number of meaſures of the great wheel is 192, *viz.* 96 teeth and 96 ſpaces, each meaſuring 1-24th of an inch; then as $3.1416 : 1 :: 192 : 61.1$; therefore, if to the geometrical diameter expreſſed by 61.1 meaſures there be added 1.5, the ſum 62.6 or $62\frac{6}{10}$ will be the acting diameter in the ſame denomination, which are ſo many 24th parts of an inch; but $\frac{62.6}{24}$ gives 2.6 inches for the full acting diameter of the wheel in queſtion:—again, the pinion 8 has 16 ſimilar meaſures in its circumference, and by the ſame proportion the diameter will be 5.09 meaſures; to which if 1.5 be added, the acting diameter will be $5.09 + 1.5 = 6.59$, or with ſufficient accuracy $6\frac{6}{10}$, which divided by 24 as before, will give the ſame $\frac{27}{100}$ of an inch, or ſomewhat more than a quarter for the acting diameter of the pinion. Upon theſe principles Hatton ("Introduction to the Mechanical Part of Clock and Watch-work," page 334,) has conſtructed a table of the ſizes of pinions meaſured diametrically, and compared by a pair of callipers with a given number of teeth and ſpaces, in their correſponding wheels, which many workmen copy in practice; but as his calculations are founded on a ſuppoſition that the ends of the teeth are circular, requiring unity as the ſupplemental portion, we find them differ eſſentially from Berthoud's determination in his "Eſſai ſur l'Horlogerie," p. 172, tome i. and ſhall therefore inſert here a new table calculated on a ſuppoſition that the curve is epicycloidal, and that the circumference is to the diameter as $3 : 1$, inſtead of $3.1416 : 1$; the reſult of which mode agrees very nearly with Berthoud's experiments on the proper ſizes of wheels and pinions, and therefore we recommend it to the notice of the accurate workman.

Table of the true practical Sizes of Pinions.

Teeth in the Pinions.	Meaſures of the Wheel for a Diameter of the Pinion.
3	3.5
4	4.1
5	4.8
6	5.5
7	6.1
8	6.8
9	7.5

Teeth

Teeth in the Pinions.	Meafures of the Wheel for a Diameter of the Pinion.
10 - - -	8.1
11 - - -	8.8
12 - - -	9.5
13 - - -	10.1
14 - - -	10.8
15 - - -	11.5
16 - - -	12.1

The procefs by which this table is calculated is fimply this; multiply the pinion by 2 for the meafures in the circumference; divide by 3 for the diameter, and add thereto $1\frac{1}{2}$ for the acting fize; thus for the diameter of a pinion of 6, it is $\overline{6 \times 2 \div 3 + 1\frac{1}{2}} = 5\frac{1}{2}$ or 5.5; namely, $6 \times 2 = 12$, and $\frac{12}{3} = 4$ and $4 + 1.5 = 5.5$ for the meafures; which laft quantity taken by the callipers acrofs the extreme edge of the wheel will be 3 teeth and $2\frac{1}{2}$ fpaces, or 3 fpaces and $2\frac{1}{2}$ teeth, which are here fuppofed to be cut but not rounded.

The application of this table, it is prefumed, cannot be eafily miftaken by any workman who underftands that the figures in the fecond column, to the left of the decimal point, mean fo many meafures, either teeth or fpaces, and the figure to the right of the faid point, fo many tenth parts more of a meafure to be added to the integral meafures. It may be proper to add here that a proportioned pinion muft be made fomewhat fmaller for a fmall wheel than for a large one, and alfo fmaller when driven than when it is the driver. We now know the numbers of our movement, and alfo that whatever the diameters of the wheels may be, our pinions of 8 muft be turned in the lathe till their diameters are precifely each 6.8 meafures, or three teeth and very nearly four fpaces, (taken by a pair of pinion callipers from their refpective wheels, in a ftraight line acrofs the ends of the teeth) either before or after they are flit, as the operation of dividing and cutting is called by the workmen. The diameters of the wheels are ufually made to diminifh as the train afcends, probably becaufe the force to overcome their inertia diminifhes, and the friction alfo is lefs in fine teeth with flender pivots, than in coarfe ones with thick pivots: indeed there feems to want a ftandard rule for the guide of workmen in this particular. Having taken the great wheel at 12 teeth per inch, meafured at the pitch line, we will take the centre wheel of 64 at 14, and the fecond wheel of 60 at 16, which will make fomething like a regular diminution in the fizes in the afcent of the train, and allow us room enough in our plates for the reprefentation. From thefe data, by the help of the foregoing directions, we readily afcertain the requifites for drawing the calliper as expreffed in the fubjoined table.

Table of Wheels and Pinions.

Wheels.		Teeth per Inch.	Acting Diameters in Inches.	Geometrical Diameters meafured from the Pitch Lines
Great wheel	96	12	2.60	2.55
Its pinion	8	12	0.273	0.21
Centre wheel	64	14	1.514	1.46
Its pinion	8	14	0.234	0.18
Second wheel	60	16	1.24	1.19
Its pinion	8	16	0.207	0.16
Swing wheel	60	16	1.24	

Pennington, of Camberwell, the ingenious mechanift who conftructed Mr. Mudge's time-piece, and gave the drawings in Mr. Mudge's pamphlet, has paid particular attention to the fubject of fizing wheels and pinions, and has publifhed a fmall pamphlet, recommending the ufe of his method of calculation by a fector of a peculiar conftruction; but we do not find that its ufe has become general. On conferring with him, we were informed that his practice is, to add $2\frac{1}{2}$ meafures of the geometrical diameter to the wheel, and $1\frac{1}{2}$ to the pinion, in watch-work, when the wheel is the driver; and $1\frac{8}{10}$ to each, when the pinion is the driver. This rule, it will be feen, differs very little from our theory above laid down, where we obferved that the driver ought to be fomewhat larger than the proportion affigned by the addition of $1\frac{1}{2}$ parts or meafures to each, and more particularly where the wheels have fmall diameters, as is the cafe in watch-work. But, as the good action of wheels and pinions depends upon their being duly proportioned and callipered, as well as on a proper fhape being given to the teeth, the latter of which requifites is defcribed under Clock-*movement*, we will not fatisfy ourfelves with having given our own method of fizing, which it is poffible the unlettered portion of the workmen may not underftand, by reafon of its requiring fome knowledge of arithmetical proportion, but we will add moreover the method of fizing pinions practifed and recommended by F. Berthoud, in his "Effai fur l'Horlogerie," which is as follows; *viz.*

No. of Teeth. *The full or acting Diameter of the Pinion.*

4 = two full teeth of the wheel, unrounded, and the fpace between.
5 = three teeth, rounded from point to point.
6 = three full teeth, unrounded.
7 = three full teeth and a quarter of a fpace beyond.
8 = four teeth, rounded, from point to point.
9 = fomewhat lefs than four full teeth.
10 = four full teeth.
11 no meafure given.
12 = five full teeth.
13 no meafure given.
14 = fix teeth, rounded from point to point.
15 = fix full teeth.

The pinions in watches, he remarks, muft be fmaller in comparifon with their wheels than in clocks, agreeably to what we have above faid.

Copioufly, however, as we have treated the fubject of proportioning the fizes of wheels and pinions in a train of wheel-work, we think the fubject of fuch importance, that we are unwilling to fatisfy ourfelves with merely having explained, and illuftrated, by an example, the method of converting geometrical into practical dimenfions, but hope to render the bufinefs ftill more familiar by an extenfive table containing the geometrical diameters of all numbers from 4 to 64, and alfo twenty different variations in the ftrength of the tooth which we have newly calculated on purpofe. The data, on which the table is calculated, have been already explained, and its application, it is prefumed, is fo eafy, that the geometrical diameter, in inches and decimal parts, of any wheel or pinion contained therein, may be feen by infpection, and immediately converted into the proper practical diameter, by the fimple addition of the quantity of engagement of the tooth, at the bottom of the fame vertical column, out of which the geometrical diameter is taken, which addenda are calculated on a fuppofition that the teeth are intended to be rounded of an epicycloidal form.

Table of the Geometrical Diameters of Wheels and Pinions.

Wheels and Pinions.	Teeth per Inch. 4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
4	.32	.25	.21	.18	.16	.14	.13	.12	.105	.098	.09	.085	.08	.075	.07	.067	.064	.061	.058	.055	.053
5	.40	.32	.26	.23	.20	.18	.16	.15	.13	.12	.11	.106	.10	.094	.09	.084	.08	.076	.072	[illegible]	.067
6	.48	.38	.32	.27	.24	.21	.19	.17	.16	.15	.14	.13	.12	.11	.105	.10	.096	.091	.087	.083	.08
7	.56	.45	.37	.32	.28	.25	.22	.20	.18	.17	.16	.15	.14	.13	.12	.12	.11	.106	.101	.097	.093
8	.64	.51	.42	.36	.32	.28	.25	.23	.21	.20	.18	.17	.16	.15	.14	.13	.12	.12	.116	.11	.106
9	.72	.57	.48	.41	.36	.32	.29	.26	.24	.22	.20	.19	.18	.17	.16	.15	.14	.134	.13	.125	.12
10	.80	.64	.53	.45	.40	.35	.32	.29	.26	.24	.22	.21	.20	.19	.17	.17	.16	.15	.14	.14	.1
11	.88	.70	.58	.50	.44	.39	.35	.32	.29	.27	.25	.23	.2	.21	.19	.18	.17	.165	.16	.15	.14
12	96	.76	.64	.54	.48	.42	.38	.35	.32	.29	.27	.25	.24	.22	.21	.20	.19	.18	.17	.17	.16
13	1.04	.82	.69	.59	.52	.46	.41	.38	.34	.32	.29	.28	.26	.24	.23	.22	.20	.196	.19	.18	.17
14	1.12	.89	.74	.64	.56	.49	.44	.40	.37	.34	.32	.30	.28	.26	.24	.23	.22	.21	20	.19	.18
15	1.20	.99	.80	.68	.60	.53	.48	.43	.40	.37	.34	.32	30	.28	.26	.25	.24	.22	.21	.21	.20
16	1.28	1.02	.85	.73	.64	.56	.51	.46	.42	.39	.36	.34	.32	.30	.28	.27	.25	.24	.23	.22	.21
17	1.36	1.08	90	.77	.67	.60	.54	.49	.45	.41	.38	.36	.34	.32	30	.28	.27	.26	.24	.23	.22
18	1.44	1.15	.96	.82	.71	.64	.57	.52	.48	.44	.41	.38	.35	.34	.32	30	.28	.27	.26	.25	.24
19	1.52	1.21	1.01	.86	.75	.67	.60	.55	.51	.46	.43	.40	.37	.35	.33	.32	.30	.29	.27	.26	.25
20	1.59	1.27	1.06	.91	.79	.71	.64	.58	.53	.49	.45	.42	.39	37	.35	.33	.32	.30	.29	.28	.26
21	1.67	1.33	1.11	.96	.83	.74	.67	.61	.55	.51	.48	.44	.41	.39	.37	.35	.33	.32	.30	.29	.27
22	1.75	1.40	1.17	1.00	.87	.78	.70	.64	.58	.54	.50	.46	.43	.41	.39	.37	.35	.33	.32	.30	.29
23	1.83	1.46	1.22	1.04	.91	.81	.73	.67	.61	.56	.52	.48	.45	.43	40	.38	.36	.34	.33	.32	.30
24	1.91	1.53	1.27	1.09	.96	.85	.76	.69	.64	.59	.54	.51	.47	.45	.42	.40	.38	.36	.34	.33	.32
25	1.99	1.59	1.33	1.14	.99	.88	.79	.72	.66	.61	.57	.53	.49	.47	.44	.42	.39	.38	.36	.35	.33
26	2.07	1.66	1.38	1.18	1.03	.92	.83	.75	.69	.64	.59	.55	.51	.49	.46	.43	.41	.39	.37	.36	.34
27	2.15	1.72	1.43	1.23	1.07	.96	.86	.78	.71	.66	.61	.57	.53	.51	.48	45	.43	.41	.39	.37	.35
28	2.23	1.78	1.49	1.27	1.11	.99	.89	.81	.74	.68	.64	.59	.55	.52	.49	.47	.44	.42	40	39	.37
29	2.31	1.85	1.54	1.32	1.15	1.02	.93	.84	.77	.71	.66	.61	.57	.54	.51	.48	.46	.44	.42	.40	.38
30	2.39	1.91	1.59	1.37	1.19	1.06	.96	.87	.79	.73	.68	.64	.59	.56	.53	.50	.48	.46	.45	.41	.39
31	2.47	1.97	1.64	1.41	1.23	1.09	.99	.90	.82	.76	.70	.66	.61	.58	.55	.52	.49	.47	.45	.43	.41
32	2.55	2.04	1.70	1.45	1.27	1.13	1.02	.93	.85	.78	.72	.68	.64	.60	.57	.53	.51	.48	.46	.44	.42
33	2.63	2.10	1.75	1.50	1.31	1.17	1.05	.96	.87	.81	.75	.70	.66	.62	.59	.55	.52	.50	.48	.45	.44
34	2.71	2.16	1.81	1.54	1.35	1.20	1.08	.98	.90	.83	.77	.72	.68	.64	.60	.57	.54	.51	.49	.47	.45
Epicycloid Addenda	188	.150	125	.107	.094	.083	075	.068	.063	.058	.054	.05	047	.044	.042	.04	.038	.036	.034	.033	.031

Table of the Geometrical Diameters of Wheels and Pinions (continued.)

Wheels and Pinions	Teeth per Inch. 4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
35	2.79	2.22	1.85	1.59	1.39	1.23	1.11	1.01	.93	.86	.79	.74	.69	.65	.62	.59	.55	.53	.50	.48	.46
36	[illegible]	2.2[illegible]	1.91	[illegible]	1.43	1.27	1.14	1.04	.96	.88	.81	.76	.71	.67	.64	.60	.57	.54	.52	.5[illegible]	.48
37	2.95	2.35	1.96	1.68	1.47	1.31	1.18	1.07	.98	.91	.84	.79	.73	.69	.65	.62	.59	.56	.53	.51	[illegible]
38	3.03	2.42	2.02	1.73	1.51	1.35	1.21	1.10	1.01	.93	.86	.81	.75	.71	.67	.64	.60	.58	.55	[illegible]	.50
39	3.10	2.48	2.07	1.77	1.55	1.38	1.24	1.13	1.03	.96	.88	.83	.77	.73	.69	.65	.62	.59	.56	.54	.51
40	3.18	2.55	2.12	1.82	1.59	1.41	1.27	1.16	1.06	.98	.91	.85	.79	.75	.70	.67	.64	.61	.58	.55	.53
41	3.27	2.61	2.17	1.87	1.63	1.45	1.30	1.19	1.08	1.01	.93	.87	.81	.77	.72	.69	.65	.62	.59	.57	.54
42	3.35	2.67	2.23	1.91	1.67	1.48	1.34	1.21	1.11	1.03	.96	.89	.83	.79	.74	.70	.67	.64	.60	.58	.55
43	3.43	2.73	2.28	1.96	1.71	1.52	1.37	1.24	1.14	1.05	.98	.91	.85	.80	.76	.72	.68	.65	.62	.59	.57
44	3.50	2.[illegible]	2.33	2.01	1.75	1.5[illegible]	1.40	1.27	1.16	1.08	1.00	.93	.87	.82	.78	.74	.70	.67	.64	.61	.58
45	3.58	2.87	2.39	2.05	1.7[illegible]	1.5[illegible]	1.4[illegible]	1.30	1.19	1.10	1.02	.95	.89	.84	.80	.75	.71	.68	.65	.62	.59
46	3.67	2.92	2.45	[illegible]	1.83	1.63	1.46	1.33	1.22	1.13	1.04	.97	.91	.86	.81	.77	.73	.70	.66	.64	.61
47	3.75	2.99	2.5[illegible]	[illegible]	1.87	1.67	1.49	1.3[illegible]	1.25	1.15	1.07	.99	.93	.88	.83	.79	.75	.71	.68	.65	.62
48	3.82	3.05	2.5[illegible]	[illegible]	1.9[illegible]	1.70	1.53	[illegible]	1.27	1.18	1.09	1.01	.95	.90	.85	.80	.76	.73	.69	.66	.64
49	3.90	3.1[illegible]	2.6[illegible]	[illegible]	1.94	1.7[illegible]	1.57	1.42	1.30	1.20	1.11	1.04	.97	.92	.86	.82	.78	.74	.71	.67	.65
50	3.98	3.18	2.65	2.28	1.9[illegible]	1.77	1.60	1.45	1.32	1.22	1.14	1.06	.99	.94	.88	.83	.80	.76	.72	.69	.66
51	4.06	3.24	2.7[illegible]	2.32	2.03	1.81	1.63	1.48	1.35	1.25	1.16	1.08	1.01	.95	.90	.85	.81	.77	.74	.70	.67
52	4.14	3.31	2.76	2.3[illegible]	2.06	1.84	1.66	1.51	1.38	1.27	1.18	1.10	1.03	.97	.92	.87	.8[illegible]	.79	.75	.71	.69
53	4.21	3.37	2.81	2.41	2.10	1.88	1.69	1.54	1.40	1.30	1.20	1.12	1.05	.99	.94	.88	.84	.80	.77	.73	.70
54	4.[illegible]	3.4[illegible]	2.87	2.4[illegible]	2.14	1.91	1.7[illegible]	1.56	1.43	1.32	1.22	1.14	1.07	1.01	.95	.90	.86	.81	.78	.74	.71
55	4.[illegible]	3.49	2.91	2.50	2.18	1.94	1.75	1.59	1.46	1.35	1.25	1.16	1.09	1.03	.97	.92	.89	.83	.79	.75	.73
56	4.4[illegible]	3.5[illegible]	2.97	2.54	2.22	1.98	1.78	1.62	1.49	1.37	1.27	1.19	1.11	1.05	.99	.93	.89	.84	.81	.77	.74
57	4.54	3.63	3.0[illegible]	2.5[illegible]	2.26	2.02	1.8[illegible]	1.65	1.51	1.40	1.29	1.21	1.13	1.07	1.01	.95	.91	.86	.82	.78	.75
58	4.62	3.69	3.08	2.64	2.30	2.06	1.85	1.68	1.54	1.42	1.31	1.23	1.15	1.09	1.03	.97	.92	.88	.84	.80	.77
59	4.69	3.75	3.13	2.68	2.34	2.09	1.88	1.71	1.56	1.45	1.34	1.25	1.17	1.10	1.05	.98	.94	.89	.85	.81	.78
60	4.77	3.82	3.18	2.7[illegible]	2.38	2.12	1.91	1.74	1.59	1.47	1.36	1.27	1.19	1.12	1.06	1.00	.95	.91	.87	.82	.79
61	4.86	3.88	3.[illegible]3	2.78	2.42	2.16	1.94	1.77	1.61	1.50	1.38	1.29	1.21	1.14	1.08	1.02	.97	.93	.88	.84	.80
62	4.94	3.94	3.29	2.82	2.46	2.19	1.98	1.79	1.64	1.52	1.41	1.31	1.23	1.16	1.09	1.03	.99	.94	.89	.85	.82
63	5.02	4.00	3.34	2.87	2.50	2.23	2.01	1.82	1.67	1.54	1.43	1.33	1.25	1.18	1.11	1.05	1.00	.96	.91	.87	.83
64	5.10	4.07	3.40	2.92	2.54	2.27	2.04	1.85	1.70	1.57	1.46	1.36	1.27	1.20	1.13	1.07	1.02	.97	.92	.88	.85
Epicycloidal Addenda	.188	.150	.125	.107	.094	.083	.075	.068	.063	.058	.054	.05	.047	.044	.042	.04	.038	[illegible]	.034	.03[illegible]	.031

Use of the Table.

1. In the preceding table, the figures at the top of each column, from 4 to 24, denote the numbers of teeth per inch, and those at the left hand, from 4 to 64, denote the numbers of such teeth in the respective wheels and pinions, and the squares, formed by the vertical and horizontal columns intersecting each other, contain, in inches and decimal parts of an inch, the geometrical diameters of the wheels or pinions so circumstanced, to which diameters, if the quantity of engagement entitled, "addenda" at the bottom of the vertical column be added, the sum will be the practical size of the wheel or pinion standing at the left hand of the said horizontal column; for instance, let us take our centre wheel of 64 of 14 per inch, and we shall find at the intersection of 64 at the side and 14 at the top, 1.46 for the diameter, and under it .054, as the quantity to be added, which together make 1.514, agreeably to our former calculation; also, if we take its pinion 8, the intersection of 8 at the side and 14 at the top is 0.18, and the quantity to be added again .054, the sum of which is 0.234, as before. The application of the table to all other numbers, both of teeth in the whole, and teeth per inch, is equally easy and accurate; and even if the numbers run too high for the vertical columns, like our great wheel 96, the result may be as well obtained by taking the halves, or other component parts, separately, and using their sum afterwards as a whole; for half of 96 is 48 and the intersection of 48 with 12 per inch is 1.27, which doubled gives 2.54 for 96, to which add .063 and the practical diameter is 2.603 as before determined; or otherwise take out for $50 + 46$ and the sum will be $1.32 + 1.22 = 2.54$ for the geometrical diameter again as before. This mode of application renders the table unlimited in its extent.

2. But the determination of the practical diameter of a wheel, suitable for a given number of teeth, of a given strength, is not the only use of this table; any two of the three things contained being given in clock and watch-work, the third may be found by inspection, of which the preceding is but one variety; as another exemplification, if it were required to cut a wheel of some given dimensions into a given number of teeth, the size of the cutter, which is of great importance, may be immediately ascertained; for, supposing that a wheel of 1 inch diameter be required to be cut into 45 teeth, if we follow the column 45 horizontally towards the right hand till we come at .95, which has .05 for its epicycloidal addition, the sum 1.00 or 1 is found in the column 15 per inch, which denotes twice the thickness of the cutter; and though the sum may seldom be found, in other instances, to be so exact without a fraction, yet the nearest number to the given diameter is always readily found, and if the difference between the teeth per inch, in the columns next above and next below, be taken, the proportional part, properly applied, will give a decimal quantity to be added to the thicker cutter, or lower number per inch, provided very great accuracy be requisite in the thickness of the cutter.

3. When the cutter and dimensions of the wheel are given without the number of teeth, which may be the case in some instruments with rack adjustment work, where calculations are out of the question, come down the horizontal column from the teeth per inch suitable for the cutter, till the diameter given is met with; thus in the column of 5 per inch, for a wheel of 2 inches, the addition .15 added to 1.85 makes 2.0 exactly, and this coincidence happens in the horizontal column 29, which number will therefore be that of the wheel, for which the engine for cutting must be set to perform the requisite work. Thus the table is not only extremely serviceable to the clock-maker, but to all instrument-makers where wheel-work is required.

4. Lastly, when the number of teeth per inch is not ascertained in a wheel, and the diameter of a corresponding pinion of a given number is wanted, the measured diameter of the wheel, excluding the rounded ends of the teeth, will be at any time sufficient for finding, by the table, the corresponding pinion, and *vice versâ;* for supposing the wheel to be 48, and its diameter, exclusively of the rounded ends of the teeth, 1.7 or $1\frac{7}{10}$ inches; from 48 on the left hand vertical column proceed horizontally till 1.7 is found, which will be in column 9 per inch; then in that vertical column ascend till the given pinion, 8 for instance, stands opposite on the left hand, and its geometrical diameter is .28, to which, if its epicycloidal addendum be added, *viz.* .083, the sum .363 will be the practical diameter of the pinion wanted: and in this way any wheel or pinion, previously made for a foreign purpose, may readily and accurately be made a portion of a clock-movement; and the calliper made accordingly.

4. *Callipering.*—We come next to laying down the plan or calliper of the clock-movement on pasteboard to be transferred to the plates of the frame when properly hammered, filed, and scraped, or planed; the disposition of the calliper depends not on the acting, but on the geometrical proportions of the wheels and pinions, conjointly with the disposition of the circles of indication on the face; when the wheels are small, such as we have chosen for our example of a half-second's pendulum, the distance from the minute to the second hands will not be too great for an ordinary face, if the arbors are pivoted in a straight line, as in *fig. 3*, of *Plate* X. where the dotted circles, taken from the last column of our TABLE of *Wheels* and *Pinions*, represent the geometrical proportions, or the places of the pitch-lines, and the complete circles taken from the column of "acting diameters in inches," are supposed to coincide with the extreme ends of the teeth; hence the little spaces contained between the dotted and complete circles, at each side, represent the additional measure and half of each wheel and pinion, such as were determined by calculation, to convert the geometrical into the actual size, or such as are given by the large TABLE of *geometrical diameters* and *addenda.* It is evident, therefore, to the eye, that the distance between any two arbors or pivot holes is always equal to the sum of the geometrical radii of the wheel and pinion, which act together; this consideration renders the business of callipering very simple; for, the centre wheel of 64 being described from any convenient point in the given plane, a portion of a larger circle, A B, may be described with an extent equal to $\frac{1.46+0.18}{2} = .82$, or $\frac{82}{100}$ of an inch, which is half the sum of the geometrical radii of the wheel 64, and of its pinion 8, and the pivot hole of the pinion may be in any point of this chord line; we have fixed upon a point in a line parallel to the side of the plate, from which as a centre we describe the second wheel of 60, and also the pinion of 8 on its arbor, to be actuated by the centre wheel of 64; we now take another sweep from this determined point or pivot hole, with the extent $\frac{1.19+.16}{2} = .67$, or $\frac{67}{100}$ of an inch, which is again half the sum of the geometrical radii of the second wheel and its pinion, according to our table; and the pivot hole of the seconds arbor, or pallet wheel, may be in any point of the chord C D; but we have said we proposed to have all the pinions in a straight line; another

another point is consequently fixed upon in a line parallel to the edge of the plate, which could not have been the case, if the wheels had been large, like those usually adopted to sustain the great maintaining power of a seconds pendulum. Again with the extent $\frac{2.55+.21}{2} = 1.37$, or $1\frac{37}{100}$ inches, or sum of the geometrical radii of the great wheel and centre pinion, which it actuates, we describe the portion of a circle E F, in any point of which the pivot hole may be placed for the fusee arbor; we have placed it, in our calliper, in a point at right angles to the line of the centres of the train, which is a matter of option, and the spring barrel may be either above, below, or on one side of the fusee, as fancy, or the room left by the other work, may direct. From what has been here said, it will be easy to conceive that there is almost an endless variety in calliper-drawing, the disposition depending on the variable sizes of the wheels and pinions of a movement, compared with the distance from the seconds to the minute-hand arbors; but the particulars we have here detailed, being thoroughly understood, will suffice as a guide in all possible cases; for, supposing a face to be previously given, and the centres for the minute and second hands already made, the pivot hole for the second wheel may easily be determined by intersection from the two given centres with the respective extents as above determined; provided the diameters of the wheels be calculated large enough for the distance of the given centres; that is, provided the aggregate of the geometrical radii of the two interposed wheels and pinions exceed the said distance.

As we intend to give a particular account, at some length, of the various kinds of pallets, under the article ESCAPEMENT, we shall here satisfy ourselves with a brief delineation of the dead-beat pallets, which we have proposed to adopt in our half seconds little clock, and defer, for the present, our account of its peculiar properties. The number of teeth in the pallet-wheel has been determined to be 60, of which any portion less than half may be chosen to be included between the points of the pallets, as will be seen hereafter; we will assume sixteen as a suitable number for a convenient construction; then, as 16 teeth bear the same proportion to 60, the whole number, that 96° do to 360°; from the point *a*, at the extremity of the wheel, in the line of the centres, we set off *a b* and *a c*, each equal to 48°, and from the points *b and c*, draw tangents which will meet at the point *d*, which point will be the required centre of motion for the axis of the pallets: from this point *d*, with the extent *d b*, we draw the curve lines *b e* and *c f*, for the extremities of the pallets, and also parallel thereto, with a smaller ex-extent; two other curves for the interior limits of the pallets, care being taken that the thickness of the pallets, or space between the two concentric curves, be equal to almost one half of a space contained between the extreme ends of two contiguous teeth; the body of the pallets may then be described at option by two curves from the centre of the pallet wheel, reserving a little semicircular portion in addition, for the centre of motion. Had we fixed upon 12 teeth only to be contained between the points of the pallets, the centre of motion would have been, as appears in the figure, nearer the pallet-wheel, as at the interior edge of the body of the pallets; and if more teeth than 16 had been taken, the point *d* would have been more distant than is represented, and the pallets would have required a stem to have brought them down low enough; so that the shape, as well as size of the pallets, depends on the number of teeth included between their acting points, it being advantageous for the action that two lines, drawn from the centres of motion of the pallets and the pallet-wheel respectively, to the acting points, should always form a right angle. With regard to the sloping faces of the pallets, their direction is determined geometrically from the angles that the pendulum is required to pass through in its vibration before the wheel escapes, which is therefore called the angle of escapement: we will not attempt here to ascertain what angle of escapement is best for a given angle of the whole excursion, but assume it, for our present purpose, at 2° on each side of the perpendicular, as a guide for the slope of our intended pallets. From the centre of motion of the pallets, *d*, with any extent, *dg*, therefore, we describe the small chords, *g h*, and *i k*, from the dotted tangent lines prolonged, and set off from *g* towards *h*, also from *i* towards *k*, 2° each, and draw two dotted lines from the point *d*, to the said chords, so as to contain each an angle of 2°; then if a short line be drawn from the upper interior to the lower exterior intersection of the dotted lines with the curved ends of the right hand pallet, it will give the proper slope as seen in the figure; also, if another short line be drawn from the lower interior to the upper exterior intersection of the left hand pallet, it will give its proper slope, and the plan of the pallets will be finished.

The spring box, as we have said, may be placed either above the great wheel of 96, or below it, which is more usual, as at G, in such a situation that the band or chain may wind round both it and the fusee attached to the arbor of the great wheel, without interfering with any part of the movement. We shall have occasion to speak more minutely respecting the requisite size of the spring-box, when we come to treat of the articles MAINTAINING *Power* and MAIN-*spring*.

The calliper of the going part being thus finished on pasteboard, we may proceed to draw the end and side lines to enclose the wheel-work, taking care to leave space enough for the wheel-work of the striking part, and for the ends of the pillars not to interfere with the movement; the space included within the four bounding lines, which may constitute either a parallelogram or a square, limits the size and shape of each of the plates, which, together with the pillars, usually placed near their corners or edges, constitute the frame of the clock-work.

We might here extend our account of the preparation of the plates for receiving the calliper, but as the processes of hammering, filing, and scraping are manipulations familiar to the mechanician, as well as to the labouring workman, we may be allowed to pass over them without any further notice, than that we strongly recommend planing to be substituted for scraping, agreeably to the practice of mathematical instrument-makers, which operation makes an even surface.

The calliper for the striking part of a clock, which is usually and properly called the clock-part, might now be added to the pasteboard; but as we proposed first to pursue the operations attending the construction of the going-part, which has also been called the watch-part, on account of its watching or counting the time as it passes silently along, we will return to the striking-part hereafter, and preserve our account of the *going-part* distinct.

The calliper drawn on pasteboard may now be transferred to one of the plates, either by pricking through the centres upon the brass plate, or by delineating again the same figure according to the directions we have given, unless a deepening tool be made use of for callipering the exact depth at which each wheel and pinion have had their action previously examined; this method is very little known in England, and still less used, though it conduces greatly to perfect

perfect action; whenever this tool is used, which is exhibited in our collection of CLOCK-*tools*, *Plate* XXI. *fig.* 6., of course the ultimate delineation of the calliper on the plate must necessarily be deferred till the wheels and pinions are divided and rounded, and their action duly adjusted in the tool, before the transfer is made by means of the fine points of the parallel arbors, used as dividers, for the description of the requisite circles.

5. *The Pillars and Pivot-holes.* We have said that the pillars, which connect the two plates of the frame, and keep them in their parallel position in a firm manner, are placed at the corners or sides of the plates, as at B, B, B, B, B, *fig.* 1, of *Plates* XI. and XII; the reasons are obvious; the work will thus be more firm than if the pillars were contiguous, and they will be out of the way of the wheel-work and cocks; their number may be three, four, or five, as circumstances may require. Before the holes are drilled for the ends of the pillars, the plates are usually pinned together at each end, and filed to the same dimensions, so that one piercing with the drill and opening with a broach, perforates both plates alike, and ensures the perpendicularity of the pillars when they come to be inserted into their places. It is also usual to pierce with a small drill the pivot holes for the arbors of the different wheels while the plates are pinned together, that the arbors may pass across the frame at right angles to the surfaces of the plates, which is an essential condition in the planting of the wheel-work, and requires the workman to drill in as perpendicular a direction as possible, otherwise the plane of the wheel would not be parallel to the surfaces of the plates, and consequently the communication of motion and transmission of the maintaining power would have an obliquity in their direction, which would produce injurious friction among the teeth.

The strength of the pillars depends chiefly upon the maintaining power and scale upon which the works are constructed; in pieces with a heavy weight they must necessarily be pretty thick, but in spring pieces much metal only gives a heavy appearance, without adding to the utility; the length of the pillars, however, is not so optional; for it depends entirely upon the number of turns of the fusee in spring pieces, and of the barrel in clocks with a suspended weight; in our little eight-days' piece, two inches will be a suitable distance between the interior surfaces of the plates to allow for sixteen turns of the fusee, with the addition of the guard-gut, or stop, at one end of the arbor, and the great wheel and double ratchet, with the auxiliary spring (hereafter described) to produce constant motion, together with space for the rim of the centre wheel at the other. The pillars are generally riveted into the back plate, and pass through the front one to shoulders against which the plate rests, in which situation they are fixed by pins passing through their projecting ends; which mode of fixing the plates admits, indeed, of their being readily dismounted, but is by no means so neat as the method of mounting frames for wheel-work used by the mathematical instrument-makers, which ought to be adopted by clock-makers. The method alluded to is, to screw the pillars into the back plate, even with its exterior surface, and to fix the front plate by screws instead of pins, which screws go into the ends of the pillars, and cover the perforations of the plate by means of intervening collars, as represented in the front of our frame, *Plate* XII. *fig.* 1. The preference of this mode consists in its allowing the plates to preserve their surfaces uninjured and perfectly parallel after being dressed, which the act of riveting would distort; besides, when the clock is at any time cleaned, the plates thus mounted are made handsome again, as they were at first, with little trouble, and the general appearance is thus more workmanlike than in the ordinary way. The shape of the pillars seems to be mere matter of fancy, when they are left strong enough to effect their purpose; but custom has sanctioned the bead, or spheroidical enlargement, at the middle.

Main-spring, Barrel, Arbor, and Ratchet.

The frame being put together and ready to receive the works, a suitable spring must be obtained for a small clock from the spring-maker, whose art is distinct, and will form a separate account in its place; the breadth of the spring we will suppose to be an inch, which will require a box or barrel, C, *Plate* XI. sufficiently deep to hold it, and to be of a diameter sufficient to admit of as many effective coils or spirals as will turn the fusee sixteen times round, before its force is expended in unbending itself. Sometimes it may be necessary to try two or three springs before a good one is met with, that will act with a due degree of regularity; and it has been asserted that a spring will act more regularly and be less liable to have undue friction among the coils, if the breadth be gradually diminished from the exterior to the interior end; but we pledge not ourselves for the existence of the fact, though we conceive that the friction of the sides of the spring against the ends of the barrel, will thereby be greatly diminished. The spring arbor must be strong in proportion to the force of the spring, particularly at the pivots, the front one of which must be thick enough to admit of being squared to hold a ratchet, or small serrated wheel, C, at the outside of the frame, (see *Plate* XII.) the teeth of which ratchet must be strong enough to hold the arbor in any situation to which it is turned, which it does by means of a click attached by a screw to the exterior surface of the front plate of the frame; the spring-arbor has a strong pin inserted into it at the middle, within the barrel, on which pin a hole made near the interior end of the spring hooks, while the exterior end is riveted to the circular side of the box; hence it is not difficult to conceive that when the spring fills the box in its relaxed state, and has its coils most close at the rim of the barrel, it may be coiled up close to the arbor in the centre, or, in other words, it may be wound up, by two different methods; either the barrel may be held fast, and the arbor be turned backward by its ratchet, or by a key fitting its square; or otherwise, which is the general and better practice, the ratchet may be suffered to detain the arbor in its place, and with it the interior end of the spring, and the barrel itself, to which the exterior end is riveted, may be turned forwards by a chain or cat-gut attached to it by a knot at one end and wound round it, as seen at C, in *Plate* XI. We have said the latter method is the better, and the reason is, that, when the greatest and smallest forces of the spring are adjusted to the shape of the fusee, or rather the fusee to them, the ratchet cannot be altered without deranging this adjustment. The arbor is turned in a turning-frame with pivots and shoulders sufficiently remote from each other to reach the interior faces of the plates, but to have just so much play endways as will prevent friction; and the chain or gut must be long enough to fill the spiral grooves of the fusee, and have at least one half-turn on the barrel to spare; also care must be taken that the depth or side of the barrel must be nearly equal to the effective length of the fusee, otherwise the gut will be liable to slip off at the ends of it. The remote end-piece of the barrel is soldered fast, and has a large pivot-hole, against which an inner shoulder of the arbor rests, and the nearer end-piece is turned in the frame so large as to be capable of being forced or sprung into a receptacle turned for it, round the inner part of the edge of the circular

cular rim of the barrel, in which situation it rests against a corresponding inner shoulder of the arbor, and completes the barrel; when this adjustable end is to be taken off for the purpose of examining or taking out the spring, a slight stroke at the remote pivot of the arbor will force it out of its place; some skill is necessary for putting the spring into the barrel, when a tool on purpose is not at hand, which will be described among the WATCH-*tools*, and which seems necessary to be more generally used in clock-work to prevent accidents consequent upon a manual insertion of the spring.

6. *Fusee, Ratchet, and Guard-gut or Stop.*—The spring-barrel and its appendages being finished, a rough estimate of the power of the spring may now be made by first coiling the gut, in a proper direction round it a few times till it is nearly all wound up, the arbor being held by its ratchet, or in a vice, and then by suspending a weight to the spare end, such as will just pull the barrel two or three times round from its relaxed state; this weight will denote the smallest power, which suppose to be one pound; then add such a heavier weight as will uncoil so much more of the gut as may be supposed to fill the fusee, and note it, which we will again suppose to be two pounds and a half for the greatest power of the spring; now this proportion of $1 : 2\frac{1}{2}$ or $2 : 5$, may be taken as a guide for the respective diameters of the conical piece of metal, E, *fig.* 1, *Plate* XI, called the fusee, which is introduced to equalize the varying power of the spring, by acting, as it were, with a succession of levers of different lengths, reciprocally proportionate to the power of the spring in any given situation, so that when the power is great it is pulling by a short lever, and *vice versâ*. The piece of solid metal intended for the fusee must be drilled through the centre, and opened with a broach, and then have a steel arbor of considerable strength driven tight into it, by which it is turned into a conical or rather paraboloidal shape, that has its thicker end somewhat smaller generally than the diameter of the barrel, and the other end smaller in the proportion, according to our supposition of $2 : 5$, but sometimes in a greater ratio, without the thickness of the gut; the length of the fusee must be shorter than the pillars by as much as will admit the great wheel and two ratchets, with the centre-wheel behind them, to be introduced between it and the plate at one end, and a contrivance for stopping the revolutions when the spirals are filled with the gut, called therefore the guard-gut, at the other end of the arbor, as we have already said. The fusee may now be grooved into sixteen complete spirals by a fusee-engine, the method of doing which will be explained under this term hereafter; after this operation, a pair of strong pivots may be turned on the fusee arbor, the pivot-holes opened by a pivot-broach held perpendicularly with respect to the faces of the plates, and the fusee introduced into the frame, parallel to the spring-barrel arbor; a hole is now drilled at the large end of the spiral, perpendicularly into the metal, the fusee being taken from the frame, and another hole to meet it from the plane of the thick end, about a quarter of an inch from the circumference, which two holes are just large enough to receive the gut; the latter is then enlarged by a chamfering tool to form a bed for a knot to be made at the end of the gut, when inserted into the hole made in the spiral groove. If now a square be made, either on the front or back pivot, which must project through the plate, accordingly as it is intended to be wound up in the face or behind, and if a key be inserted upon it, the spring may be wound up, and it will appear whether or not the gut is too long, and how much, nearly, which may accordingly be altered. Hitherto the work has proceeded, on a supposition that the fusee has been turned of a paraboloidal shape, and that the spring is perfect at the two extremes, as well as at all the intermediate degrees of tension; but it yet remains to be proved, by mechanical adjustment, that these coincidences have been effected, or are even capable of being accurately effected, without material subsequent alterations in the length of the spring and shape of the fusee; for this purpose a long graduated lever, with an adjustable weight, hereafter mentioned under CLOCK-*tools* by the title of an *adjusting-tool*, (*fig.* 10, *Plate* XXI.) is inserted on the square end of the fusee, at N, when the frame is mounted, as in *Plate* XII. and the weight is gradually removed along the bar, until by trial it is found to be an exact counterpoise to the spring previously wound up a few turns by means of the ratchet on the barrel-arbor; such balance being effected, the spring may be wound up by the adjusting tool, used as a key, till the sixteenth spiral at the top, or small end of the fusee, be filled with gut, in which situation, if the weight of the tool still constitute an exact counterpoise to the power of the spring, it is to be presumed that the spring is properly fixed, with respect to its quantum of intensity, by its ratchet; but if, in the latter situation of the tool, it turns out to be more than a counterpoise, either the spring is of too low an intensity in the present situation of its ratchet, or the fusee is too small at the small end, or both may be so circumstanced; on the contrary, if the tool is not a counterpoise for the spring when wound up, either the spring is set too high by the ratchet, or the small end of the fusee is too thick; a few successive trials of similar adjustment for the opposite ends of the fusee, by an increase or decrease of intensity being gradually given to the spring by means of turning its ratchet, will generally determine whether the failure in the adjustment is occasioned by the spring or fusee, and the former may be shortened, or the latter altered, by a detached tool to run in the groove as it revolves in the turning frame, if a fusee-engine is not at hand; though, it must be confessed that some experience in this business will greatly facilitate the determination of the proper means of final adjustment. We will now suppose the spring fixed, and the fusee adjusted by the tool, so as to render the maintaining power precisely the same at the bottom and top of the spiral groove; the adjustments must next be made for all the intermediate turns of the helix successively, by means of the same adjusting tool with the weight unaltered, the spring arbor also resuming at every trial its original position, which we will suppose to have been marked on the holding tooth of the ratchet. When the spring is good, and the fusee approaching to a conical shape, it will be found on trial, that the maintaining power is too great for the tool of adjustment to balance before it is wound up half way; in consequence of which increase in the maintaining power, the fusee must necessarily be again put into the fusee engine and have its groove deepened so as to make a parabolic curve instead of a straight line from the top to the bottom of the fusee; after this alteration the frame must be remounted, the spring coiled up again to its determined position, and the weight of the adjusting tool kept unaltered in its situation; the intermediate grooves in the helix may not yet be found all sufficiently deep to render the maintaining power equal in its effects throughout the whole length of the fusee, but the adjusting tool will detect the particular places where the power predominates; which places when marked may be again altered in the fusee engine, and the parts replaced in the frame, when, after three, four, or perhaps more alterations of the fusee, and adjustments of the spring, at length the effect produced by the power of the spring is the same

whatever part of the fusee be actuated by the gut; the accuracy of this adjustment is of the utmost importance, and should be minutely attended to, otherwise the piece may be made to vary its rate of going on each successive day of the week, by reason of the irregularity of the maintaining power, unless indeed such a consequence be obviated by the nature of the escapement, or other contrivance, which ought not to be depended upon while there is a fundamental remedy. Hence it is evident that, whenever the original main-spring of a clock (or watch) happens to be broken, or by any means altered, another spring, though of the same dimensions ought not to be substituted, as is often injudiciously done, without a corresponding alteration in the fusee, if found necessary, by a trial of the adjusting tool. Were an optician to put a thermometer tube containing mercury, already hermetically sealed, into an old scale previously graduated, the indication of temperature with such an instrument could not be depended upon to any thing like accuracy. Of the same nature is the probability of an imperfect measure and indication of time arising out of an exchange of the main-spring without a corresponding adjustment in the shape of the fusee, more particularly if the crown wheel escapement happen to be adopted, which is almost constantly under the influence of the maintaining power.

During this labour of adjusting the fusee to the spring, it will occur that the gut might be wound up beyond the end of the fusee, if it were turned more that sixteen times round, on which account a snail piece of soft steel, equal in diameter to the small end of the fusee, independently of the claw or projecting piece, is usually screwed against this end of the fusee at N, *Plate* XI., to prevent the gut from slipping off when it comes to the projection of the claw in question, which contrivance it has been said is called the guard-gut; but it may be remarked, that the gut might wind back again by a second course, like the cord of a kitchen jack on its barrel, when it comes to the snail-piece of the guard-gut; to prevent such effect, there are supperadded a spring, M, screwed at one end to the inner face of the front plate, which plate is taken off in the drawing, and a lever, L, moveable on a pin as a centre, which pin passes through a stud in the front plate, according to the position given in *Plate* XI.; the remote end of the spring, M, stretches itself towards the back plate of the frame, and carries the lever before it; of which the consequence is, that as the gut approaches the guard in winding, it at length meets with the lever, L, and pressing against it drives it forwards till at length a shoulder near its remote end, seen near the pillar, is presented to the claw, N, of the snail-piece, for which it becomes a stop at the instant that the sixteenth spiral is filled by the gut, and the winding is then necessarily finished.

The contrivance for allowing the fusee to turn in the act of winding up, while the great wheel retains its position unaltered, but which prevents the return of the fusee to take place by the pulling of the spring without the great wheel being actuated, is called the *fusee* ratchet; it usually consists of a serrated wheel with sloping teeth, and a click to catch the teeth, like the mechanism already mentioned as being at the projecting arbor of the spring barrel, but with the addition of a spring to press upon the click to keep it in the teeth; the ratchet wheel may be attached either to the end of the fusee, and the spring and click to the plane of the great wheel, or otherwise the spring and click may be at the end of the fusee, and the ratchet wheel on the plane of the great wheel, but the direction of the slope of the teeth will not be the same in both cases, for in one case the wheel drives the click during the time of going, and in the other the click must drive the wheel; it is usual to turn a circular groove between the edge of the ratchet wheel and the circumference of the fusee large enough to form a bed for the click and its spring, which therefore are hid from sight, when the spring is carried by the great wheel; but when it is carried by the end of the fusee, the said groove must be in the plane of the great wheel to answer the same purpose of concealment; the number of teeth in the ratchet wheel is optional, provided they be strong enough to sustain the maintaining power, and numerous enough to prevent a considerable return of the fusee backward after winding, before the click catches a tooth; the construction will be sufficiently understood without further description, from a reference to *fig.* 5, of *Plate* VIII., to *fig.* 7, of *Plate* XV., and to *fig.* 4, of *Plate* XXII. of *Horology*.

7. *Auxiliary-spring.* But we proposed that our piece should continue to go while it is wound up, which effect requires an additional apparatus to the ratchet we have just described, as being usual in an ordinary spring-clock; the addition usually consists of another ratchet-wheel with teeth inclined in a contrary direction, and of a larger diameter, of a circular or sometimes a horse-shoe spring, and of a lever operating as a detent with one end fastened to the inner face of the back plate, and the other resting upon and sliding over the sloping face of the teeth of the large ratchet when the clock is in motion, but which prevents the ratchet's return when the clock is wound up. One end of the spring is pinned or screwed to the rim of the great wheel, and the other end to the plane of the large ratchet, and in this case the small ratchet before described actuates this large one, instead of the great wheel, exactly as above described; and then the large ratchet contracts the spring connecting it with the great wheel, till its resistance in a contrary direction is equal to the maintaining power, in which situation the great wheel is then impelled in the same manner as if it were immediately connected with the small ratchet; the effect of this beautiful contrivance is, that when the clock is under winding, the spring attached to the great wheel being no longer contracted by the maintaining power, immediately endeavours to extend itself, but the large ratchet-wheel, to which it is riveted, is stopped from going back by the end of the lever or detent, which is always in a position to catch the end of some one of the sloping teeth of this ratchet, the consequence of which is, that as the ratchet will not go back, the great wheel is impelled to go forward at the opposite end of the spring by a force, at the commencement of its action, equal to the maintaining power; and this force will continue for a much longer time than is necessary for the winding-up of any clock. This apparatus may be more clearly apprehended by a careful inspection of *fig.* 4, of *Plate* XXII., and of *figs.* 7 and 8, of Brockbank's chronometer in *Plate* XV., which differ in no other respect, but in their size, from the same parts as used in a clock.

8. *Arbors, Pinions, and Wheels.* Hitherto we have said nothing of the manipulation of the arbors, pinions, and wheels of a clock, but have merely spoken of their diameters, numbers of teeth, and respective situations of their pivot-holes. It will not be necessary to enter into a detail of the manner of forging the arbors, or of casting the brass by models of given dimensions, the ironmongers and tool-sellers having on sale sets of wheels, and arbors with pinions of different numbers ready slit, and also pinion steel-wire drawn into a proper shape for the teeth of small pinions, of all which clock-makers usually avail themselves instead of preparing them; otherwise the brass-founders in Chancery-lane, and in other parts of London, as well as in Lanca-

 shire,

ſhire, will caſt wheels to any model at a certain price per pound, which is a great convenience to the workman who has occaſion for unuſual ſizes in his wheel-work.

It will not, however, be deemed foreign to our purpoſe to mention, that it is often found requiſite to ſoften the pinions of ſteel, and their arbors, before the graver for turning can cut them with ſufficient eaſe in the turning frame; this ſoftening is uſually effected by putting the ſteel pieces into a wooden fire for ſome hours, and leaving them to cool gradually as the fire goes out. The wheels are generally croſſed in their original caſt ſtate to make them light, in order to avoid the effect of their inertia, and to prevent friction on the pivots of the arbors; but it is neceſſary to hammer the rims and other parts of a wheel well before they are filed flat, to be put on the arbor for turning, otherwiſe the metal would be too ſoft to wear well, and the teeth of a wheel would not ſtand the graver in the operation of being turned, after it is cut by the engine, in caſe the diameter ſhould require to be reduced, as is commonly done, to work well in its calliper with its pinion. When the wheels are hammered, and filed flat to nearly their exact thickneſs, according to the force they are deſtined to tranſmit, they are turned in the turning-frame to their practical diameters, after being previouſly perforated in the centre, and ſcrewed faſt on a ſuitable arbor, ſuch as is repreſented by *fig* 2, of *Plate* XIX.; they are then in a ſtate to be cut by an engine made on purpoſe, which is not always in the poſſeſſion of the clock-maker, particularly in large towns, but which is uſually kept by ſome individual, whoſe buſineſs is chiefly to cut wheels for the clock-makers at a certain price per ſet. An ingenious workman, of the name of Brown, who lived in King-ſtreet, Seven-dials, but who is now dead, was noted in London for his dexterity and accuracy in cutting clock-wheels, and occaſionally pinions, into any number of teeth; his engine, however, is now in the hands of Mr. Fidler, mathematical inſtrument-maker, Oxford-market, London, who has lately begun to uſe it; but the beſt engine for this purpoſe at preſent in conſtant uſe, belongs to Mr. Edward Troughton, of Fleet-ſtreet, and is uſed by James Fayer, at No. 35, White-lion-ſtreet, Pentonville, London.

This engine, which was contrived and made by the late ingenious mechaniſt Rehe, will round the teeth at the ſame time that it cuts them, if required, and is valued at 300*l.* in its preſent ſtate. As we ſhall have occaſion to treat further of the conſtruction and operations of the CUTTING-*engine*, we ſhall here conſider that our wheels have now undergone their operation, and are returned into the hands of the clock-maker for finiſhing; we cannot, however, forbear remarking here, that the clock-makers of the preſent day have greatly the advantage of thoſe who laboured in the art in the infancy of clock-making, in that they have ſome of the moſt difficult operations in theory, ſuch as dividing and cutting the wheels, and forming the ſpiral groove of the fuſee, done by engines not only in leſs than one-hundredth part of the time, but with infinitely more accuracy, than they could be performed by hand with manual tools; and it is much to be deſired that they would, like watch-makers, have their wheels cut and rounded in the engine at the ſame time; that they would make uſe of the deepening tool, *fig.* 6, *Plate* XXI. for pitching their depth of action; and that they would in that ſtate transfer the diſtances of the pivots to the calliper, as we before recommended; for then the equable tranſmiſſion of motion and maintaining power would be enſured, provided the teeth be of a due ſize and form; the expence in cutting would, indeed, be ſomewhat more, but the labour of rounding by a file would be ſuperſeded, and conſequently the work would be more expeditiouſly, as well as more accurately, performed.

But it has been remarked, by a philoſopher well qualified to make the remark (Mr. W. Nicholſon), that the introduction of new inſtruments, and of new operations, requires the ſame ſpace of time that is neceſſary for inſtructing another generation; ſo much does that facility, which ariſes out of habit, militate againſt the adoption of new practices: we muſt, therefore, ſuppoſe our wheels returned from the engine with their teeth not rounded, and proceed with our detail. When a wheel has been cut, in the ordinary way, by the engine, there are uſually ſome filaments of metal, denominated burs, left at the edges of the teeth by the cutter, as well as general roughneſs on the ſides and at the bottom of the ſpaces; theſe are firſt cleared away by a fine file, juſt thin enough to go into the ſpace left by the cutter, which is called an equalling file, (ſuch as is repreſented in *Plate* XXI, *fig.* 14.) from its ſuppoſed property of leaving all the ſpaces equal, when the burs are removed. The croſſes of the wheel and interior edges of the rim are next dreſſed, firſt by a rough file, then by a ſmooth one, and laſtly by a burniſher of poliſhed ſteel, all ſhaped like *fig.* 17, of *Plate* XXI.; the arbor is next turned in a frame, by a well-tempered tool, or ſtrong graver, like that ſeen in *fig.* 9, of *Plate* XXI., to its propoſed thickneſs, and the pinion reduced to its practical diameter; after which its teeth are rounded, hardened, and poliſhed, each of which operations we will ſuppoſe to be underſtood, and the wheel is riveted on a ſhoulder left on the proper end of the pinion, exterior or interior, as the work may require, if it is on the hour arbor; otherwiſe it may be riveted, or ſtill better fixed by two oppoſite ſcrews, on a braſs collet, which is previouſly ſoldered upon ſuch part of the arbor, to which it belongs, as the place of the pinion which it actuates may require. The French call that portion of an arbor, which is between the wheel and the remote pivot, a *tige*; and that portion a *tigeron*, which lies between the wheel and the nearer pivot. Some of the moſt ſkilful workmen contend that the wheel ought always to be placed on its arbor, ſo as to be equally diſtant from both pivots, and we have ſeen clocks conſtructed with cocks, at the back of the plates, to hold the pivots of projecting arbors, in order to effect this purpoſe, but we will not undertake to affirm that this additional work is compenſated by any advantage thus gained; we rather conceive that the grievance complained of in the ordinary method of pivoting in the plates, *viz.* the alleged unequal preſſure and conſequent unequal friction in the oppoſite pivot-holes, when a pinion is at one end of the arbor, is to be attributed to another cauſe principally; *i. e.* the too great aperture of the pivot-holes: the workmen have a maxim, that "the pivots muſt have play to avoid friction," but they ſeem not always to underſtand what this play means; it certainly ought not to mean, that the holes ſhould be much larger than the pivots which are to turn in them, for in that caſe the pivots would be driven round the interior circumference of the holes, and cauſe the wheel to act at different depths in the pinion, which would be a great evil; the meaning of the maxim is, that the ſhoulders of the arbors ſhould not preſs againſt the plates when mounted, but that each arbor ſhould have a little play in the direction of its length, or, in other words, be left ſo as to be at liberty to move a little backwards and forwards; which condition ſeems requiſite.

We will now ſuppoſe all the wheels and pinions rounded neatly in the bay-leaf form, and their action tried in the deepening tool, with the correſponding pivot-holes drilled with

with drills refpectively proportioned to the propofed thicknefs of the pivots; the next ftep will be to attach them to their arbors: the great wheel, however, notwithftanding what we have faid about riveting, fcrewing, and foldering, is not fixed by any of thefe operations, but is attached to its arbor by a method which admits of its being taken off at pleafure, thus;—a hole is opened by a broach in the centre of this wheel, large enough to take the arbor of the fufee without play, and, when it is preffed clofe againft the end of the fufee, or, in our prefent inftance, againft the plane of the fecond large ratchet, two marks are made, with a fine file, at oppofite fides of the arbor, clofe to the plane of the wheel; it is then taken off the arbor, and two fquare-fided notches are filed carefully in the faid marks of the arbor, but not deep enough to injure its ftrength; a collet with a circular hole, like that at the centre of the wheel, made at one fide of its centre, and with a ftraight-edged flit acrofs the centre from the faid hole, is then put on the arbor, after the wheel has been firft put on, and is pufhed forcibly along the notches of the arbor till, by means of the oblong aperture, it is concentric with the wheel, againft the plane of which it preffes, when in the notches, and keeps it clofe in its place, and at the fame time allows it to turn on its centre without the arbor. The auxiliary fpring is fcrewed or pinned, in the next place, at one end to the great ratchet, and at the other to the great wheel, as before noticed. When the wheel is thus firmly attached to the fufee arbor, with a power to recede but not to proceed, on account of the click, without carrying the arbor with it, it muft be put into the turning frame and examined, as to its being truly centered, and alfo as to its being in a plane perpendicular to the arbor; which trial may detect fome flight alterations, neceffary to be made, to fulfil thefe two conditions: after which, its pivots may be turned to their exact fize, hardened, and polifhed.

The practice of fome workmen is, to folder their collets on the arbors with hard folder, but we difapprove this practice, and recommend foft folder, particularly if the arbors have been before hardened; it is fcarcely neceffary to add, that if the ends of the collets are opened a little within, the folder will there have beds to contain a quantity fufficient to keep the wheel firm on its arbor. What we have here faid will not be equally applicable to the hour or centre wheel, becaufe it is ufually riveted on the end of its pinion, which will require a riveting punch and clamp, on purpofe (*fig.* 16, of *Plate* XIX.) to prevent any injury being done to the pinion. Before the wheels are all firmly attached to their arbors, they muft be tried in the turning frame, or callipers with a ftraight edge for that purpofe, to fee if they are concentric, and that their planes are perpendicular to their arbors, which conditions the workmen call being "in the round," and being "in the flat;" and when properly adjufted, in thefe refpects, they may be finally fixed as above defcribed, and their arbor-pivots finifhed. Should a wheel, that has had its teeth rounded in the engine, be at any time found a little eccentric in the trial, before it is fixed on its collet, which will not happen if the central hole be enlarged with a good broach and with due care, the remedy in this cafe would be, to mark the fide of the wheel which has the longeft radius, and enlarge the central hole carefully on that fide moft, and then to make a new collet for it, after the hole is again made perfectly round, and found to be concentric on an arbor that fits it; but when the teeth have been rounded by hand, the wheel may have the eccentricity rectified on its own arbor, and be again rounded where the teeth have been touched by the graver, which is the common practice, and which conftitutes the greateft recommendation of manual rounding of the teeth.

The files ufed in rounding the ends of the teeth of a wheel are fmooth, and curved on one fide (fee *fig.* 16, of *Plate* XXI.), and have each a projecting pivot at the remote end, which a dexterous workman holds againft one finger of the left hand as a reft behind the wheel, while the right hand guides the file from one fide of the tooth to the other, alternately, with a degree of rapidity which furprifes the fpectator.

We have hitherto fuppofed our piece not to be jewelled, nor bufhed with bell-metal, which addition enhances the price, but greatly diminifhes the friction in the pivot holes: if the holes are carefully enlarged with a good broach, fmall pieces of metal holding ruby, agate, or bell-metal, may be made to fit them exactly, the holes in which may be refpectively equal to the original pivot holes, and then the good action of the wheel-work will not be altered thereby. The friction in the pivot holes is greatly diminifhed too by the application of fine nut-oil; they are, therefore, generally chamfered, or counter-funk, at the exterior furfaces of the plates, in order that the oil may be retained; but what fhould be the exact depth of the bearing part of the pivot-hole, is a matter not abfolutely decided. Mr. Reid, we have feen, prefers, to a counter-funk hole, a conical point, which holds the oil in a globule by cohefion, and which is held by a fmall cock.

In fome clocks which we have feen well-finifhed, the ends of the pivots are conical, and bear againft holes of nearly the fame fhape, not entirely perforated; but we conceive that, unlefs the pillars and arbors were all of the fame metal, the difference of their expanfibilities muft materially alter the quantity of play, lengthwife, at different feafons of the year, and in cold weather create confiderable friction, by affecting the brafs pillars more than the fteel arbors; an effect which the workman probably does not take into his account, who thinks of avoiding friction by fuch a conftruction.

As the pallet-wheel makes many more revolutions than any other in the movement, it is neceffary that the metal, of which it is made, fhould not be very deftructible, particularly when pallets are ufed which rub againft its teeth; we therefore recommend a tempered fteel wheel to be ufed, which ought to be alfo divided and cut with extraordinary care, becaufe any irregularity in the fhape of the tooth, or diftance between the teeth, would injure the efcapement, and produce befides fuch irregularity in the motion of the feconds hand, placed on this wheel's arbor, as would offend the eye. We referve our obfervations on the fhape of the teeth proper for different efcapements to act with, until we treat this part of our fubject more particularly in its proper place.

9. *Pallets.* There is no part of a clock which requires greater nicety in the execution than the efcapement, or part which limits the intenfity and duration of the impulfe given to the pendulum by the maintaining power, and which keeps up the due quantity of motion, that would otherwife be gradually diminifhed to a ftate of quiefcence, by reafon, as we have faid, of the unavoidable friction at the point of fufpenfion, and of the refiftance which the air affords to the folid parts of the moving pendulum: but for the fame reafon that we have poftponed our particular directions concerning the conftruction of the pallet or fwing-wheel, till we come to the article Escapement, muft we alfo fatisfy ourfelves here with a few general directions and obfervations, which apply exclufively to our dead-beat pallets. We have already detailed, under our fubdivifion, entitled *callipering*, the method of laying down the plan of the pallets in queftion; the fhape and dimenfions there afcertained muft be exactly copied, or otherwife projected again, either on one of the plates

plates or on a ſmooth ſheet of braſs, as a plate of trial for the eſcape, which will admit of pivot-holes being drilled, exactly as in the plates of the frame, for the centres of the pallet and pallet-wheel arbors; a piece of good ſteel muſt then be forged nearly into the ſhape of the anchor, compared with the plan on the frame or braſs plate, but ſomewhat larger: after the arbor hole is drilled in the anchor, and enlarged to the propoſed aperture, the requiſite circles may be deſcribed, with extents borrowed from the braſs calliper, by means of a pair of ſmall bullet compaſſes, and the ſlopes may be copied or re-traced for the faces of the pallets; the excluded metal may then be filed away very nearly, and all the ſurfaces be ſmoothed, firſt with fine files, and then with oil-ſtone duſt and oil. It has been ſaid that the breadth of each pallet muſt be ſomewhat leſs than half of a ſpace meaſured from tooth end to tooth end of the pallet wheel, but the quantity of diminution muſt not depend on conjecture; therefore the breadth is left at firſt equal to one half as nearly as can be aſcertained, ſo that the diminution of breadth may be effected by tentative adjuſtment, firſt partially when the wheel has its teeth finiſhed, and when both it and the anchor of the pallets are inſerted on pins urged into the pivot-holes of the frame, or trial plate; and again more minutely when they are fixed on arbors, and mounted in the frame. To enſure the perfect portion of a circle at the extremities of the anchor, we recommend that it be put on a motion arbor, that juſt fits the central hole, and that it be turned in a frame or lathe, like a wheel, before it is cut; for then it is certain there will be no recoil in the pallet-wheel, and ſeconds hand, when thoſe parts preſs againſt the ends of the teeth, during an excurſion of the pendulum; and if the inner circles could be turned alſo after the eſcape is nearly adjuſted, it would be deſireable; however, the point of a graver may trace in the turning frame this inner circle, and then a proper curvi-linear file, made and kept on purpoſe, may take off the interior ſuperfluity of metal. In adjuſting the ſlopes and breadth of the pallets, it will be ſerviceable to inſert an index on the pallet's arbor, after it is finiſhed and the pivots turned, and to mark on the frame plate the quantity of the eſcapement angle, in this inſtance 2° at each ſide of the perpendicular demitted from the pivot-hole, which will be a good guide for the true final adjuſtment of the eſcape. Particular care muſt now be taken that there be as little drop as poſſible, *i. e.* that as ſoon as one tooth has completely eſcaped the face of its pallet, the next acting tooth ſhall be cloſe to the back of the following pallet, ſo as not to ſtrike it with a jerk; the place where the firſt contact takes place between the end of the tooth and interior or exterior circle of the pallet, accordingly as it is the leading or following pallet, muſt be very near the commencement of the ſlope, but not upon it, nor yet on the angular point of interſection. Indeed it is extremely difficult to give complete verbal directions for this delicate adjuſtment, which requires long and attentive practice to do perfectly; for frequently, after the pallets are hardened, which they muſt be as much as poſſible, the ſhape of the anchor is found to be altered, and the adjuſtment of the pallets conſequently deranged: to remedy this conſequence, it is uſual to harden only the pallet parts of the anchor, ſo that by certain ſtrokes given near its arbor, the pallets may be brought in or ſet out a little to rectify them; but after ſuch rectification it will always be neceſſary to try, in the turning frame, or at leaſt by a pair of bullet compaſſes, if the circular parts are again perfectly concentric, without which condition the pallets will not be truly what are called dead-beat.

Hitherto we have conſidered the back pivot hole of the pallets arbor, as being in the plate of the frame, but it becomes neceſſary to cut away that portion of the back plate where the pivot hole falls, by reaſon of the crutch, or little rod of ſteel which muſt be ſcrewed to a collet attached behind the frame to the arbor, to form an L; which contrivance impreſſes the force that the pallets receive from the maintaining power upon the pendulum; the bent end of the crutch is uſually inſerted into a ſlit made in the verge or rod of the pendulum, but when the bent part is divided and encloſes the pendulum rod, it is denominated the fork: the crutch is moſt uſually about one ſixth part of the whole length of the pendulum rod, but there ſeems to be no fixed rule laid down by which its beſt length might and ought to be determined in different caſes, which therefore we think deſerves further conſideration.

But to return to the pivot-hole of the pallet's arbor; this, for the reaſon we have juſt given, is finally placed in a cock at the back of the poſterior plate, which is generally ſo ſhaped as to furniſh alſo a point of ſuſpenſion for the pendulum. (See *a*, in *fig.* 3, of *Plate* XI.) The exact placing of the cock, ſo that the arbor pivoted into it ſhall be perfectly at right angles to the ſurface of the plates, is of the greateſt importance, and therefore it ought to be placed and its ſteady pins fixed, before the original pivot-hole, through which it muſt protrude, is cut away in the plate; for in that caſe the protruding end of the arbor, while in its proper poſition after the adjuſtment of the eſcapement, will be like a fixed arbor on which to ſlide the cock, and fix its poſition before the ſteady pins are applied and the ſcrews fitted to their places.

It is, however, the practice of ſome workmen to adjuſt the eſcapement, by moving the cock before the ſteady pins are inſerted.

We might have noticed, that after the anchor of the pallets is ſcrewed to the collet of its arbor, it ſhould be ſuſpended by the pivots of the verge, which is the name given to this arbor, to try if the weight of each pallet exactly balance that of the other, which may be effected by dimiſhing the thickneſs of the heavier pallet a little by a fine file before it is finally poliſhed; alſo before the crutch is ſcrewed it ſhould be hung on the verge of the pallets arbor, after the pallets are balanced and ſuffered to find their place of quieſcence, in order to find its own perpendicular direction, and then it ſhould be fixed in that ſituation; for without this care it will require to be bent ſo as to offend the eye, for the purpoſe of putting the clock into beat, or otherwiſe will require a ſlit in it acroſs the centre, to admit of an eccentric adjuſtment, or ſome ſuch contrivance. When all the adjuſtments of the eſcapement are thus made, the pallet faces, if not jewelled, and alſo the pivots, muſt be hardened and finally dreſſed by the uſual ſucceſſive operations of poliſhing.

10. *Pendulum and Suſpenſion.* The precautions we have hitherto dictated, in our directions for the ſucceſſive operations in clock-making, have for their principal object the regular tranſmiſſion of a certain quantity of the maintaining power to the pendulum, in order to preſerve the arc of vibration unaltered, which is one of the two eſſential qualities of the going pendulum, on which the exact meaſurement of time depends; the other, which is an indiſpenſable quality of the pendulum, where great exactneſs is required, is that by which its length is preſerved unaltered in all the variations of temperature, as the centre of oſcillation regards the centre of ſuſpenſion. Theſe two properties of the pendulum, its conſtant arc, and conſtant length, conſtitute the excellence to which all the other parts of the mechaniſm are ſubſervient, and without which no clock will continue invariably

variably to indicate true time at all ſeaſons of the year, however exquiſite the workmanſhip of the movement and other parts. In an ordinary clock, the iron or ſteel rod of the pendulum is liable to conſiderable alternate expanſions and contractions, which render a compenſating contrivance neceſſary for pieces deſtined for aſtronomical purpoſes; or, otherwiſe, a deal or ebony rod is ſubſtituted for the metallic one, which natural ſubſtances, when of a ſtraight grain and gradually dried by age, are found to be much leſs liable to alteration in their length by changes of temperature, than iron or any other metal; their dimenſions, however, are a little altered by moiſture, which alteration renders them in our opinion objectionable.

In our half-ſeconds pendulum we propoſed to make uſe of a compenſation, in which the unequal and oppoſing expanſibilities of two different metals produce the deſired effect. It would, however, extend our preſent article to an improper length, if we entered here into the geometrical theory of the pendulum, or even if we detailed again the arrangement of the bars which conſtitute the mechaniſm of the compenſation propoſed; but under our article Pendulum, the reader will, we preſume, find the former omiſſion amply ſupplied; and the latter has been anticipated in our deſcriptions of Reid's and Brockbank's aſtronomical clocks. Reſpecting the ſhape and ſize of a requiſite bob or ball for the pendulum, we have already made our remarks under the word Bob, and therefore ſhall not repeat them here, particularly as we ſhall have occaſion to reſume the ſubject under the article Maintaining *Power;* it ſeems proper, notwithſtanding, to add a few words on the ſubject of the ſuſpenſion of the pendulum. Berthoud, the juſtly admired author of many French works on clock and watch-making, has affirmed (in conſequence of ſome of his experiments on the length of time that pendulums, differently ſuſpended, take in coming to the ſtate of quieſcence, after being moved the ſpace of a given angle from the line of direction), that what is called a knife-edge ſuſpenſion is preferable to that in which a piece of watch main-ſpring is uſed at the point of ſuſpenſion; we will not undertake to decide to which mode the preference is due, but adopt that which our Engliſh clock-makers, perhaps without a ſufficient compariſon of the two, have brought into general uſe. In ordinary clocks a ſlit is made in the moſt prominent part of the cock, into which the piece of watch-ſpring is inſerted, which carries a ſmall piece of braſs riveted to its extremity, by which the weight of the pendulum is ſuſpended on the cock, and a hole drilled through both the clock and braſs piece receives a pin to keep the pendulum in its ſituation; but this mode of ſuſpenſion is liable to two conſiderable objections:—firſt, if the pendulum ſpring happen not to coincide with a perpendicular line paſſing through the pivot-hole of the pallet's arbor, one ſemi-arc of vibration will be greater than the other, even after the bending or eccentric adjuſtment of the crutch has brought the clock into beat, for which imperfection this mode of ſuſpenſion affords no remedy; and ſecondly, the adjuſtment for time, as determined by the going of the clock, cannot be made without ſtopping the pendulum to ſcrew up the adjuſting ball at the bottom of the rod; to obviate theſe two evils, we might have ſuſpended our pendulum in a way which admits of both a lateral and longitudinal adjuſtment, without ſtopping the motion of the pendulum, according to the drawings contained in *Plate* XXVII., and deſcribed under the ſection of *Aſtronomical Clock*, by Meſſrs. Brockbanks; but for the ſake of variety, we propoſe to introduce a different mode of limiting the effective length of a pendulum, which mode is frequently uſed, but we believe has never before been publiſhed. The method we mean, is that which we have deſcribed under the head of *an eight-days portable clock*, contained in *Plates* XI. and XII.; from which deſcription, it is preſumed, the reader will already have apprehended all that is neceſſary to be underſtood relating to the mechaniſm, and its application to the regulation of the going pendulum.

11. *Dial-work.*—In the deſcription of the ſame eight-days clock which we have juſt referred to, has alſo been particularly explained the common dial-work of a clock, the different parts of which are ſo diſtinctly repreſented in *Plate* XII., that no further directions ſeem neceſſary in this place, eſpecially as we propoſe to give an ample account of the different methods of indicating time on the faces of clocks and watches, under the article Dial-*work.*

12. *Striking part.* As we have dwelt ſome time on the different ſucceſſive parts of the mechaniſm of the going-part of a clock, which are the moſt eſſential to be attended to, we hope to be excuſed, if we treat more generally, and claſs under one head what remains to be ſaid on the ſtriking part, which requires leſs of ſcience, and more of mere mechanical contrivance, than the parts we have hitherto treated of.

Neither do we mean to deſcribe over again here, the offices of the different parts of the ſtriking mechaniſm, but to point out the order in which the various conſtituent pieces ought to be ſucceſſively made, and to give our reaſons for their requiſite diſpoſition; leaving the mechanician and workman in poſſeſſion of their own mechanical reſources, to be applied in their own way.

The directions which we have given for the callipering and manipulation of the train in the going part of the clock, will equally apply to the wheels and pinions of the ſtriking part, and the ſpring box, D, *fig.* 1. *Plate* XI. together with the great wheel, F, and its fuſee, may be made preciſely in the ſame way as thoſe of the going part, C, and E, have been directed to be made; alſo the guard-gut muſt be ſimilar. To ſhew the manner in which the main-ſpring is coiled within the box, the lid or end piece is left out in our drawing. The numbers of teeth proper for the wheels and pinions of the ſtriking train, and alſo the number of pins in the pin-wheel, have been before explained; as alſo the ſtructure and poſition of the fly, hammer, and bell; which explanations therefore, need not be repeated.

When the dial-work is finiſhed, and the clock is meant to ſtrike the hours only, which is our ſuppoſition here, the warning-pin may be attached to the wheel which revolves in an hour, which we have elſewhere called the minute wheel, (ſee *fig.* 2, *Plate* XII.) becauſe it carries the minute hand as it revolves; or otherwiſe it may be put, as we have placed it, in the ſecond wheel of a ſimilar number of teeth, marked *g*, in *fig.* 1, of *Plate* XII. where it is better ſeen. The warning-piece, *t u v*, muſt revolve round the angular point, by means of a tube fitting nicely on a fixed ſtud, in ſuch a ſituation on the front plate of the frame, that the piece will not require much force, to be deducted from the maintaining power, to be moved from its ſtationary ſituation at the end of each hour; and that this may be the caſe, the tail-piece, *v*, ſhould lie at right angles with the tangent line, in which the warning pin is moving at the time of their contact; the bent end, *t*, muſt neceſſarily be at ſuch a diſtance from the centre of motion of the warning-piece, as the pin in wheel R, *fig.* 1, *Plate* XI. which it muſt fall in the way of demands. Alſo the hawk's-bill *p q r*, *fig.* 1, *Plate* XII. which is lifted by the bent end of the warning-piece, ſhould lie in a line,

p r,

p r, perpendicular to the tangent-line, in which the end of the warning piece moves at the inſtant of lifting, in order that the leaſt impreſſed force may detach the bill from the teeth of the ſubjacent rack; and that the hawk's-bill may have the mechanical advantage of a long lever, its centre of motion muſt be at the remote end *r*; likewiſe, in order that it may always move in the ſame plane, it muſt have alſo, like the warning-piece, a tube moving round a ſtud in the plate of the frame conſidered as its centre of motion. The weight and ſtrength of the materials of theſe two pieces, which are uſually of ſteel, ſhould be proportioned to the power of the main-ſpring which lifts them; for which reaſon, the lighter they are the better, provided they do not bend with the forces they have to ſuſtain as detents, when at reſt. The length of the gathering pallet, *s*, in the laſt named plate, muſt be guided by the ſtrength of the main-ſpring, as exerted at the arbor on which this pallet is placed, compared with that of the counter-ſpring, *o*, of the rack-tail: for if the latter is comparatively ſtrong, the pallet muſt neceſſarily be ſhort, to have power enough to gather up the rack; but the length of the tail of this pallet, depending on the diſtance that the catching pin, *m*, on the rack, is from the laſt tooth of the rack, may be optional; only it may be obſerved, that the longer the tail is, the more power it has to arreſt the motion of the ſtriking train, when the hour is ſtruck. It is of little importance, whether the gathering pallet be before or behind the bill of the hawk's-bill, provided they act clear of one another, and provided the rack have 12 notches, to be caught ſucceſſively by the pallet.

The ſize and ſhape of the rack, *m n*, depend on the diſtance of the centre wheel arbor from the gathering pallet, conjointly with the ſize of the ſnail *l*; when the quarters are not ſtruck, the ſnail is uſually attached to the 12-hours wheel, and revolves with it, as in our drawing; but it might with equal propriety be placed on a ſecond wheel, revolving in the ſame ſpace of time, as is the caſe in the clock with chimes, repreſented in *Plate* XVII. of *Horology*. The ſteps which form the notched ſpiral outline of the ſnail have their depth depending partly on the length of the tail-piece, *n*, of the rack, and partly on the ſize of the teeth of the rack; the diſtance from the outer to the inner end of the irregular ſpiral of the ſnail muſt be ſuch, and the length of the rack-tail ſo proportioned to the body of the rack, that the 12 teeth of the rack will only juſt paſs the gathering pallet, while the pin, in the extremity of the ſaid tail, moves down the ſtraight line that connects the two ends of the ſpiral, formed by the boundary of the ſnail; hence, ſuppoſing the rack previouſly made, the point for its centre of motion muſt be found ſuch, that the two conditions will be exactly fulfilled; but the beſt way is, to fix upon a point for the centre of motion firſt, and then to proportion the rack and ſnail to each other, for the aſſumed length of tail, from the ſaid centre of motion; the ſteps will aſcend by equal additions of height, if the teeth of the rack are equidiſtant. When the ſnail is deſigned, care muſt be taken, that each ſtep ſhall ſubtend exactly the twelfth part of a circle, or 30 degrees; the apparent increaſe in the ſize of the ſteps is not owing to any increaſe in the angles ſucceſſively ſubtended, but to the increaſe of the ſucceſſive radii of curvature: for as the wheel that carries the ſnail round revolves in 12 hours, every ſtep muſt correſpond to an hour's motion, otherwiſe the ſame hour might be ſtruck a ſecond time ſometimes, when a greater ſpace than the hour has elapſed, as indicated by the minute hand. The rack, like the warning-piece and hawk's-bill, is uſually made of ſteel; but the ſnail may be made of braſs, which is more eaſily cut by the file than ſteel. The bar for repetition, and the ſtrike or ſilent, may be added with little trouble, if deemed deſireable, but the account we have given of theſe parts before, when deſcribing a portable eight-days clock, will be deemed ſufficient by the generality of readers, and thoſe, who have been inſtructed in the art, will need no further direction from us reſpecting thoſe parts of the workmanſhip which are merely mechanical; for were we to enter into a detail of all the nick-nacks which have been introduced into the ſtriking part of a clock, we might write a whole quarto volume on the ſubject. Neither do we think it incumbent on us to enter minutely here into the particulars of the enamelling, ſilvering, &c. of the dial, or of the manufactory of the hands, and caſe, which are ſeparate departments: it may, however, be proper to obſerve, that ſome care is requiſite in making the pillars of the dial to be all of an equal length, that the plane of the dial may be exactly at right angles to the axes of the hands; otherwiſe they will approach the dial in ſome points of their reſpective revolutions more than in others, which will offend the eye of a ſpectator. It is a matter of very little importance whether the bell of the ſtriking part be fixed vertically or horizontally; this point is generally determined by the ſize and ſhape of the caſe that is fixed upon.

13. *Adjuſtment for Rate.* Suppoſe now our propoſed clock to be finiſhed, and fixed in its caſe, and this firmly attached to a ſolid wall, to avoid all caſual motion, that might be derived from the floor of the room in which it is placed, when trodden upon; ſuppoſe moreover, its poſition ſuch, that when the pendulum is put into motion, the two alternate excurſions are exactly ſimilar in extent and time, or, in other words, that the clock is in perfect beat; it then only remains to be brought to true mean time, ſolar or ſidereal, as its deſtination may be; if the latter is fixed upon, the adjuſtment for the length of the pendulum muſt be made from night to night ſucceſſively, till a ſtar, ſeen through a tranſit-inſtrument, ſhall be found to croſs the central thread of the eye-piece, exactly at the ſame hour, minute, and ſecond, for two or three ſucceſſive nights, which nicety of adjuſtment may be effected at any ſeaſon of the year, provided the compenſating mechaniſm be perfect; indeed an examination of the paſſage of the ſame ſtar, whatever it be, will detect the inaccuracy of the compenſation if there be any, provided the tranſit-inſtrument have its adjuſtments perfect. It is hardly neceſſary, perhaps, to add, that when any known ſtar is paſſing the middle thread of the field of view of a tranſit-inſtrument, properly ſet in the true meridian line, the ſidereal clock ought to be indicating the exact hour, minute, and ſecond, denoted by the ſaid ſtar's right aſcenſion for the year and day in queſtion. When ſolar or common time is intended to be indicated by the clock, which is the caſe for all civil purpoſes, the clock may be tried by a compariſon with a regulator previouſly adjuſted, or more accurately by ſucceſſive obſervations, taken of any of the heavenly bodies, as explained in ſome of the problems contained in our article CHRONOMETER.

If a tranſit-inſtrument is uſed as the inſtrument of obſervation, an allowance of $3^m\ 55^s.9$ muſt be made for each twenty four ſidereal hours, which is the quantity by which a ſolar day is longer than a ſidereal one, as has been explained under the article juſt referred to. It may ſave ſome time in making calculations for this purpoſe, if we ſubjoin a table computed for the ſervice of thoſe who wiſh their clocks to be properly regulated.

Table

Table for regulating Clocks or Watches.

Revolutions of the Stars.	Mean Solar Time corresponding.				Acceleration of the Stars in Solar Time.		
	d.	h.	m.	s.	h.	m.	s.
1	0	23	56	4.1	0	3	55.9
2	1	23	52	8.2	0	7	51.8
3	2	2[illegible]	48	12.3	0	11	47.7
4	3	23	44	16.4	0	15	43.6
5	4	23	40	20.5	0	19	39.5
6	5	23	36	24.6	0	23	35.4
7	6	23	32	28.7	0	27	31.3
8	7	23	28	32.8	0	31	27.2
9	8	23	24	36.9	0	35	23.1
10	9	23	20	41.0	0	39	19.0
11	10	23	16	45.1	0	43	14.9
12	11	23	12	49.2	0	47	10.8
13	12	23	8	53.3	0	51	6.7
14	13	23	4	57.4	0	55	2.6
15	14	23	1	1.5	0	58	58.5
16	15	22	57	5.6	1	2	54.4
17	16	22	53	9.7	1	6	50.3
18	17	22	49	13.8	1	10	46.2
19	18	22	45	17.9	1	14	42.1
20	19	22	41	22.0	1	18	38.0
21	20	22	37	26.1	1	22	33.9
22	21	22	33	30.2	1	26	29.8
23	22	22	29	34.3	1	30	25.7
24	23	22	25	38.4	1	34	21.6
25	24	22	2[illegible]	4[illegible].5	1	38	1[illegible].5
26	25	22	17	46.6	1	42	13.4
27	26	22	13	50.7	1	46	9.3
28	27	22	9	54.8	1	50	5.2
29	28	22	5	58.9	1	54	1.1
30	29	22	2	3.0	1	57	57.0
40	39	21	22	44.0	2	37	16.0
50	49	20	43	25.0	3	16	35.0
60	59	20	4	6.0	3	55	54.0
70	69	19	24	47.0	4	35	13.0
80	79	18	45	28.0	5	14	32.0
90	89	18	6	9.0	5	53	51.0
100	99	17	26	50.0	6	33	10.0
200	199	10	53	40.0	13	6	20.0
300	299	4	20	30.0	19	39	30.0
360	359	0	24	36.0	23	35	24.0
365	364	0	4	56.5	23	55	[illegible]
366	365	0	1	0.6	23	58	59.4

The application of the preceding table can hardly be mistaken, but, for the sake of illustration, we will suppose an example that shall include all the difficulties that are likely to occur in practice; let it, for instance, be required first to put the clock to mean solar time, when Spica Virginis is passing the meridian hair of a transit-instrument, on the evening of the 1st of May, 1807, and that, on the evening of the seventh succeeding day, the said clock being observed to be indicating $10^h\ 15^m\ 29^s$ at the moment, it be required to ascertain the daily loss or gain on an average of the said sidereal days? The work may be thus performed; *viz.*

R. A. of Spica Virginis for 1806 (Tab. III. Chronometer)	13^h	14^m	$59^s.29$
Annual variation for one year, add			3 .15
Ditto for four months, - do.			1 .05
	13	15	3 .49

Star's corrected R. A. for May 1, 1807	13^h	15^m	$3^s.49$
Sun's R. A. for noon of ditto, subtract	2	30	56 .3
Approx. solar time of star's passage	10	44	7 .19
Propor. part of $3^m\ 48^s.7$ (daily dif.) subtract		1	42 .03
True time of the star's passage to which the clock must be set	10	42	[illegible]
Seven days acceleration of the star from the Tab. subtract		27	31 .3
True mean solar time -	10	14	53 .86
Time by clock per supposition -	10	15	29
Amount of error in seven days	+0	0	35 .14

Hence the daily error, in excess in each sidereal day, is $= \frac{35^s.14}{7} = 5^s.02$, which was to be determined.

For the other methods of ascertaining the rate of a clock or watch, and for the manner of applying the equation of time, the reader is desired to consult the problems under the article Chronometer.

Clock-*movement* is a term in *Horology*, which sometimes implies a combination of wheels and pinions employed in the striking part of a clock, but most usually that succession of wheels and pinions which move one another, from the maintaining power to the pallets in the going part, and which are employed to transmit the force of that power in an equable but modified manner to the regulator, at the same time that they count and indicate the number of its vibrations in a given period of time. That these offices of the going part, to which we will confine ourselves principally, may be performed in a proper manner, it is requisite that the wheels and pinions of the movement should have their number of teeth properly calculated; that their diameters should be exactly proportioned to act in suitable pairs; that they should be properly callipered to make the pitch-line of each wheel coincide with that of its pinion; and that the teeth should be of a proper size and shape, to transmit the motion and force they have received, to the teeth acting with them in an uniform manner in every possible situation of the acting parts.

The three first of these requisites have already occupied a considerable portion of our attention under the article Clock-*making*, to which the reader is referred; and the fourth, which relates to the size and shape of the teeth, might have been properly deferred till we come to the word Tooth, had it not fallen so far into the alphabet; we shall therefore introduce the substance, appropriated to that word, in this place, that the subject may appear in as complete a state as our arrangement will admit, at an early period of our work.

Before we proceed to examine scientifically the requisites which ought to guide the practical construction of the teeth of wheels and pinions, it seems necessary that we should premise some observations on the principle by which a communication of motion and a transmission of force in general are effected in wheel-work.

In *Plate* III. *fig.* 1, of *Horology*, let A B be a lever, or rod without weight, moveable on C as a centre, and let W and *w*, supposed to be two bodies with weight, have their masses so proportioned to each other, that the mass *w* may be to the distance C A, as the mass W is to C B; or, in other words, if the mass *w*, multiplied by its distance from the centre of motion,

motion, B C, give a product, or momentum, equal to the product of the mass W multiplied by its distance C A; then the two bodies, *w* and W, will remain in equilibrio in any situation, A B, or *a b* of the free lever; but if we suppose the two bodies to have equal masses, or, which is the same thing, equal weights, it is equally evident, that the body, *w*, would preponderate in consequence of its greater distance from the centre of motion, which we will suppose to be three times as great as that of W, and its velocity would, in this case, be three times that of W; consequently it would require an opposing force, three times as much as W would require, to arrest its motion; but if W has its mass or weight increased three times, the distances remaining unaltered, the opposing forces, becoming similar, would then arrest one another, and produce an equilibrium.

The same effects would follow if the threads of suspension were not left free at the ends of the lever, but were folded round the circumferences of two circles, described round the common centre, C, with their respective radii, C A and C B, *fig.* 2; in this case, also, the smaller the circumference of the dark circle is, the greater must be the suspended weight to preserve the equilibrium of the two circles, and *vice versâ*, the ratio being constantly reciprocal.

Let us suppose, now, *fig.* 1 placed contiguous to *fig.* 2, with the large circle of one converted into the portion of a wheel, and the small one of the other into a pinion, as in *fig.* 3, and let us see what will be the consequence, when the teeth are connected and the weights, W and *w*, applied as before; if we suppose the materials of which the portion of the wheel and the pinion are made, to be without weight, an equilibrium will still take place; but remove the small weight *w*, and what will then be the consequence? Why, the pinion D will be impelled at a mean rate, in a direction contrary to that of wheel B, with a force equal to the weight of the small mass, *w*, or, as we have assumed, equal to one third of the large mass, W, which may now be called the maintaining power. But when a tooth of the pinion moves with only one third of the force of W, applied at the point, A, of the wheel, which is at a distance from the centre, C, equal to the radius of the pinion, it moves with the velocity of point B of the wheel, tooth for tooth, and therefore the pinion makes three revolutions for the wheel's one, supposing their numbers to be respectively 16 and 48, as their radii; hence 3, the acquired angular velocity of the pinion's circumference, multiplied by $\frac{1}{3}$, its diminished force, makes the momentum unity, which will also represent the momentum of the maintaining power in motion, *viz.* force *3* multiplied by $\frac{1}{3}$ comparative velocity. Again, let us suppose the pinion, D, actuated by a body, *w*, equal to $\frac{1}{3}$ of the weight of W, and disregard its velocity for the present, the portion of another wheel, E, attached to it by the lever E D, will have its motion contemporary with it; but, by the same mode of reasoning, the velocity of the point E will be increased to three times that of the pitch-line of the pinion, as before was the case with the wheel B, compared with the point A; but its force will be diminished in the same ratio: that is, the velocity will be $3 \times 3 = 9$, and the force, disregarding friction, &c. will be $\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$; but $\frac{1}{9}$, the force, multiplied by 9, the velocity, will still be unity as before; accordingly, a small body, F, having one-ninth part of the weight of W, the maintaining power, carried over a small fixed pulley, G, will be sufficient to preserve the equilibrium with respect to the maintaining power, when the second body, *w*, is removed. If an additional wheel and pinion were added to the above, and were supposed to have the same dimensions, the velocity produced at the pitch-line of this third wheel would be $9 \times 3 = 27$, and the diminished force, on our former supposition of no friction or opposing force, would be $\frac{1}{27}$ only of the maintaining power. In this illustration of the principle by which an increase of velocity, and a corresponding decrease of power, accompany a communication of motion in alternate directions in wheel-work, the teeth may be considered as the remote ends of so many levers, which have their fulcra at the centres of the wheels and pinions respectively, as in *fig.* 4; and it is easy to see, that an accumulation of velocity, accompanied by a corresponding diminution of force, may be produced in any machine where the wheels drive the pinions, as is the case in clock-movements, to such an extent, even where the ratio of the wheel to the pinion is 3 : 1 only, that the friction of the acting parts, together with the resistance of the air opposed to the moving parts, may become a complete counterpoise to the maintaining power. In higher ratios of 12 : 1, 8 : 1, &c. which are used in clocks, the number of wheels and pinions, to produce such an equilibrium, would not require many pairs beyond what an ordinary clock has for its movement. If, however, the pinions had been the drivers instead of the wheels, the reverse of what we have stated would have taken place; the velocity would have decreased, and the force applied have been augmented in the same ratio we have explained, which is the case in cranes, and other engines for raising heavy bodies. Hence, if the movement of a clock were composed of strong wheels and pinions with thick arbors, and had the power applied at the balance-wheel, which may be called the top of the movement, the barrel of an eight days clock having a thick cord coiled round it, would raise a very ponderous body, and become no mean engine for lifting weights, surpassing the ordinary efforts of man's natural strength.

A slight consideration of what we have here advanced, will suffice to convey an idea to any one, who has not previously considered the subject, how admirably well adapted for the purposes of a clock-movement this property in dynamics is, by which an increase of velocity is always accompanied by a proportionate abatement of force; for by means of it, the maintaining power, however large, may be so economically portioned out in minute quantities, sufficient only to compensate the loss of motion which the pendulum or balance sustains, at each vibration, that it may be made to last for many days, or even weeks, before it is exhausted by the great number of successive minute deductions, which are made at periodical intervals; at the same time, certain wheels and pinions, by their numbers and due arrangement, divide and subdivide, by means of hands and divided circles, the sexagesimal portions of each hour, denominated minutes, and also of each minute by the name of seconds. The various offices of communicating motion, of increasing its velocity as at first produced, of diminishing the original force of the maintaining power, of dividing, subdividing, counting, and indicating the hours, minutes, and seconds, all performed by the simple contrivance of a clock-movement, or watch-movement, in conjunction with the regulator, we hesitate not to affirm, when duly considered, exhibit one of the most striking instances of human ingenuity. The experiments of the philosopher, the calculations of the mathematician, and the persevering skill of the mechanist, have combined to produce ultimately this admirable piece of mechanism, of which we hardly know which most to admire, the simplicity of the construction, or the complexity of the various offices, constantly and most correctly performed.

As a further illustration of this fundamental part of our subject, we will here introduce the reader again to the calliper of our proposed half-seconds clock, (see CLOCK-*making*) where we will suppose the centres of the wheels and pinions arranged in a straight line, as seen in *fig.* 4, of *Plate* III. We will suppose the main-spring, or power, pulling with a force, at the point P of the great wheel A, equal to the weight of a body, W, of three pounds; then because this wheel has 96 teeth, and actuates a pinion, *a*, of 8 leaves, their numbers of teeth being directly to each other as their radii, which are represented as levers acting together, with their fulcra at the respective centres, the velocity at the circumference of the wheel will be communicated to the circumference of its pinion *a*, which therefore will make $\frac{96}{8}$, or 12 revolutions, during the time that the wheel makes one; hence if the great wheel be assumed to revolve once in 12 hours, as we proposed, the centre pinion *a*, together with its wheel B, will revolve in one hour, and its arbor will be proper for the hand to indicate minutes on a circle of 60 on the clock face; but it must be observed, that the velocity is not increased 12 times, as it respects the point P, where the maintaining power is applied, nor is the force diminished in the same ratio as it regards that point; but, to make the calculation more simple, we will consider the distance of P, from the centre of A, equal to $\frac{1}{12}$ of the radius of wheel A, which is the radius of pinion *a*, and correct the conclusion drawn from such a supposition afterwards: the pinion *a* then, we say, has its velocity at the pitch-line, or its number of revolutions equal to 12, and its force equal to $\frac{1}{12}$; in the next place, the radius of a pinion *a*, is to the radius of the concentric and contemporary wheel B, as 8 : 64, and $\frac{64}{8} = 8$; the circumference of this centre wheel, therefore, will move with a velocity equal to 12×8, or 96, and with a force only of $\frac{1}{96}$; both which will be imparted to the pitch-line of the pinion *b*, of 8 leaves; again, the radius of the latter pinion *b*, is to the radius of its concentric and contemporary wheel C, as 8 : 60; but $\frac{60}{8}$ is a fraction, the value of which is $7\frac{1}{2}$; and $96 \times 7\frac{1}{2}$ therefore make 720 to express the velocity, or number of revolutions of pinion *c*, actuated by the wheel C; and $\frac{1}{720}$ will express the force, or fractional part of three pounds, the quantity assumed for the maintaining power, which is equal to 24 grains of troy weight. We have now found, that while the wheel A is making one revolution, the last pinion *c* will make 720, and that 24 grains troy, suspended by a small pulley over the pitch-line of pinion *c*, and attached to it, will balance three pounds of the same species of weight, suspended at $\frac{1}{12}$ of the radius from the centre of the great wheel, if we disregard the effects of friction. Let us examine the consequence of these calculations as they regard our arrangement of the calliper: the pinion *c*, we have seen, revolves in $\frac{1}{720}$ of 12 hours, according to our original assumption of A revolving in 12 hours; but in twelve hours there are just 720 minutes; one revolution consequently of the last pinion *c*, is performed in exactly one minute; its arbor will therefore be proper for the axis of the seconds hand, which goes round its circle of 60 in this time: but the maintaining power, W, is not actually suspended at $\frac{1}{12}$ of the radius of wheel A, according to our supposition when we calculated, consequently the result, as it relates to the modified force at the pitch-line of pinion *c*, requires yet to be corrected, or somehow compensated; this is done by making the radius of the swing or balance wheel D, equal to the distance of P from the centre of A, in which case, the calculated velocity and force at any point in the circumference of D will be in the same proportion to what those of the maintaining power suspended at P are, as the velocity and force at the pitch-line of pinion *c* would have been, if the same maintaining power had been actually suspended $\frac{1}{12}$ of the radius of A, from its centre; the body W of 24 grains therefore attached to the circumference of wheel D, and carried over the small pulley above it, will balance three pounds, suspended at the point P, of the great wheel, if, as before, we disregard friction; and the push made, in any direction, against the pallet face, will be equal to a force of 24 grains, acting in the same direction: the same result would also have accrued, if the body W had been suspended at the circumference of wheel A, provided the swing-wheel had been of the same radius; but, supposing the body W to remain at P, and the swing-wheel D made equal to the great wheel, then the velocity of the former would have been increased, and its force diminished, in the proportion of the diameter of the swing-wheel to the diameter of the barrel, by which we suppose the body W to be suspended at P: in this case, the small dotted body, *x*, suspended at *y*, at a distance equal to the radius of wheel A, would have been sufficient to keep the body W in equilibrio.

The pendulum proposed to be adopted, being a half seconds pendulum, the swing-wheel must have 60 teeth, in order that one tooth may escape the pallets at every second vibration, which therefore becomes a proper regulator for our present movement.

When the whole movement is previously given in any clock, and we want to ascertain the relative revolutions of the first and last wheels, a little consideration of what we have said will show, that the product of all the wheels, divided by the product of all the pinions at one operation, will give the result at once thus, $\frac{96}{8} \times \frac{64}{8} \times \frac{60}{8} = \frac{368640}{512} = 720$, as before.

Also, when the relative forces of the maintaining power, at the barrel, and at the end of a tooth of the pallet-wheel are thus ascertained, this calculated force must be altered, inasmuch as the pallet-wheel has its diameter greater or less than that of the barrel, accordingly as we have shown above. When a spring and fusee are used, the power of the spring may be ascertained either by the instrument of adjustment used as a lever with a sliding weight, or, what will be less equivocal, a barrel may be attached to the square of the fusee arbor, when the spring is adjusted, and then a heavy body suspended by it in a scale to admit of weights of adjustment, which barrel and weights may be substituted for the spring and fusee in the calculation, first of the whole force applied as a maintaining power, and then of its modification at the face of the pallets.

If we were to take the opposing force of friction into our calculation, we should find the problem extremely complicated; for there are not only various causes of friction in a movement, such as that caused by the action of the teeth, and in the pivot-holes, &c.; but the continual variation of the quantum of friction, arising from the destruction of the rubbing parts, the thickening of the oil usually applied, and the admission of dust, is such, that no regular and constant data can be obtained whereon to ground such a calculation as would prove serviceable. The readiest, and perhaps best, practical way of ascertaining how much of the maintaining power is expended in friction, is really to suspend such small weight by a tooth of the swing-wheel, as will balance the maintaining power, and compare this with the requisite force obtained by calculation; the difference will give the collective quantum of friction, at the time of the experiment, in the whole movement.

Friction, however, is not the only obstacle to the maintaining

ing power in the works of a clock in motion; the tranfmiffion of force is not conftant, but effected at fuch equi-diftant intervals of time, as depend on the vibrations; for inftance, in our half-feconds piece, the wheels and pinions are put into motion, and ftopped again alternately 60, and where there is recoil 120 times in each minute; hence the inertia of the matter compofing the wheel-work is as often to be overcome as the arrefted motion is re-produced, and if the wheels are not made very light at the upper end of the train, where the force is greatly reduced, a very confiderable portion of the calculated force will be employed in moving the works from a ftate of reft, at every vibration. We prefume it is on this account, more than on account of friction, that the workmen have found it neceffary to diminifh the wheels, and to reduce their weight, as much as is confiftent with ftrength, accordingly as the train afcends. To overcome the obftacles to the due effect of the maintaining power, arifing from friction, and the inertia of the wheels and pinions, more force is ufually given to it than would otherwife be neceffary, and the requifite addition, over what calculation gives, muft in every inftance depend upon tentative adjuftments of the maintaining power to the momentum of the regulator, fo as to produce the due excurfion of the pendulum or balance beyond the efcapement angle. In fome delicate machines for keeping true time, the pivots of the arbors are made to reft on friction rollers, or otherwife, are bufhed with fome of the precious ftones that take a high polifh, which expenfive additions admit of the maintaining power being fmall in comparifon with the momentum of the regulator; which circumftance, when the regulator is rendered unchangeable by fome compenfating mechanifm, is beft calculated to preferve the angle of vibration alfo unchanged, provided the maintaining power remain uniformly the fame; and even if fome flight alterations of force fhould arife out of an imperfect adjuftment of the fufee, where a fpring is ufed, the great controul of the regulator would, under fuch circumftances, reftrain the effects of the flight irregularities of the impulfes on the pallets.

Hitherto we have confidered the action of the wheel with its pinion, or what the French call *engrenage*, to be fo perfect, that the velocity and force, at the circumference of every wheel, is truly and conftantly imparted to its refpective pinion; which is fuppofing not only the wheel-work to be proportioned and callipered with the utmoft exactnefs, but alfo their teeth fhaped in the beft manner. There are, however, three very common caufes of bad action; firftly, whenever the wheel is too fmall for the pinion, though ever fo well callipered, its teeth will pitch againft the ends of the pinion's leaves, and require more then ordinary force to be confumed in their difengagement; fecondly, when the wheel is too large, it will impart to the pinion too much velocity during the action, and part of the force will be expended in the drop that will take place before the action commences againft each following leaf of the pinion, after it has ceafed to act with the leading leaf; and thirdly, if the curve of the tooth be ill formed, the tranfmitted force will, in fome fituations, exceed, and in others fall fhort of a mean force; in all thefe cafes the varied intenfities of the tranfmitted force will confiderably affect the ifochronifm of the regulator with any of the ordinary efcapements. Of the two firft of thefe caufes of bad action, we have pointed out the remedy, when we treated of the proper method of proportioning and callipering a movement, under the word CLOCK-*making*; the third, which is of the utmoft importance, not only in clock-work, but in wheel-work of every defcription, prefents itfelf now for difcuffion.

In *fig.* 5 of *Plate* III., let us fuppofe b C A and $b\,c\,a$ two bent levers, refpectively moveable on the points C and c, as their centres, and let us conceive that the parts, C A and $c\ a$, which are in the direction c C of the line of the centres of motion, be unchangeable in length, and be loaded with their refpective weights W and w; but that the parts, b C and $b\ c$, be variable in length, fo that in any fituation their extremities may meet and act reciprocally on each other; we affirm that the fame weights W and w, which will keep the two variable levers in equilibrio at the point P, in the line of the centres, will alfo keep them in equilibrio when their ends reft againft each other at any other point, b, in the circumference of a circle, of which c P, or C P, is the diameter.

Demonftration. Let $b\ d$, the fhort line perpendicular to b C, which may reprefent the fhort arc made in an inftant by the lever b C, turning on the centre C, exprefs the abfolute force of the weight W, acting at the extremity of the lever; and let this abfolute force be decompofed into two others, $b\ e$ and $b\ f$, the former of which, $b\ e$, may be perpendicular to $c\ b$, in the direction of P b, the angle at b being a right angle, by reafon of its being formed at the circumference by two chords from oppofite ends of the diameter, and the latter, $b\ f$, may be parallel to the line b C; it is evident that $b\ e$ expreffes that portion of the force $b\ d$, which is employed in moving the point, b, of the lever $c\ b$, from b towards g, and, confequently, in making the lever, $c\ b$, revolve, whilft the other portion, $b\ f$, expreffes that part of the force, $b\ d$, which has a tendency to pufh the point b towards C; but C is a fixed refifting point, which therefore deftroys this part of the decompofed force: we fay, likewife, that $b\ d$ expreffes the abfolute force exerted at the end, b, of the bent lever, $a\ c\ b$, by the weight w, to oppofe the revolution of the point, b, round its centre, c; for, becaufe the right line, A W, is perpendicular to C A, and alfo $b\ d$ to b C, the weight, W, is to the force, $b\ d$, as the line, b C, is to C A; but in taking C B perpendicularly to the line, b P, prolonged, the like triangles, $d\ b\ e$, and C b B, give $b\ d : b\ e$: C B : C b, therefore, by multiplying, W : $b\ e$ :: C B : C A: now let the abfolute force with which the weight, w, urges the point, b, in a direction oppofite to $b\ g$, be called x, and we fhall have $w : x :: c\ b : c\ a$, or, on account of the fimilarity of the triangles, $c\ b$ P, C B P, as C B to C P; but on the fuppofition that the two weights, w and W, will balance each other, when their forces are exerted reciprocally at the point P, on account of the equality of the levers, $c\ a$, c P, the weight, w, may be fuppofed to be fufpended at the point P; it will be then as W : w :: C P : C A; likewife, by multiplying, W : x :: C B : C A; but we have juft proved that W : eb :: C B : C A, therefore $e\ b = x$; hence there will be an equilibrium, when the force, $e\ b$, is equal to the force with which the point, b, is urged to revolve by the weight W. It is equally demonftrable, that an equilibrium will take place between the two levers when their point of contact falls in any other part of the circumference of the circle, $c\,b$ P; and alfo, that an equilibrium will not take place if fuch point of contact fall either within or without the circumference of the faid circle. Vide Berthoud's "Effai fur l'Horlogerie," tom. i. p. 41.

Corollary. From the preceding demonftration an inference is deducible, of the utmoft importance in wheel-work; namely, if we fuppofe the point b to be always in the circumference of $c\,b$ P, while the lever b C A impels the lever $b\,c\,a$, the circles H K and $h\ k$ defcribed from the centres of motion C and c, and touching one another at P, when attached each to its own lever, will move with the fame force and the fame velocity.

For 1ft. Let F and f be the refpective forces with which

which the circumferences of the circles H K and hk are urged, and we shall have $bd : F :: CP : Cb$, and $f : be :: cb : ch$ or cP; but we have seen above that $be : bd :: Cb : CB$, therefore $f : F :: CP \times cb : cP \times CB$; but the similar triangles cbP and CBP give $cP : CP :: cb : CB$; hence $cP \times CB = CP \times cb$, therefore $f = F$; consequently, if the circle H K be moved by any force uniformly, the circle hk will also be moved uniformly.

2dly. Whatever may be the velocity of the point b, of the lever ACb, that which it will communicate to the lever bca, in the direction be, perpendicular to the point of contact, will be the same as that of point b; that is, if we demit the perpendicular dg, the velocity in the direction bd, being represented by bd, the velocity in the direction be will be represented by bg. If then V be the velocity of the circumference of the circle, or wheel, H K, and v that of the smaller circle, or pinion hk, it is evident that $V : bd :: CP : Cb$, likewise, that $bg : v :: cb : ch$; also, the like triangles, bdg, and CbB, give $bd : bg :: Cb : CB$; therefore, $V : v :: CP \times cb : cP \times CB$; but these two last products we have seen are equal, therefore $v = V$.

By a similar reasoning it is equally demonstrable, that neither the force nor velocity of the wheel would be equally communicated to the pinion, nor those of the pinion to the wheel, if the point of action were situated either within or without the semi-circle cbP.

To apply the preceding corollary to our present purpose, of effecting an equable communication of force and velocity in wheel-work, let us conceive the variable levers ACb, and acb, in *fig.* 1, *Plate* IV. so circumstanced, that their remote points, b, meet at P, and that the points H and h, of the wheel H K, and pinion hk, be also in contact at P; let the wheel now move through five successive portions, $H\alpha$, $\alpha\beta$, $\beta\gamma$, $\gamma\delta$, and δP, successively, and conceive it to drive the pinion hk, by simple contact; in this case, the pinion will move in like manner, through similar arcs $h\alpha'$, $\alpha'\beta'$, $\beta'\gamma'$, $\gamma'\delta'$ and $\delta' P$, and at each of the successive points of contact, $\alpha\alpha'$, $\beta\beta'$, $\gamma\gamma'$, &c. the respective lengths of the levers, in order to meet in the semi-circle cbP, will be $AC1$ and $ac1$, $AC2$ and $ac2$, $AC3$ and $ac3$, $AC4$ and $ac4$; and, lastly, ACb and acb, continually varying: hence we may conceive a curve, Hb, such, that some point of the variable lever ach, between b and h, shall always rest on it in every successive situation of the wheel and pinion, beginning at h, and ending at b; if now we suppose the curve H, on which the variable end of the lever cbh rests, to be attached to the wheel H K, and to be brought back into its original situation P, and also ch to be coincident with cP, it is evident that, though the wheel and pinion were not so in contact as to impel one another, yet if the wheel were to be moved uniformly as before, the curve-piece attached to it would drive the lever cbh before it in such a manner, as to effect a constant variation in its length, but whether such motion of the pinion occasioned by the attached straight lever, when urged by the curve-piece Hb, will or will not be uniform, depends entirely on the nature of the curve which we have not yet established. Let us examine the figure a little more closely. The arcs P H, of the wheel, and Ph of the pinion, we have assumed to be equal in length, though one contains double the number of degrees as the other, by reason of having only half its radius; but the semicircle, cbP, is described from only half the radius of the pinion; consequently the dotted lines, $c1$, $c2$, $c3$, &c. which measure degrees, by being prolonged, on the circumference of the pinion, measure double degrees on the semi-circle, cbP, by reason of their meeting at the end of the diameter, instead of at the centre; therefore the arc Pb, is also equal in length to either of the others, P H, and Pb. These considerations will enable us to determine the requisite curve, thus; transfer the divisions, $H\alpha$, $H\beta$, &c. from P, back towards K; and through the intersections 1, 2, 3, 4, b, of the small semi-circle, cbP, draw parallel arcs, 11′, 22′, &c. in dotted curves from C, as a centre; which extents will be the successive acting lengths of the radius of wheel H K, in the successive situations, as it revolves from P to H; also the small extents P 1, P 2, P 3, &c. will be so many radii of curvature applied successively from the different points of division; for instance, P 1, applied to the first point below P, will intersect the innermost dotted arc at 1′; P 2, from the second point in P K, will intersect the second dotted curve line at 2′; P 3, from the third point, will intersect the third dotted line at 3′; P 4 at 4′; and, lastly, P 6, at 6′; and if the interstices of the curve so formed be completed, it will have the peculiar property of driving the straight line, bh, and its pinion, with an equable force, and an equable velocity, provided the wheel H K, to which it is attached, move equably; for the acting point will always be found in the semi-circle cbP, which is fulfilling the condition of the problem; also, reversing the motion, the straight line, bh, will drive the curve, b H, and its wheel, back again, with an equable force and velocity, as though the pinion drove the wheel by contact. We have here supposed the curve piece attached to the wheel, and driving the pinion, but the same projection, or rather the same mode of projecting the curve, will apply when the pinion has the curve, and is the driver according to the representation given in *fig.* 2, of *Plate* IV. which is the reverse of *fig.* 1. We have also hitherto supposed, that a wheel or pinion moves always in the same direction; but as it is frequently required in wheel-work, that the works should turn both backward and forward, it is necessary to have a counter-curve on the following part of the tooth, which in its turn may occasionally be the leading part; the same geometrical process will give this reverse curve, which must necessarily begin at the distance from the other of the whole breadth of the tooth; in our drawing, we have given the tooth equal to four divisions, in order to show more clearly the process of describing it, but in ordinary works, particularly in clock movements, the strength of the tooth is too small to admit of being described and demonstrated in this way; we have notwithstanding thought it our indispensable duty to investigate, and lay before the reader, the fundamental principle on which the proper shape of a tooth depends. According to the preceding investigation, the curved portion of one tooth, it will be seen, must always drive a straight edge of the other, and *vice versâ;* also a line drawn from the point of action to the primitive circles, or pitch line, where it is intersected by a line joining the centres, will be always perpendicular to both the straight line and the curve.

Here the reader will naturally be led to ask, what is the precise nature of the curve we have determined? and what name shall we give it? A little reflection on its property and delineation will soon convince the geometrician that it is an epicycloid, or rather a portion of an epicycloid, for the generation of which the wheel constitutes the base, and a circle, equal in diameter to the radius of the pinion, the generating circle. Camus in his "Cours de Mathématiques," Liv. x. and xi. has investigated the epicycloid, as it affords a rule for the formation of teeth in wheel-work, which portion of the work has lately been translated into English, but the translator has added some practical directions respecting the shape of a tooth, taken from "Imison's Elements of Science and Art," the principle of which we think it necessary here to correct, at the same

ſame time that we avail ourſelves of the elucidation of our ſubject which Camus's maſterly treatment of it affords.

In *fig.* 3, of *Plate* IV. let H K repreſent a portion of the ſame wheel which is repreſented by the ſame letters in *fig.* 1, and let the epicycloidal curve, H 2′ 4′ 6′, be deſcribed in the uſual way by a fixed point in the circumference of a ſmall circle, with a radius equal to that of the ſemicircle, *c b* P, in *fig.* 1, coming in contact with the circle H K, and thereby effecting a revolution; then it is evident that the epicycloidal curve in our preſent diagram is preciſely the ſame as the curve P 1′ 2′ 3′ 4′, &c. in *fig.* 1, which ſimilarity proves the latter to be alſo epicycloidal; for the chords 2 2′, 4 4′, &c. in *fig.* 3, are preciſely the ſame as P 2, P 4, &c. with which the points 2′, 4′, &c. are deſcribed in the curve P 1′ 2′ 3′, &c., in *fig.* 1; and in *fig.* 3, the arcs, 2 2′, and 4 4′, &c. are reſpectively equal to 2 H, 4 H, &c. of the ſame *fig.* in the ſame way that P δ′, P γ′, &c. are reſpectively equal to P δ, P γ, &c. in *fig.* 1. This epicycloidal curve, P 1′ 2′ 3′ 4′ *b*′, in *fig.* 1, or H 2′ 4′ 6′, in *fig.* 3, is of the kind called exterior, by reaſon of the generating circle revolving round the outſide of the baſe H K; but if it were made to revolve by a ſimilar contact with the interior ſide of a circle, the generated curve would be of a different ſhape, and would be denominated an interior epicycloid. In the particular caſe where the generating circle has its diameter, exactly equal to the radius of the circle which conſtitutes the baſe, the line generated by a fixed point in the circumference of this generating circle will not be a curve, but an exact ſtraight line paſſing through the centre of the circle which is made the baſe: thus in the lower part of *fig.* 3, if we conceive the fixed point, in the generating circle, for deſcribing the line required, to be at *a*, a point in the circumference of the baſe, *a d e*, and the generating circle to move forwards to the points *d* and *e* ſucceſſively, it is demonſtrable that the ſaid fixed point, *a*, will be found ſucceſſively at *b* and *c*, and will conſequently deſcribe the ſtraight line or radius, *a b c*, in the ſame time that the generating circle revolves down one quadrant, *a d e*, of the circle conſtituting the baſe; this conſequence muſt follow from the conſideration that the arc, *d b*, is equal to the arc, *d a*, and that the ſemi-circle, *e c*, is equal to the quadrant, *e d a*, according to our aſſumption of the diameter of the ſmaller circle being exactly equal to the radius of the larger.

With theſe demonſtrable truths in our recollection let us now turn to *fig.* 4, and ſee how both the exterior and interior epicycloids are concerned in the formation of an epicycloidal tooth, or tooth that has the property of tranſmitting both the force and velocity it has received without alteration to its fellow-tooth, when it is alſo ſhaped according to the ſame principle: if we ſuppoſe the portion of a circle, H K, to drive the ſmall generating circle, *c b* P, equably by ſimple contact at the point, P, the fixed point *b* will deſcribe the portion, H *b*, of an exterior epicycloid on the plane of H K, extended, which portion we will ſuppoſe to be one ſide of a tooth attached to H K, to which curve the line P *b* is always perpendicular; again, if we ſuppoſe not only the ſaid generating circle *c b* P, but alſo at the ſame time the circle *k h*, to revolve, by means of a ſimilar contact with H K at the point P, then the inner or generating circle, *c b* P, will make two revolutions, while the outer one, *k h*, makes only one; the conſequence reſulting from ſuch a combination will be the ſame, as though the generating circle, *c b* P, moved only once round within the circle, *k h*, conſidered as ſtationary, that is, the circle *k h* becomes the baſe to the generating circle, and the deſcribing point *b* ſo circumſtanced will trace on the plane of circle *k h*, the ſtraight line or interior epicycloid, *b b c*, which is the radius to the circle conſtituting the baſe in this caſe. Hence if we conceive the points *b*, *h*, and H, to coincide at H, for the original poſition of the three circles, and alſo of the tracer *b*, it is eaſy to comprehend, that, if a ſlit were cut in the plane of the circle *k h*, in the direction of the radius *c h*, ſuch as would juſt admit the tracer to paſs through it, provided the great circle, H K, communicates its motion equably to the other two by contact at the point P, the tracer will paſs along the ſlit, conſidered as an interior epicycloid, and at the ſame time will deſcribe an exterior epicycloid on the plane beneath both the circles, *c b* P, and *k h*. A ſmall inſtrument might readily be made to prove practically that the reſult we have here pointed out would follow from this arrangement of three circular metallic plates kept in their places by a ſuitable frame. But this is not all; if the curve H *b* be made to form a part of the circle H K, conſidered as a wheel, and the point, P, of contact be removed a very ſmall diſtance from the two circles, ſo as not to touch them, the points, *b*, *h*, and H, may be again brought into their original coincident ſtate, either by puſhing the tracer, attached to the extremity of the generating ſmall circle, againſt the edge of the epicycloidal curve, or otherwiſe by ſubſtituting a ſtraight lever in the place of the ſlit, as a radius of the circle *k h*, and by preſſing it, inſtead of the tracer, againſt the ſaid curve; in either caſe an equable motion will be communicated to the great circle or wheel, K H, as well as though it had been actuated at the point of contact, P: nay, moving the tracer back from *h*, while in the ſlit at P, would give an equable motion to all the three circles: alſo reciprocally, the curve H *b*, by preſſing againſt the tracer, while the wheel H K is in motion, will give an uniform motion to the generating circle, *c b* P; or otherwiſe it will uniformly drive the larger circle *k h*, by preſſing againſt its radial lever; in either caſe the motion will be as equable as though communication were to take place by mere contact, or by teeth infinitely ſmall, at the point P.

This view of the ſubject, it is preſumed, will afford the reader a full and clear elucidation of the application of the exterior and interior epicycloidal curves to the formation of teeth in wheel-work, and, at the ſame time, eſtabliſh an eſſential difference, which has been overlooked hitherto in practice, between the curve generated by a circle equal to one of the acting wheels or pinions, and the curve generated by a circle equal in diameter to only *half* of one of the acting wheels or pinions, the correſponding wheel or pinion being in both caſes taken of its full geometrical diameter as the baſe of generation. The tranſlator of a part of Camus, and the editor of "Imiſon's Elements of Science and Art," have poſitively though erroneouſly aſſerted that the generating circle ſhould in all caſes of wheels and pinions be equal to the fellow of the wheel on which the curve is to be deſcribed, in which opinion ſome very reſpectable mechanicians agree; but others, on the contrary, aſſert, with equal confidence, and more truth, that the ſaid generating circle ſhould have its diameter equal to only one half of the diameter of the ſaid fellow. (See Camus, Dr. Young's Syllabus, and Brewſter's Edit. of Ferguſon's Select Exer. &c.) A careful examination of Camus's demonſtrations would of itſelf have reconciled the diſagreeing parties, which we truſt a due attention to our elucidation, by means of the tracer and radial lever, will not fail to effect. The fact is, that, where pins like our tracer, or ſpindles are uſed for teeth in any wheel or lantern, as is frequently the caſe in large works, the generating circle muſt be equal in diameter to the diameter of the acting wheel or lantern which it repreſents, in order to trace the epicycloidal

teeth

teeth of its fellow; but in clock-movements, and in all other inftances in wheel-work where both the wheels and pinions have the epicycloidal formation, the generating circle muft be only one half in diameter to what it is required when lanterns are ufed, for in this cafe, which is what is moft frequent, the interior and exterior epicycloids impel each other alternately, the former being a portion of the radial lever, and the latter a portion of the epicycloidal curve: thus, if a pin were attached to the extremity of the generating circle cbP, and a radial lever to the plane of the circle, kh, of twice its diameter, they would be alike driven by the epicycloidal tooth, H b, of the driving great wheel, HK. Hence the fhape of the tooth of the driven wheel or pinion will always determine whether the curve of a tooth in the driver muft be defcribed by a circle of the full or half fize ufed as a generating circle, neither of which, it appears, will apply exclufively in all cafes. It may be remarked, however, here, that the beginning of the curve, or that part which is formed on the end of a tooth, will in practice be, as nearly as may be, the fame whichever of the two generating circles be made ufe of, particularly if the teeth to be formed are fmall; for in *fig.* 1, it will make little difference whether P 1 and P 2, or P δ and P γ, be taken as fucceffive extents for defcribing the curve P 1′, 2′, &c.; but if Ph were taken inftead of Pb, the difference at b', the remote end of the curve generated, would be confiderable. Hence the argument in favour of the erroneous principle, adduced from the trial of feven years wear without repair, by the tranflator of Camus, is without weight, and proves only that a convenient approximation to the truth may fometimes be fubftituted for the truth itfelf in practice; as the fmall circular arcs of a pendulum are fubftituted for cycloidal arcs, to which they are very fimilar at the loweft point; but where the truth itfelf is attainable by equally fimple means, approximations ought to be inadmiffible.

Our theory, it will be obferved, hitherto fuppofes that the whole tooth of the driving wheel or pinion be formed by interfecting portions of an exterior epicycloid, and that the whole tooth of the driven wheel or pinion be formed like a ftraight radial lever, which is eafily fhaped; thefe formations will act pretty well together, and when they are adopted, the outer ends of the teeth of the driven one muft be in its primitive circumference; but in the driver the whole tooth muft project beyond its primitive circle; fo that the two primitive circles, geometrically obtained, muft not meet at what is called the pitch-line, but be feparated by a fpace equal to the length of the driving tooth; but in practical works, particularly in horology, the teeth of both the driver and driven wheel or pinion are ufually formed nearly alike; partly by means of the exterior epicycloid, and partly by means of the interior one, or ftraight line; the exterior ends are formed ufually by being curved, and the interior parts are bounded by radial ftraight lines, either of which parts will drive the other, which office they do alternately; this fhape is not only found to be the moft practicable, but admits of a contact of the two primitive circles at a point of each tooth, called the *pitch-line*; the confequence of which formation is, that nearly an equal addition may be made to each curve for the rounded parts of the teeth of both the wheel and pinion; it is this formation that we mean when we fpeak of ordinary teeth, and to which our table is applicable, which is given under the article CLOCK-*making*.

Olaus Roemer, the celebrated aftronomer and mechanift of Denmark, according to Wolfius and Leibnitz, was the firft who pointed out the utility of the epicycloidal curve, when applied to delineate the fhape of a tooth; but De la Hire took up the fubject after him, and demonftrated, that if a tooth of either a wheel or pinion be formed by portions of an exterior epicycloid defcribed by a generating circle of any diameter whatever, the tooth of its fellow will be properly formed by portions of an interior epicycloid, defcribed by the fame generating circle, which curious circumftance allows of an infinite variety in the two correfponding curves that form the teeth of the wheel and pinion, if they were practicable. Nay De la Hire has fhewn, that if the teeth of any wheel be triangular, circular, or of any other regular figure, an uniformity of force and velocity may be mutually imparted, provided the teeth of the correfponding wheel or pinion have its teeth formed by a figure, compounded of the epicycloid and faid figure, which he has further fhewn the method of effecting in a variety of cafes, not however adapted for practice. But whether the mechanift may choofe to ufe his exterior and interior epicycloids jointly in the fame tooth, or feparately, in different wheels acting together, this practical rule ought never to be loft fight of, *viz.* the outer end of his interior, and alfo the inner end of his exterior epicycloid fhould univerfally commence in the primitive or geometrical circle of his wheel or pinion.

The reader is now prepared to be told, what otherwife might have appeared paradoxical, not only that the fame pinion, of eight leaves for inftance, will require the teeth of a wheel of thirty to be fomewhat differently rounded at the ends, from thofe of a wheel of fixty, or any other number, in order to have like action in both cafes, but that, however accurately the teeth of wheels are rounded, all numbers are not equally good to be ufed indifferently for wheels and correfponding pinions. This latter part of our fubject has not been much attended to in practice, but is curious, and may contribute to great utility, particularly in horology, where an equable tranfmiffion of velocity and force is defirable.

The whole of what we have hitherto faid refpecting the action of epicycloidal teeth, has been upon a fuppofition that the impelling force begins at the line which joins the centres of any pair of wheels, or of a wheel and pinion, and is exerted outwards always on one fide of this line until the teeth efcape one another, which mode is allowed to be the beft, when it can be effected; but there are many ratios, and thofe in common ufe between a wheel and its pinion, which will not admit of this kind of action, however good the fhape of the teeth. Indeed, Camus has fhewn, that no pinion lefs than one of eleven leaves, will entirely anfwer the purpofe of acting always on one fide of the line joining the centres, and that confequently the common pinions of fix are very ill calculated to effect an equable tranfmiffion of velocity and force, by reafon of their leaves acting alternately before and behind the line of the centres.

In *fig.* 5, fuppofe H K to be a portion of a wheel of 50 teeth, and kh a pinion of feven thin leaves or levers, each like cbh; Camus has proved, that this wheel will not impel its pinion in an uniform manner, by acting always behind the centres. His reafoning is to this effect; in order that the leaves of a pinion of feven, may be impelled only behind the line joining the centres, the tooth, P b H, of the wheel muft not quit the leaf ch, until the next following leaf, cI, has reached the point, P, in the line of the centres, in order that it may be impelled in its turn by the next tooth, K I, behind that line. The angle I c h, or quantity that one leaf of the pinion muft be moved before the following one comes to the line of the centres, is one feventh of 360°, or 51° 25′ 43″ almoft; confequently the angle C c h, or C cb, is 51° 25′ 43″. Then taking the radius of the pinion at feven parts, the fide cb of the fmall right angled triangle, when folved, will be 4.364

4.364 of fuch parts; alfo in the triangle b C c we have the two fides $c\,b$ as before, and c C equal 57, with the included angle $b\,c$ C, from which data, by a folution of the problem, we have the angle b C c equal $3°\ 35'\ 50''$ nearly. The angular quantity of the wheel H C I, which one tooth and one fpace occupy, or $\frac{1}{50}$ of $360°$, is $7°\ 12'$, from which, if we deduct the angle b C c, or $3°\ 35'\ 50''$, the remainder, $3°\ 36'\ 10''$, will be the angle H C b. Now, as the two epicycloidal portions of the tooth P b and H b are equal and fimilar, and alfo fimilarly placed with refpect to the full radius C b, and as the angle H C b has been found to be $3°\ 36'\ 10''$, the angle H C P, which ought to contain one tooth and fpace, will be $7°\ 12'\ 20''$; but we have feen that the angle H C I is only $7°\ 12'$, confequently the angle H C P will be greater than H C I by $20''$, which is impoffible, becaufe a part cannot be greater than the whole. It is, therefore, impoffible that a wheel of 50 fhould move in an uniform manner, a proportionate pinion of feven leaves impelling them only behind the line joining the centres. A wheel of fewer teeth than fifty will be ftill lefs proper, and one of a greater number will not leave fpace enough for a fufficient thicknefs of leaf in a pinion. Hence it appears, that when a pinion of feven leaves is ufed, it will be impelled by its wheel, partly before and partly behind the line joining the centres, as may be feen more fully in *fig.* 6, where the pinion is fuppofed to be impelled by the wheel from right to left.

In the fame manner it may be proved, that if a wheel of 57 were made to drive a pinion of eight, the whole arc for both the tooth and fpace would be $6°\ 18'\ 57''$, of which $5°\ 7'\ 40''$ would be occupied by the tooth of the wheel, and only $1°\ 11'\ 17''$ by the fpace, or by the tooth of the pinion, which quantity is not enough for the thicknefs of an acting tooth; therefore if the teeth of the wheel are made nearly equal to the fpaces, they will drive the pinion of eight both before and behind the line of the centres.

Alfo if a wheel of 64 were to drive a pinion of nine leaves in fuch a way, that the impulfe might be only behind the line of the centres, the arc at the pitch-line of the wheel for both tooth and fpace, will be $5°\ 37'\ 30''$, of which the tooth will occupy $3°\ 45'\ 42''$, and the fpace only $1°\ 51'\ 48''$, which will not leave room for a leaf fufficiently thick for the pinion.

Likewife where a wheel of 72 drives a pinion of ten leaves behind the line of the centres, the arc of the wheel's tooth is $2°\ 47'\ 16''$, and of the fpace between two teeth $2°\ 12'\ 44''$ only, therefore here the tooth and fpace cannot be equal.

In pinions of 11, 12, &c. the impulfe may take place entirely behind the line of the centres, and the extreme ends of the teeth might be taken away, as in the pinion of *fig.* 6, and in the two teeth of the wheel, which are fuppofed to have paffed the centre. Nay, in thofe cafes where the pinion is always driven by an impulfe made only behind the line of the centres, the addition to its tooth beyond the geometrical diameter, may, as we have faid, be nearly difpenfed with; that is, the acting and the geometrical diameters may be almoft the fame, provided the angular points be a little rounded to prevent their catching and fcraping the teeth of the wheel, though it is fafer to give a little addition for the curves.

Under our article CLOCK-*making*, we faid that the driving wheel or pinion ought to be fomewhat larger than according to its calculated proportion; but we did not give the reafon there, which is, that in thofe cafes where the teeth are actuated both before and behind the line of the centres, the impulfe of the tooth before the line of the centres takes place later than it otherwife would do, as well as occafions a fmaller fhock at the commencement of the impulfe. The defect attending fuch a conftruction is a little more velocity in the driver than in the driven wheel or pinion, but this is confidered as of lefs importance than the fhock otherwife occafioned in movements, with pinions of low numbers.

It is of the utmoft importance, that the mechanift fhould bear in mind another practical rule, which we have now to offer, as it arifes out of the preceding difcuffion of this fubject, which is, that, in all ordinary cafes of wheel-work, the portion of an interior epicycloid of any tooth, whether that portion be a curve or ftraight line, fhould always drive the portion of an exterior epicycloid of the tooth of its fellow, before the line joining their centres; but that, on the contrary, a portion of an exterior epicycloid muft always drive a portion of an interior epicycloid, whether the latter be a curve or ftraight line, after the line of the centres.

We are not, however, to infer from this rule, that it is a matter of indifference, whether a wheel drive its pinion, and a pinion its wheel, before or after the line joining their centres; for in the action that takes place before this line, there is much friction occafioned, by the fliding of the tooth of the driver, along that of the driven wheel or pinion, as well as an accumulation of dirt occafioned at the bottom of the tooth of the latter; whereas, when the action is after the line in queftion, the teeth roll on one another, and the dirt is carried out of the fpace between the teeth; this confideration is the greateft recommendation of that kind of action, where an exterior epicycloid impels an interior one only after the line of the centres, which mode we have feen, cannot take place with low pinions; from which view of the fubject the direct inference is, that pinions of high numbers ought to be adopted in every cafe that admits of fuch an adoption. We may alfo refer to the fame caufe the origin of the common bay-leaf fhape of a tooth, which impels both before and after the line of the centres, and acts at the pitch-line, at the moment of paffing this line.

The epicycloidal teeth, fuch as we have defcribed, are not however the only ones which have the requifite property of tranfmitting the force and velocity uniformly, though we have hitherto confined our obfervations to thefe fhapes, by reafon of their being moft generally ufed. Two teeth which are formed by the evolution of threads from their refpective geometrical circles, as feen in *fig.* 7., and which are fhaped by the interfection of portions of their refpective involutes, though lefs known and confequently lefs ufed, have, according to the late profeffor Robinfon and others, the fame requifite property as the foregoing ones, and may be ufed inftead of them in practice. The curve formed at any point, i, by a thread refting at the point H, of the wheel or point, h, of the pinion, is perpendicular to the thread, and the thread is a tangent to the circumference of the circle from which it is evolved; whenever therefore one tooth drives the other, the point, i, of action lies in the line H h, which is a common tangent to both circles, and the force is conftantly exerted in the direction of the common tangent, in every pofition of the acting teeth; the nature of the action confequently will be precifely the fame as though the points H and h were in contact, and impelled each other at the point of contact, hence the angular velocity of K H, will be to the angular velocity of $k\,h$, as the radius, $c\,h$, is to the radius C H; that is, the motion and force communicated will be uniform.

It is evident from an infpection of the figure, that when teeth compofed of interfecting involutes are ufed in a pair of of wheels, or in a wheel and pinion, the geometrical radii must have the whole length of their respective teeth added to them to constitute their acting radii; and also, that the two proportionate circles which come in contact and designate the place of the pitch-line in ordinary epicycloidal wheel work, must be removed from each other to a distance equal at least to the length of the longer tooth. This length will depend upon the geometrical radius of the wheel or pinion, and coarseness of the tooth conjointly. In large wheels the tooth will be long, and in small ones the contrary, where the coarseness is the same, the breadth of the tooth being in every instance the abscis, and its length the ordinate of the involute or curve that forms one side of the tooth. The full length of any tooth of a given coarseness, in a wheel of a given diameter, may consequently be ascertained by a fluxional process, which we intentionally avoid as being too intricate for ordinary purposes.

This formation of a tooth, where the involute is derived from the wheel or pinion's own circumference, is recommended by professor Robison, on account of its admitting the simultaneous action of many teeth, thereby participating the force among them; but as he does not profess to say that they act without friction, we conceive that horology would not be benefited by their adoption, even if the formation were practical. Mr. Brewster, in his new edition of Ferguson's Lectures, vol. ii. page 223, has properly observed, that the principle of the professor's teeth is not new. De la Hire having long ago considered the involute of a circle as the last of the exterior epicycloids, which it may be proved to be, if we consider the generating straight line as a curve with an infinite radius; and the involute may be described most conveniently by a ruler or other straight edge, bearing a tracing point moved round the circular base, while they are kept in contact. Accordingly, our rule for the situation of the geometrical or primitive circles holds good. The teeth which project beyond these circles are formed by portions of exterior epicycloids; but our rule for the action before and after the line of the centres, cannot, in this case, apply, because here the interior epicycloid is not concerned, and the formation of the exterior one has no reference to the diameter of its fellow. (Vide the articles EVOLUTE and INVOLUTE.)

After having said so much on the requisite shape of a tooth in a wheel or pinion, to transmit the motion and force equably through a movement; we might here add the necessary directions for calculating the suitable numbers for constituting movements of various kinds; but these have been anticipated under the article CLOCK-*making*, to which the reader is desired to refer, and in which he will see that we have divided the whole movement of the going part into three portions; any one of which may be altered at pleasure, without affecting the other two. Upon the plan there laid down, we have calculated three separate tables of the different portions, which we subjoin, with a view of giving a great variety of trains, to be had by mere inspection, and of thus saving the clock-makers the trouble of going through tedious calculations, according to the prevailing custom of taking into one calculation the whole movement at once, and of breaking it into portions by a substitution of ratios equal in value to the different factors of an assumed product, which process makes the determination intricate.

TABLE I.

The first Portion of a Clock-movement.

Hours.	6	7	8	9	10	11	12	13	14	15	16
3	18	21	24	27	30	33	36	39	42	45	48
4	24	28	32	36	40	44	48	52	56	60	64
5	30	35	40	45	50	55	60	65	70	75	80
6	36	42	48	54	60	66	72	78	84	90	96
7	42	49	56	63	70	77	84	91	98	105	112
8	48	56	64	72	80	88	96	104	112	120	128
9	54	63	72	81	90	99	108	117	126	135	144
10	60	70	80	90	100	110	120	130	140	150	160
11	66	77	88	99	110	121	132	143	154	165	176
12	72	84	96	108	120	132	144	156	168	180	192
13	78	91	104	117	130	143	156	169	182	195	[illegible]
14	84	98	112	126	140	154	168	182	196	210	224
15	90	105	120	135	150	165	180	195	210	[illegible]	240
16	96	112	128	144	160	176	192	208	224	240	256

TABLE II.

The second Portion of a Clock-movement.

Factors.	6	7	8	9	10	11	12	13	14	15	16
4 15	24 90	28 105	32 120	36 135	40 150	44 165	48 180	52 195	56 210	60 225	64 240
$4\frac{2}{7}$ 14	84	30 98	112	126	140	154	168	182	60 196	210	224
$4\frac{1}{2}$ $13\frac{1}{3}$	27 80		36	120	45		54 160		63	200	72
$4\frac{8}{13}$ 13	78	91	104	117	130	143	156	60 169	182	195	208
5 12	30 72	35 84	40 96	45 108	50 120	55 132	60 144	65 156	70 168	75 180	80 192
$5\frac{5}{11}$ 11	66	77	88	99	110	60 121	132	143	154	165	176
6 10	36 60	42 70	48 80	54 90	60 100	66 110	72 120	78 130	84 140	90 150	96 160
$6\frac{2}{3}$ 9	40 54	63	72	60 81	90	99	80 108	117	126	100 135	144
7 $8\frac{4}{7}$	42	49 60	56	63	70	77	84	91	98 120	105	112
$7\frac{1}{2}$ 8	45 48	56	60 64	72	75 80	88	80 96	104	105 112	120	120 128

TABLE III.

The third Portion of a Clock-movement.

	6	7	8	9	10	11	12	13	14	15	Vibrations per second.	Length of the pendulum.
12	[illegible]	35	40	45	50	55	60	65	70	75	2	9.8
15	24	28	3	36	40	44	48	52	56	6		
20	18	21	24	27	30	33	36	39	42	45		
30	2	14	16	18	20	22	24	26	28	30		
12			52				75				$2\frac{1}{2}$	6.27
15	30	35	40	45	50	55	60	65	70	75		
25	18	21	2	27	3	33	36	39	42	45		
30	15		20		2		30		35			
15	36	42	48	54	60	66	72	78	84	9	3	4.35
18	30	35	40	45	50	55	6	65	70	75		
20	18	21	24	27	30	33	36	39	42	45		
45	12	14	16	18	20	22	24	26	28	30		
15	42	49	56	63	70	77	84	91	98	105	$3\frac{1}{2}$	3.20
21	30	35	40	45	50	55	60	65	70	75		
35	18	21	24	27	30	3	36	39	42	4		
15	48	56	64	72	80	88	96	104	112	120	4	2.45
20	36	42	48	54	60	66	72	78	84	90		
24	30	35	40	45	5	55	60	65	70	75		
30	24	28	3	36	40	44	48	52	56	60		
40	18	21	24	27	30	33	36	39	42	45		
15	54	63	72	81	90	99	108	117	126	135	$4\frac{1}{2}$	1.935
27	30	35	40	45	50	55	60	65	70	75		
45	18	21	24	27	30	33	36	39	4	45		
15	60	70	80	90	100	110	120	13	140	150	5	1.57
25	36	42	48	54	60	66	72	78	84	90		
[illegible]	30	35	40	45	50	55	60	65	70	75		
5	18	21	24	27	30	3	36	39	42	4		

Explanation of Table I.—Table I contains numbers suitable for the great wheel, and the pinion on the arbor of the centre wheel, together denominated "the first portion of a clock-movement," which is that on which the duration of motion at one winding up depends: the numbers on the uppermost horizontal column, from 6 to 16 inclusively, represent so many pinions; the numbers in the first vertical column, from 3 to 16 inclusively, are the respective hours in which the barrel or fusee turns once, as the case may be; and the larger numbers beginning with 18, and ending with 256, in the intersections of the horizontal and vertical columns are the great wheels. By way of exemplification, suppose we want a fusee to revolve in twelve hours, with a pinion of 8 on the arbor of the centre wheel, the intersection of 12 hours at the left-hand side, and eight at the top, gives 96 for the number of teeth in the great wheel, to produce the desired effect; or if the pinion had been required for a wheel of 96, to revolve in 12 hours, over 96, in the column of 12 hours, stands the pinion 8. In the same manner for 4 hours, and a wheel of 48, the pinion will be 12, and *vice versâ*.

Explanation of Table II. Table II. contains wheels and pinions suitable for the second portion of a clock-movement or first portion of the train, being that which effects a multiplication of 60, and regulates the velocity of the seconds' hand, by making its arbor revolve in one minute. This might be done by one large wheel of 300, and a small pinion of 5, but such a construction would require a large frame; a composition of two wheels and two pinions is therefore substituted to produce the same effect more conveniently, the first wheel being placed on the centre or hour arbor that carries the minutes' hand, and the last pinion on the arbor of the seconds' hand that revolves in a minute. The uppermost horizontal column contains the pinions from 6 to 16 inclusive, like Table I., and the left-hand vertical column contains couplets of factors, which, multiplied together, produce 60 always as a product. Any pair of factors, which are coupled together by a $\}$, may be taken at pleasure, and the wheels in the spaces made by the intersections of the vertical and horizontal columns, under the pinions made choice of, and opposite the factors selected, will be proper for the second portion of the movement. For instance, when pinions of 8 are used with the factors $\left.\begin{matrix}7\frac{1}{2}\\8\end{matrix}\right\}$, the wheels, found in the space formed by the intersection of the vertical column under 8 and horizontal column in which $\left.\begin{matrix}7\frac{1}{2}\\8\end{matrix}\right\}$ stand, are 64 and 60; but if the pinions were to be assumed, one 10 and the other 8, then the wheels would be either 80 and 60, or otherwise 75 and 64, accordingly as the pinion 10 is made a part of the ratio to represent the factor 8, or the factor $7\frac{1}{2}$, which it may be taken to do indifferently; hence the notation may be $\frac{10}{80} \times \frac{8}{60}$, or $\frac{8}{80} \times \frac{10}{60}$, or $\frac{10}{75} \times \frac{8}{64}$, or $\frac{8}{75} \times \frac{10}{64}$, the result in point of accuracy is the same, but in the construction, the wheels of largest diameter and weight are required to be taken first in the movement, because the diameters diminish as the train ascends, by reason of the diminution of the transmitted force, which otherwise would not overcome the inertia of the wheels, which it is required to do at each vibration of the pendulum: any two pair of wheels and pinions properly taken out of the corresponding columns when reduced to a simple ratio by the usual method of multiplying the numerators together for one numerator, and the denominators for one denomination, will be found equal to $\frac{1}{60}$; thus $\frac{10}{80} \times \frac{8}{60} = \frac{80}{4800} = \frac{1}{60}$, and $\frac{10}{75} \times \frac{8}{64} = \frac{80}{4800} = \frac{1}{60}$, as before; therefore, if the first wheel revolve in an hour, the last pinion will, in this and in every other instance, revolve in a minute. The diminution of the diameter of the third wheel of the movement, which is the second wheel of the train, may be effected in two ways, either by taking the seconds' pinion smaller than the first from a column at the bottom of the table, where the factors are nearly of equal value, or by taking the pinions alike, and the wheels from one of the higher horizontal columns where the factors differ considerably in value; thus $\frac{7}{60} \times \frac{6}{42}$ from column $\left.\begin{matrix}7\\8\frac{4}{7}\end{matrix}\right\}$ and $\frac{7}{70} \times \frac{7}{42}$ from column $\left.\begin{matrix}6\\10\end{matrix}\right\}$ are each equal to $\frac{1}{60}$, but in the first portion of the movement the ratio of the size of the two wheels is 60 : 42, and in the other 70 : 42, from which mode of comparison of the columns it will be seen that a decrease in the diameters of almost any given ratio may be adopted from this table, so comprehensive is its extent, as it relates both to the variety of 11 pinions, and to the choice of 10 pair of factors, which begin with the ratio 4 : 15, or 1 : 4, and end with $7\frac{1}{2}$: 8. The

The principal care to be taken is, that every wheel be taken under its own pinion and opposite its own factor; for another instance, in the horizontal column of factor $\left.\begin{matrix}6\frac{2}{3}\\9\end{matrix}\right\}$, the pinions of 9 will do for wheels 81 and 60; or otherwise, wheel 90 may be taken with pinion 10, and wheel 60 with pinion 9; that is, any wheel may be taken opposite its own factor, provided the pinion in the same column over it be used as its fellow; so that examples may be given to a very great extent, which will afford abundant means of ascertaining by experiment the best possible numbers for this part of the movement, without the trouble of calculation.

Explanation of Table III. Table III. contains the third portion of a clock-movement, or second portion of the train, which is that on which the number of vibrations per second depends. When a vibration is performed in an exact second, one wheel only is necessary for this purpose, with 30 teeth, because one tooth completely escapes the pallets at every second vibration, which wheel must be placed in this case on the arbor of the seconds' hand, and is usually denominated the swing wheel; also a wheel of 60, similarly placed, will be proper for half seconds, 75 for $2\frac{1}{2}$ vibrations per second, and 90 for 3 per second; but these last numbers are found too high for portable clocks, time-pieces, &c. therefore a wheel and pinion are introduced in addition to the escapement-wheel, in order to diminish its diameter into a convenient size for a portable construction, as well as to render it light, so as to have but little inertia to be overcome by the diminished force, which acts at this part of the movement. In ordinary pieces the two wheels are, one a contrate-wheel, and the other called the crown-wheel, with the pinion on its arbor, but the wheels may all have the ordinary form of the wheels of a clock that swings seconds, it being not the shape, but the numbers of the teeth of the wheels and pinions that determine the frequency of the vibrations. The uppermost horizontal column in this table, like that in the two preceding tables, contains all the variety of pinions from 6 to 15 inclusively; the pinion of 16 being omitted, however, to make room for two additional vertical columns at the right hand of the table, the first for the number of vibrations per second made by the pendulum, and the other for the length of the corresponding pendulum in inches and decimal parts, measured from the centre of suspension to the centre of oscillation, which two data once fixed upon determine the horizontal column out of which the wheels must be taken with a given pinion; the left-hand vertical column is that in which one of the two wheels is found, and the number standing on the same horizontal line, under the given pinion, is the other; for as the product of the two wheels, divided by the pinion under which one of them stands, is always equal to 60 in the highest large column, or column of 2 vibrations per second, it is of no importance to the accuracy which of the two wheels is made the pallet-wheel; the determination of this point being a matter of practical convenience; in the same manner in the second large horizontal column, the quotient arising from the product of any two wheels standing in the same line taken horizontally, one in the first vertical column, and the other under the chosen pinion, divided by the pinion, is always 75; in the third parallel column the quotient so obtained is 90; in the fourth 105, and so on; hence any of the combinations adopted will be equal in value respectively to those large simple numbers used as pallet-wheels without such combination, which, it has been said, are objectionable in practice.

Let our first example be to ascertain the requisites contained in the table for a half-seconds' pendulum, where a pinion of 8 is used?

In the first place, 12 with 40 may be taken as the required numbers for the two wheels; in the second, 15 with 32; in the third, 20 with 24; and, lastly, 30 with 16; any one of which wheels may be the pallet-wheel, as the nature of the escapement may require; if the crown-wheel escapement is used, which requires an *odd* number of teeth for its action to take place at opposite sides of the wheel, 15 must necessarily be the pallet-wheel, and 32 the other, with the given pinion of 8: but whichsoever of these couplets of wheels is adopted, the effective length of the pendulum must, according to the last vertical column, be 9.80 inches.

Again, for a pendulum that is required to vibrate 3 times per second with a pinion of 12: we have, in the first place, 15 with 72; secondly, 18 with 60; thirdly, 30 with 36; and, lastly, 45 with 24; so that either 15 or 45 may be in this instance the crown-wheel, and for a different escapement any of the eight numbers mentioned; and the choice is equally extensive with any other pinion that may be chosen from 6 to 15: the pendulum in this case is only 4.35 inches.

In this way, by means of the table before us, the third portion of a clock-movement may be varied almost at pleasure without affecting the other two portions, and a pendulum of any of the calculated lengths may be applied to works previously constructed; which circumstance will enable the workman to metamorphose a portable clock into a large one, and the contrary, without difficulty, or without even a knowledge of the operations of arithmetic.

We might have extended this table to take in different intermediate lengths of the pendulum and corresponding number of vibrations per second, but our object is to banish incommensurate vibrations from clock-movements, and to introduce those only which constitute some convenient subdivision of the second, to answer the nicer purposes of philosophy without extra labour and expence. The three or four last horizontal columns indeed, it may be said, will not be of much service in clock-movements, by reason of the shortness of the pendulums; but they will be found particularly useful in watch-work, as will also the other tables, which are so comprehensive as to apply with equal propriety to clock and watch-movements.

Clock-*tools*. While clock-making was in its infancy, and the different parts of the machine continued to be made by the same workman, each clock-maker was obliged to design and manufacture his own tools agreeably to his own inclination; but as soon as the art branched out into different occupations, tool-making became also a business of itself, and is now quite distinct from clock-making, nay, has itself ramified into various branches. In the present state of this manufactory by far the greatest number of clock-tools are made in Lancashire, and become an article of commerce among the ironmongers all over his majesty's dominions. In London there are a few houses that deal chiefly in clock-tools, engines, and rough materials ready prepared, as to size and shape, for the workmen; one of the principal of these is Fenn's in Newgate Street, No. 105, where tools of all kinds may be had at moderate prices. It is much to be regretted that a Swiss tool and engine-maker, called Petitpierre, who lately worked in an attic of No. 161 Fleet Street, and who made tools and engines in a very superior manner, was some months ago obliged to quit the kingdom for want of regular employ, though his prices were by no means exorbitant.

It

It will not be expected of us, to prefent the reader with all the variety of tools that individuals have refpectively contrived, but to lay before him fuch a collection as cuftom has fanctioned in the trade; which we propofe to do in three plates, devoted entirely to this purpofe; neither will it be expected, that we fhould particularize all the different ufes to which any individual tool may be applied, much lefs to point out the pofitions in which they ought to be held in the act of working, which would require almoft an unlimited variety of plates; it feems to be fufficient for our general purpofe, if we give a lift of the different tools at prefent in common ufe, with references to the plates, where the reader will comprehend the nature and ufe of each tool by a furvey of its figure, better than from any verbal defcription without the figures. We fhall, therefore, confine the remaining portion of this article to a fimple explanation of the plates.

Plate XIX. *of Horology.*

Fig. 1. A motion-arbor, or arbor for turning wheels on, with a faftening nut.
2. Motion-arbor, that fcrews up to the fhoulder, with a fmall nut to faften.
3. A plain arbor for collets, or tubes, to hold by friction.
4. A flit arbor for holding and turning fmall pieces of metal.
5. A pair of cutting bullet-compaffes for fitting any central hole, in defcribing or cutting circles.
6. A cutting-leg for ditto.
7. A marking-leg for ditto.
8. A ftake, or fmall anvil, for hammering, &c. on.
9. Common flat, fhort-nofed pliers for holding any piece of metal.
10. A pair of callipers, with a ftraight edge, adjuftable by a thumb-fcrew, of ufe for trying if a wheel is placed at right angles to its arbor, or what is called in the flat, and alfo if it is perfectly concentric, or in the round.
11. Common callipers for meafuring diameters.
12. A frame-guage, infide and out.
13. A pinion-guage, with fpring and fcrew adjuftment.
14. Beam-compaffes for cutting out circular pieces of metal from a folid plate, defcribing large circles, dividing rectilinear and curvilinear lines, &c.
15. A fquare or rectangular piece of brafs.
16. A clamp for holding pieces of metal to be filed or riveted.
17. A drill-arbor and drill in a focket for various drills, to be ufed with a bow and gut.
18. A drill detached to fit the faid arbor.
19. A drill of larger fize.
20. A tool or graver for cutting grooves, which may be of various fhapes and fizes.

Plate XX. *of Horology.*

Fig. 1. A faw for metal, with a wooden handle.
2. Cutting pliers for fhortening pins or for cutting wire.
3. A bench-vice, or vice to be clamped to a bench.
4. A hand vice for holding a fmall piece faft.
5. Clamping pliers for holding pins, &c. faft in filing.
6. Pendulum-pliers or long-nofed pliers.
7. Pivot-drill with a friction-ferril.
8. Drill-arbor in a drill-frame, to be held in a bench-vice.
9. A drill to fit the focket of the arbor, when it has a fquare tapering hole.
10. Ditto of larger bore.
11. Screw-head tool, including the arbor and frame with a reft, to be put into a bench-vice.
12. A holding piece of ditto, detached from the end of the arbor, and tapped with a female thread, to hold the fcrew to be dreffed.
13. Ditto with a different thread.
14. A detached ferril for a drill or arbor.
15. Ditto in two halves, with adjufting-fcrews to fit any arbor or drill.
16. A fcrew plate with different holes tapped.
17. A tap to be held in a hand-vice, for making a female thread in any hole. *N. B.* When long fcrews are required to be made, a die, fuch as the mathematical inftrument-makers ufe, is better than a fcrew-plate, for preferving the fcrew from bending; there muft be as many taps as the plate has different holes tapped.
18. A fcrew-driver, of which there are various dimenfions.

Plate XXI. *of Horology.*

Fig. 1. A brace for receiving various bits.
2. A chamfering or counter-finking tool to fit the brace, for which a large drill may be fubftituted.
3. A pentangular or five-fided broach to fit ditto.
4. A round broach to fit ditto.
5. A fquare broach to fit ditto.
6. A deepening tool, for adjufting the engagement of wheels with wheels or pinions, not as yet much ufed in England.
7. Turning-frame, or clock-lathe, of which there are various fizes, and conftructions; fome going by a bow like the prefent one, fome by a hand-wheel, and fome by the foot with a large wheel and crank actuated by a lever which is trodden upon. See Lathe.
8. A graver for cutting the metal in a turning-fame.
9. A large ditto.
10. An adjufting-tool for fufees, with fliding weights, to fuit any given maintaining power of a clock or watch.
11. A tool for turning pivots in, when inferted into the end-hole of the turning-frame.
12. A triangular tapering-file.
13. A file for flitting or cutting the teeth of pinions.
14. An equalling file, or file for the fpaces between the teeth of a wheel, when cut in an engine.
15. A common hand-file with a fafe edge for ordinary work.
16. A rounding-off file, for the ends of the teeth in wheels and pinions.
17. A file for croffing-out, or forming the croffes and rim of a wheel.

Befides the above there are various other files differing in fize, fhape, and coarfenefs, according to the work they are defigned to perform.

Clock-*work.* The word *Clock-work*, in its original fignification, imported thofe wheels and pinions, latches, catches, fprings, fly, hammer, &c. which conftitute the ftriking, or what was formerly called the clock, part of the works of a large horological machine; but fince clocks became common and portable, the term has been applied in a more general fenfe to the mechanifm of the going part, as well as of the ftriking part, and even fometimes to the works of thofe machines, which refemble the works of a clock in their appearance and action. Under this head, therefore, we mean to defcribe fuch detached pieces of clock-work as are not to be generally met with, but which feem, either from their utility or curiofity, to merit a public notice.

1. *Striking Part, with one Wheel and one Pinion.—Fig.* 1, of *Plate* XXV. of *Horology*, is a front view of the ſtriking part of a clock, purchaſed in the year 1806, at the ſale of a gentleman in Suſſex, who is now deceaſed, but who indulged his fondneſs for mechanical contrivances, at an almoſt incredible expence; this ſtriking work is ſo ſimple, that it has only one wheel and one pinion, and no other fly but the hammer, itſelf, and is, notwithſtanding, capable of repeating the laſt hour at any time, with the addition of a ſtring attached to the lifting piece; after our minute deſcription of the ſtriking mechaniſm of an eight-days clock, with the ſnail and rack, it will not be neceſſary for us to repeat what we have already ſaid on their action, but merely to confine ourſelves to the movement, bell, and hammer. The frame of this clock is in the ſhape of a croſs, confined by the pillars A, B, C, and another below, not ſhown; the great wheel of the ſtriking part has 300 teeth, with a barrel and ratchet as uſual on its arbor; it is actuated by a weight ſuſpended by the chain D, and drives a pinion of ſix leaves, when at liberty to move; F is a rack placed on a long lever, the tail of which, as uſual, reſts on a ſnail, on the 12-hour wheel; and G is a lifting piece to raiſe the click or hawk's-bill H, which it does by means of a pin ſliding underneath the piece H, whenever the pin in the one hour wheel moves its tail, as uſual: on the protruding end of the pinion's arbor, a gathering pallet is fixed in the common way, the long tail of which reſts on the pin at the right-hand end of the rack, when the rack is gathered up to the laſt tooth; and the click, H, is heavy enough to fall by its own weight, after ſliding over the inclined part of any tooth; all which actions are ſimilar to thoſe we have before deſcribed in *Plate* XII. The bell is mounted on the uppermoſt pillar, as ſhown in the figure, and a lever, I, is faſt to the middle of the pinion's arbor within the frame; this lever has what may be called a leg, ſuſpended by a pin at its remote end, forming what we will call the knee-joint of the leg, the foot of which leg forms the hammer: now, it is eaſy to perceive, that when the pinion begins to revolve ſuddenly, the foot of the leg flies out by its centrifugal force, and the toe moves in the curve *a*, where it meets with the edge of the bell, againſt which therefore it ſtrikes and rebounds, by permiſſion of the knee-joint, to *b*, we will ſuppoſe, the place where it would have been found if the motion had been ſo ſlow as to have no centrifugal force: but this point is in the interior part of the bell, the foot therefore proceeds within the bell, and the revolution is completed ſilently, but at the next, and at every ſubſequent revolution, this ſtroke and conſequent rebounding are repeated, till the rack is gathered up, which regulates the number of ſtrokes. The ball, K, is only a counterpoiſe fixed on the tail of the lever I, and aſſiſts with it to form a kind of fly, to regulate the velocity with which the ſtrokes are ſucceſſively made. This mechaniſm is very ſimple, and appears to have been made many years, from the dirty ſtate in which we ſaw it; but has not, that we know of, been before deſcribed.

In the year 1803, the Society of Arts, in the Adelphi, London, voted to Mr. Edward Maſſey, of Hanley in Staffordſhire, a premium of twenty guineas, for a new ſtriking part of a clock; and in the ſame year, another premium of thirty guineas, to Mr. John Prior, of Neſsfield in Yorkſhire, for another contrivance to anſwer the ſame purpoſe: the drawings and accounts of both theſe inventions, were publiſhed in the tranſactions of the ſaid ſociety, for the year above ſpecified; but the deſcriptions, as there given, are ſo imperfect, that we have found it neceſſary to have new drawings taken from the models themſelves, which are preſerved in the repoſitory of the ſociety, from ſuch points of view that the action of the different parts may be rendered as intelligible as poſſible. We ſhall deſcribe Mr. Maſſey's contrivance firſt, as being ſomewhat analogous to the one we have juſt deſcribed, inaſmuch as that it has one wheel and one pinion only, inſtead of a train of wheels and pinions, as is uſual.

2. *Maſſey's ſtriking Part. Fig.* 1, of *Plate* XXVI. of *Horology*, is a perſpective view of Mr. Maſſey's model, with the front plate of the frame removed, or ſuppoſed to be tranſparent, to ſhow the mechaniſm included. A is the great wheel with 78 teeth, like the ordinary count-wheel, impelling the pinion *a* of eight leaves; on the arbor of pinion *a*, but at the oppoſite end, is a circular plate, B, with eight pins placed in a concentric circle, at equal diſtances, ſo that one pin correſponds to one tooth of the pinion; theſe pins being near the circumference of the circular plate act with the pallets *b*, *b*, and form a kind of eſcapement; the pallets are connected with a pendulum of about 9 inches long, which therefore vibrates pretty nearly half-ſeconds, between the eſcape of each ſucceſſive pin reſpectively. It is not neceſſary to ſhow the pendulum which may be hung on a cock, or on the pivot of the pallet's arbor, which is more ſimple for this purpoſe, and not objectionable, as it would be in the going part. The lever, *d*, is a locking detent, with a claw for locking the pins of the plate B, when it falls in the way of any one of them; on the arbor of the detent, *d*, is another detent with a triangular claw, *e*, which falls in the way of the pins of the great wheel, placed at unequal diſtances, like the notches in the locking-plate of a count-wheel; on which account the great wheel may be conſidered as a count-wheel alſo; to the ſame arbor of *d* and *e*, is alſo attached a third concealed lever, which reaches to the one hour wheel, and is moved by its pin once in each hour, in the ordinary way. On the poſterior face of the locking-plate, B, are eight pins in a ſmall concentric circle, dotted in the figure, which lift the hammer tail as uſual, to which a counteracting ſpring is applied, to give a ſmartneſs to the ſtroke of the hammer, as it ſtrikes the ſide of the horizontal bell, mounted over the frame, as ſhown in the figure. The action is thus; when the detent, *d*, is raiſed, by the pin of the one hour wheel of the dial-work not ſeen, the weight ſuſpended by the cord C, draws the barrel on the arbor of the great wheel round, and with it its ratchet, which takes the click of the great wheel, and therefore carries it alſo, the detent *e* being lifted at the ſame time with the detent *d*; the wheel now impels the pinion and plate B, which is not only the locking but ſtriking plate alſo; the pins begin to lift the hammer in ſucceſſion, and the ſtriking goes on; in the mean time the detent, *d*, falls within the circle of pins, as in the figure, in conſequence of the lifting pin of the one hour-wheel letting go the concealed lever, but ſo as not to impede the paſſage of the pins of the locking plate; preſently the neareſt following pin of the great wheel ſliding on the inclined face of the detent *e*, raiſes it far enough to move the claw of the detent, *d*, into the way of the pins of the locking plate, and then all motion is arreſted, till the dial-work raiſes the detents again at the end of another hour, when the ſame proceſs is repeated, the vibrations of the pendulum regulating at all times the velocity with which the lifting pins of the hammer-tail ſhall move ſucceſſively during the period of ſtriking.

3. *Prior's ſtriking Part. Figs.* 2 and 3 of the ſame plate, exhibit in perſpective the mechaniſm of Mr. Prior, which we have already mentioned. A is the great wheel of 78 teeth, which impel the double endleſs ſcrew, B, cut on the arbor of the fly C C; like *fig.* 1, this figure has the front plate of the frame ſuppoſed to be tranſparent, to expoſe the different levers, &c. to view in their reſpective ſituations of action; on the arbor of the great wheel is the barrel, as in

fig. 1; in a concentric circle, near the edge of the large wheel, are ſeven pins, at unequal diſtances, which catch the claw of a detent *a*, placed faſt to the arbor *b*, which arbor *b* has a play or motion in the direction of its length, that will allow its pivots to go more or leſs into the plates of the frame reſpectively, as circumſtances may require, and a ſpring preſſing on the end of the pivot, which comes to the front plate, puſhes it back towards the wheel, whenever this preſſure is not taken off; the ſpring alluded to being on the front plate, of courſe cannot be ſeen in the figure; alſo a ſmall circular plate of metal, carried by the arbor of *b*, juſt fits into a circular groove turned out on a contiguous and parallel arbor *d*, in ſuch a way that the arbors can revolve independently; but when one moves lengthwiſe acroſs the frame, the other muſt neceſſarily move with it, for which purpoſe the ſecond arbor, *d*, has alſo liberty or play lengthwiſe like the arbor *b*; to this arbor *d*, is fixed a ſecond detent *e*, with a claw turning inwards; *f* is a third arbor, parallel to the other two, but below them in the frame, carrying about its middle the long tail *i* of the hammer K, and at the end next the front plate a ſmaller tail, to be preſſed by the ſpring, *g*, in the act of ſtriking; on the plane of the great wheel next the eye, are 13 pins, which ſucceſſively lift the hammer by the tail *i*, while the great wheel revolves; on the face of the great wheel, beyond the inferior circle of pins, and within the ſuperior one, is a ſpiral groove, with ſix complete turns, into which the outer end of the detent *e* ſlides as the great wheel revolves; ſo that if the groove were equally deep and ſmooth throughout, the bent end of this detent would be carried gradually from the innermoſt to the outermoſt helix without ſtopping; but the fact is, that at certain intervals in the ſix-fold ſpiral, there are deep notches at the bottom of the groove into which the detent inſerts its claw by the preſſure of the ſpring, which we have ſaid is not to be ſeen; and whenever one of theſe depreſſions of the detent *e* takes place, not only its arbor *d*, but alſo the arbor *b* are carried towards the great wheel by their motion lengthwiſe, ſo that the claw of the detent *a* comes in the way of the ſuperior pins of the great wheel; the excavated notches in the bottom of the ſix-fold groove are ſo arranged, in point of relative diſtances, that the 12 are placed at ſuch intervals of the ſpiral as gradually increaſe, like the intervals between the notches of the locking plate on a count-wheel. The action takes place in this manner; the arbor *b* has a lever connected with the pin of the one-hour wheel of the dial-work, by which it is lifted every hour; this lever is not ſeen by reaſon of its being at the other ſide of the plate B A; at the ſame time the detent *a* is raiſed, and ſets the pins at liberty, the weight ſuſpended by the cord *h* now turns the wheel and fly; the detent *e* in the mean time advances in the ſpiral groove, and the 13 pins in the inferior circle raiſe the hammer, which as often ſtrikes the bell mounted horizontally over the frame; when the detent is at the beginning of the firſt ſpiral of the half dozen, one ſtroke only is made, until the excavation at the bottom of the groove allows the claw to drop into it, which drop preſents the claw of the detent *a* to the neareſt pin, and ſtops the ſtriking; after another hour the detent *a* is again raiſed, and the wheel proceeds to move, ſo that when the detent drops again it does not fall in the way of the pins, but continues at a little diſtance from their heads, ſo long as the bent end of detent *e* does not fall into the next excavation of the groove; when this happens, however, it then falls in the way of the ſaid pins, but in the mean time two ſtrokes have been given, and in the ſame manner the hours 3, 4, 5, &c. will be ſtruck till the hour of 12 arrives; at this hour the wheel is unlocked as before, and as ſoon as 10 out of the 12 ſtrokes of the hammer are made, the end of the detent *e* comes at an inclined plane *l*, which it aſcends till it is above the plane of the wheel, and at that inſtant falls by its own gravity to the beginning of the ſpiral neareſt the centre, in which it then begins to move, while the remaining two ſtrokes of the 12 are making, after which it falls into the excavated notch where we firſt found it, and the whole proceſs has now been gone through. It may have occurred to the reader, that during the fall of the detent *e*, by its own weight, from the outermoſt to the innermoſt groove of the ſix-fold ſpiral, the ſpring acting on the neareſt pivot of the arbor *b*, would carry it againſt the plane of the wheel, and make it catch one of the ſuperior grooves before it arrived at the bottom one; this would actually have been the caſe, if there had been no precaution taken to prevent ſuch accident; but the contrivance ſhown in *fig.* 3, is introduced as a preventive, which acts thus; the little lever under the ſlender ſpring turns on a ſtud ſcrewed into the interior face of the pillar plate, or that which we have repreſented as the pillar plate; this lever reſts on the ſhoulder of the projecting pivot, which is brought forwards into the frame, when the end of *e* aſcends the inclined plane we have mentioned; at this inſtant the ſpring forces the lever down between the ſhoulder of the pivot and the pivot hole, and prevents the return of the pivot, when the lever *e* is falling; and for a ſhort time after; but while the two laſt ſtrokes of 12 are making, a pin in the back face of the great wheel ſeizes the tail of the lever, and raiſes it from the ſhoulder and pivot hole again, until the pivot has returned to the ſituation it occupies when the wheel is locked. This mechaniſm, we think, is ingeniouſly contrived, and is very ſimple; inaſmuch as only one wheel is uſed as great wheel, count-wheel, locking wheel, and ſtriking-wheel, without even ſo much as a ſingle pinion; there are 78 teeth in the wheel, and 13 pins for the hammer-tail, $\frac{78}{13} = 6$, therefore, are the teeth that paſs at each ſtroke; but the ſcrew is double, and takes two teeth at once, hence the fly makes juſt three revolutions at each ſtroke of the hammer; and a ſmall weight is ſufficient, not only to maintain the motion of the wheel, but alſo to overcome all the obſtacles it meets with, which recommendations bid fair for bringing this ſtriking mechaniſm into uſe in thoſe clocks, where the repetition is not deſired.

4. *Strike or ſilent.* When we deſcribed an eight-days clock with the mechaniſm of repetition, we had occaſion to explain one of the methods of cauſing the clock to ſtrike or be ſilent by the mere ſliding of a pin to the right or left; but there is alſo another method of doing the ſame thing, which we propoſe to deſcribe here as a detached piece of mechaniſm. *Fig.* 2, of *Plate* XXV. ſhows all the parts that are neceſſary for explaining the mechaniſm we have alluded to. A is a cock on the front plate of the frame, into which a ſmall circular plate *b* is pivoted, on the arbor *a*, of which is inſerted the ſquare hole of a hand ſeen on the dial, pointing to one of the words *ſtrike*, or *ſilent*, engraved, or otherwiſe marked, in a ſmall circle near one corner of the dial uſually, but ſometimes at the top, accordingly as the other works require; B is a lever ſlit open at the top, and moveable on a ſtud, at the angular point where the tail *c* is inſerted; and *d* is the portion of an ordinary rack with two pins in it, one at the end of the circular part as uſual, and the other at *d*, where the tail, *c*, of the ſlit lever, B, is ſeen reſting; laſtly, *e* is the pin in the front plate againſt which the rack falls as uſual, when the ſnail is off, or when the clock ſtrikes 12. The uſe of this mechaniſm may be explained in a few words thus; when the hand on the arbor *a* is turned to *ſilent*, as in the preſent poſition, the tail *c*, of B, falls in the way of pin *d*, and

d, and prevents the ſpring of the rack-tail from throwing the rack back; in conſequence of which obſtacle, the tail of the gathering pallet continues on the other pin, at the end of the curved part of the rack, and the ſtriking mechaniſm continues to be locked: but when the hand we have ſpoken of is turned to the word *ſtrike* on the dial, the tail, *c*, of the ſlit lever is raiſed above the pin, *d*, the rack falls without impediment, and the ſtriking takes place as though the mechaniſm before us had not been in the clock.

5. *Endleſs Cord of Huygens.* The reader has already read a partial deſcription of an endleſs cord, for keeping a clock in motion during the act of being wound up, when he peruſed our account of a thirty-hours clock; to do juſtice to Huygens, the original inventor, and to make the contrivance more clearly underſtood, we beg leave to refer the reader to *fig.* 3, of *Plate* XXV. where the contrivance in queſtion is diſtinctly exhibited in a way that we preſume will make it clearly underſtood. A is a metallic pulley, with pins inſerted into the bottom of its groove, and placed faſt to the centre-wheel without a ratchet; B is a ſimilar pulley, with pins and a ratchet wheel faſtened to it; the pulley and wheel, together with the click C, and its ſpring D, are all placed faſt in a detached ſtate on the frame, or caſe of the clock, as may be moſt convenient; E is a pulley, round which the endleſs cord goes, after this cord has embraced both the ſuperior pulleys, and to this pulley is attached the maintaining power, F, one half of the weight of which reſts on the pulley, A, and the other half on the pulley, B, ſo that this power is double the weight of an ordinary power, ſuſpended by a ſingle cord round a barrel; the cord, G, which goes round all the pullies, as repreſented in the figure, is made ſhort in the plate, for the ſake of being made an endleſs one, and is kept ſtretched by the ſmall weight H, and correſponding pulley. Suppoſe it to be neceſſary now to draw up the power, F, at any time; the hand takes hold of the cord at G, and pulls it down, the pulley, B, turns round in conſequence of its pins being caught by the cord; and the click ſlides over the inclined teeth, and holds the ratchet in whatever ſituation it is left when the hand lets go the cord; the pulling down of the cord, G, pulls up the part, I, of the cord, and with it the power, F, while the pulley, F, rolls along the part, K, of the ſame as it aſcends, which part, K, does not alter its ſituation, except by the ſlow revolution of the pulley, A, *i. e.* by the going of the clock; in the mean time the ſmall weight, H, falls towards G, and deſcends at the ſame time that F aſcends, till this power, F, approaches the two pulleys A and B, when the winding concludes by means of a ſtop applied over the pulley, E, to prevent the further aſcent of the power, F. From this brief account of the mechaniſm before us it is evident, that one half of the power, F, continues to actuate the pulley, A, during its aſcent, as well as during its deſcent, and that the quantity of fall compared with half the circumference of the pulley, A, will determine the continuance of going after each winding up.

6. *Forcing Spring.* We have ſeen the application of an auxiliary ſpring, attached to the fuſee of a chronometer, and to the barrel of an aſtronomical clock, conſtituting the former a going fuſee, and the latter a perpetual ratchet, both of which anſwer the ſame purpoſe as the endleſs cord we have juſt deſcribed; but there are other applications of a ſpring to produce the ſame effect, that have not yet been deſcribed. *Fig.* 4, of *Plate* XXV. repreſents a ſpring of this kind acting in the teeth of the ſecond wheel of the train, as we have ſeen it in ſome old Engliſh clocks. A and B are portions of the two plates of a clock frame; C, the ſecond wheel of the train; D, the arbor of a ſliding pallet; H, moveable in the ſmall oblong frame; I, attached to the arbor; K, a ſlender ſpring on the arbor preſſing againſt the ſtraight tail-piece of the pallet, which paſſes through a hole in the arbor; E, a ſpring ſcrewed to one of the plates of the frame, and preſſing on the tail-piece; F, of the arbor's pivot; and G, a lever with a pin projecting through the dial, with its oppoſite end reaching over the hole of winding, which it covers when the clock is going. The mode of application is thus; when the clock is to be wound up, the pin of the lever, G, is puſhed down a circular aperture of the dial to uncover the hole for the key that is uſed in winding up, which key could not otherwiſe be put into its hole in the dial; the lever, G, being faſt to the front pivot, the arbor, D, turns it a little way round during this motion, for uncovering the key-hole; the tail, F, of the arbor, conſequently is lifted upwards, and with it the ſpring, E, which is the auxiliary ſpring that moves the train by its effort to return the tooth of the pallet, H, is ſo ſhaped, that it will ſlip over a tooth of the ſecond wheel in one direction, but not in the other, without carrying the wheel with it, as may be ſeen from its ſhape in the figure; when, therefore, the pin of G is moved downwards, before winding, a ſmall ſpace, or portion of a revolution of the arbor, D, which bears the pallet and its frame, it carries the end of the pallet next the wheel over a tooth or ſometimes over two teeth; the ſmall ſpring, K, in the mean time allowing the pallet, H, to recede in its frame, I, till it has paſſed the ſaid tooth or teeth; but as the ſpring, K, inſtantly puſhes the pallet into the ſpace next to the tooth it has juſt paſſed, and holds it there, the pallet is urged back again by the auxiliary ſpring E, and carries with it the wheel ſo far that it has room to eſcape from the end of the tooth actuated by it, which eſcape does not take place till ſome time after the clock is wound up: hence the clock continues to go during the period of its being wound up, and when the force of the ſpring is an equivalent for the maintaining power, which it may be made to be when ſtretched back to a certain point; the contrivance will be a convenient temporary ſubſtitute for the maintaining power.

7. *The French Forcing-ſpring.* The forcing-ſpring made uſe of in ſome of the French clocks is ſomewhat different from the one we have juſt deſcribed, and we think more ſimple in its conſtruction, which is this; F A E, in *fig.* 5, of *Plate* XXV., is a rod of metal, moveable on a ſtud ſcrewed into the front plate at A, where is a ſmall tail-piece in contact with a quieſcent ſpring, B, alſo ſcrewed to the ſame plate; at F is a pin in the rod, which comes through a curved aperture in the dial, deſcribed from the point, A, with the radius A F; C is as before the ſecond wheel of the train, or at leaſt a portion of it; D is a pallet moveable on a pin ſcrewed into the ſuperior part of the lever F A E; and E is a ſlender ſpring preſſing againſt the pallet to keep it into the teeth of the wheel; the application of this mechaniſm is in this wiſe; the lever is ſuppoſed to cover the key-hole at ſome point near F, to uncover which the pin, F, is carried upwards towards G in the aperture of the dial; the end, E, of the lever is by this motion brought downwards, and the pallet, D, being curved on the back of it, ſlides over a tooth, or ſometimes two teeth, below it, by its motion on the pin at its upper end, the ſlender ſpring, E, during this time receding; but when the pallet, D, has paſſed the required tooth or teeth, its ſpring, E, puſhes it into the ſpace contiguous, and its ſtraight interior face lays hold of the tooth next above it; in this ſituation the mechaniſm is ready for action, but would remain inactive if the ſpring, B, or auxiliary ſpring, had not at the ſame

fame time been ftretched back by the tail-piece at A; this fpring, B, however, exerts its force to come back to its quiefcent ftate; that is, to bring the pin back again from G to F, its original fituation, and confequently raifes the end, E, with the pallet and pallet-fpring, to its original fituation, which cannot take place without urging the wheel, C, round along with the pallet; this contrivance, therefore, is a fubftitute for the maintaining power, fo long as its action continues; and it is eafy to perceive, that after a few minutes continuance the pallet will efcape the tooth which it impels *pro tempore*, and the maintaining power will then refume the fole command of the train.

8. *The Bolt and Shutter.*—Another contrivance to anfwer the purpofe of making a clock go while it is under winding is the bolt and fhutter, in which a weight is fubftituted for a fpring; *fig. 6*, of *Plate* XXV., reprefents the great wheel and barrel, together with the temporary apparatus, to be fubftituted for the maintaining power thus; the arbor, A, is pivoted into two collars, *a* and *b*, within the frame of the works, in which it is at liberty to revolve; this arbor carries three levers or arms, B, C, and D, all of which are made faft to it, and confequently revolve with it, whenever it is turned round; the lever, B, is juft long enough to extend to the hole in the dial for winding, oppofite the fquare end of the barrel-arbor, which hole it juft covers when in its ftationary fituation, by means of its circular extremity; the lever, C, carries a fmall bolt at its extremity, which is pufhed out by a cylindrical fpring of moderate ftrength, while it is confined to move in the direction of the length of this lever; and D, the third lever, has the weight appended, which is ufed *pro tempore* as a fubftitute for the maintaining power. From this fhort defcription it is eafy to perceive, that, when the clock is to be wound up, the lever, B, muft neceffarily be removed up or down, to allow the key to enter the hole in the dial's face; it is prevented from afcending, and therefore any perfon unacquainted with the nature of the mechanifm, who is going to wind up the clock, finds that he muft pufh down the covering end of B, to gain admiffion for his key; this motion of the lever, B, downwards, pulls down at the fame time the fecond lever C, and alfo elevates the third lever D, which is behind the centre of motion; but the lever, C, cannot defcend till the bolt, which meets with the teeth of the wheel, is pufhed in by them, after which it will pafs; the cylindrical fpring however inftantly pufhes it out again, and makes it fit a fpace between two teeth; in this fituation the weight, D, acting on the third lever, now urges both the levers, B and C, back again to their original fituations, and confequently urges the wheel forwards by means of the bolt, till they have attained thofe fituations; which will require fome minutes when the bolt is applied to the great wheel, according to our figure; but we are of opinion that it would be better to apply the bolt to the centre, or even the fecond wheel, where a fmaller weight would fuffice, and where it would continue to act a fhorter time; for the objection to the bolt and fhutter, as well as to the forcing-fprings juft defcribed, is, that their action continues for fome time after the act of winding in addition to the maintaining power, which therefore it doubles for a time, fuppofing the temporary power to be exactly equal to the permanent one, agreeably to the intention of the contrivance.

CLOCK-*Seaves*, in *Rural Economy*, a term applied to the black-headed bog-rufh.

CLOD, in *Agriculture*, a term frequently applied to a lump of earth, clay, or any other earthly material in a lumpy ftate.

CLODAGH, in *Geography*, the name of a river in Ireland, which rifes in the north-weft angle of the county of Cavan, and paffing by Swanlinbar falls into Lough Erne. It is alfo the name of a fmall river in the King's county which joins the Brofna.

CLODAWA, a town of Poland, in the palatinate of Kalifh; 24 miles E.S.E. of Guefna.

CLODDING-BEETLE, in *Agriculture*, a large beetle, formerly ufed in fome diftricts for breaking the clods in clayey and other ftiff tenacious forts of foil. But at prefent this fort of bufinefs may be much more expeditioufly performed, and at lefs expence, by means of rollers conftructed for the purpofe. See ROLLER.

CLODDY, in *Rural Economy*, a word fometimes applied to cattle, when thick, fhort, or full of flefh. It has the fame meaning as lumpy, when applied to beafts.

CLODEN, in *Geography*, a town of Germany, in the circle of Upper Saxony, and electorate of Saxony; 4 miles S.S.W. of Jeffen.

CLODIA FOSSA, in *Ancient Geography*, a city of one of the iflands of Venice, near the ifland Brendolo. Pliny.

CLODIÆ LEGES, in *Roman Antiquity*, comprehend a variety of laws, enacted by the inftrumentality of the tribune P. Clodius, in order to ferve his own purpofes of intereft or revenge. Thus, it was enacted in the year of Rome 695, 1. That the kingdom of Cyprus fhould be taken from Ptolemy, and reduced into the form of a province. This law was paffed in order to punifh that king for having refufed Clodius money to pay his ranfom, when taken by the pirates, and to remove Cato out of the way, by appointing him to execute this order of the people, that he might not thwart the unjuft proceedings of the tribune, nor the views of the triumviri, by whom Clodius was fupported. 2. That corn fhould be diftributed gratis to the citizens. 3. That no magiftrates fhould take the aufpices, or obferve the heavens, when the people were actually affembled on public bufinefs. 4. That the old companies or fraternities of the city, which the fenate had abolifhed, fhould be revived, and new inftituted. Thefe three laws were paffed with a view of conciliating the attachment of the people. 5. In order to pleafe thofe alfo of higher rank, it was enacted, that the cenfors fhould not expel from the fenate, or inflict any mark of infamy on any man, who was not firft openly accufed and convicted of fome crime by their joint fentence. The true defign of thefe feveral laws was to introduce the banifhment of Cicero; for which purpofe they were enacted; 6. That whoever had taken the life of a citizen uncondemned and without a trial, fhould be prohibited from fire and water. In this law Cicero was not named; but foon after, in an affembly of Clodius's hired flaves and incendiaries, it was exprefsly decreed that he fhould be interdicted from fire and water; that nobody fhould prefume to harbour or receive him on pain of death; and that whoever fhould take any ftep towards recalling him fhould be treated as a public enemy; unlefs thofe fhould firft be recalled to life, whom Cicero had unlawfully put to death. At the fame time it was decreed, with a view of rewarding the confuls Pifo and Gabinius, who had favoured Clodius in his meafures; 7. That the province of Macedonia, with Greece and Theffaly, fhould be granted to the former, and to the latter, Cilicia, which was foon after exchanged for Syria, with a power of making war upon the Parthians; the law enabled them to defray their expences out of the public treafury. In the fame affembly it was further enacted; 8. That the Ælian and Fufian laws, by which the people were left at liberty to tranfact all public bufinefs, even in the days called Fafti, without being liable to be obftructed by the magiftrates, on any pretence whatfoever, fhould be repealed. Thefe laws had been in force about

about 100 years; and Cicero frequently laments the loſs of them, as fatal to the republic; he calls them the moſt ſacred and ſalutary laws of the ſtate; the fences of their civil peace and quiet; the very walls and bulwarks of the republic, which had held out againſt the fierceneſs of the Gracchi, the audacioufneſs of Saturninus, the mobs of Druſus, the bloodſhed of Cinna, and the arms of Sylla. (In Vatin. 9. In Piſon. 4.) 9. Another law was made by Clodius, to give relief to the private members of corporate towns, (municipia) againſt the public injuries of their communities. The real deſign of this ſpecious law was to ſerve a creature of his own, one Merula, of Anagnia, who had been puniſhed or driven from his city for ſome notorious villainies, and who, in return for this ſervice, erected a ſtatue to his patron, on part of the area of Cicero's houſe, and inſcribed it to Clodius, "the author of ſo excelent a law." Among other laws one was enacted, 10. To deprive the prieſt of Cybele, at Peſſinus in Phrygia, of his office, and to ſubſtitute another in his room.

CLODIANA, in *Ancient Geography*, a town of Macedonia, near Dyrrachium. The Itinerary of Antonine places it between Scampis and Apollonia.

CLODIANUS, a river of Spain, in the Tarragonenſis, mentioned by Mela, and alſo by Ptolemy, who places the mouth of it in the country of the Ilercaonians.

CLODII, FORUM. See FORUM *Clodii*.

CLODIUS, PUBLIUS, in *Biography*, a Roman deſcended from an illuſtrious family, and remarkable for his licentiouſneſs, avarice, and ambition. He was ſuſpected of having a criminal intercourſe with his three ſiſters; of whom one was married to Lucullus, the general, under whom he ſerved in Aſia. Diſappointed in his hopes of military rank, he ſucceeded in exciting a mutiny in the army. In the famous conſpiracy of Catiline, Clodius defended the ſenate, and was himſelf one of Cicero's guards. Soon after this he introduced himſelf, by means of female attire, into the houſe of Julius Cæſar, while Pompeia, Cæſar's wife, of whom he was enamoured, was celebrating the myſteries of Ceres. As it was reckoned a very high crime for any male to be preſent at thoſe myſteries, he was accuſed, the next day, by one of the tribunes of impiety and ſacrilege, but either through bribery or intimidation his judges acquitted him. He contrived by the intereſt of Pompey and Cæſar to be choſen tribune of the people, and while he held that office, favoured the ambitious deſigns of thoſe who had aſſiſted him in obtaining it. He procured alſo a decree of the people for the dethroning of Ptolemy king of Cyprus, and Cato, who was a check upon the meaſures of Clodius, was ordered to carry th[illegible] ſentence into execution. Cicero became now the object of Clodius's hatred, and he ſucceeded in driving him into baniſhment, and then cauſed the houſe and villas of the Roman orator to be demoliſhed. Clodius, at this time, uniting himſelf to Cæſar's intereſt, began to inſult Pompey, who in his turn exerted himſelf to procure the recal of Cicero, in which he was not ſucceſsful till the tribune Milo had driven Clodius and his followers from the forum. As ſoon as Cicero was permitted to return, he cauſed all the records of the tribunitial acts of Clodius to be deſtroyed, on the plea that he had been elected to the office contrary to law. In the year, before Chriſt, 53, Clodius was killed by Milo, as he was returning from his country houſe. Cicero undertook the defence of Milo, and endeavoured to prove that the deceaſed had been the aggreſſor for which there was probably no juſt ground, and his client was baniſhed. The attachment of the people for Clodius was exhibited by the burning of Milo's houſe, and making a funeral pile for the body of their hero of the benches of the ſenate. Plutarch. Anc. Univer. Hiſt. Ciceronis Opera.

CLODRA, in *Geography*, a town of Germany, in the circle of Upper Saxony and circle of Neuſtadt; 3 miles E. of Weyda.

CLODY, a river of the county of London-derry, Ireland, riſing in the Carntogher mountains, and joining the river Bann, a little below Portglenone. On it is a village of the ſame name.

CLOERE, a priſon or dungeon; it is conjectured from Britiſh original; the dungeon or inner priſon of Wallingford caſtle, temp. H. 2. was called *Cloere brien*, i. e. *carcer Brieni*, &c.

CLOG. See RUNIC STAFFS.

CLOG, in *Rural Economy*, a word ſometimes applied to a log of wood. It alſo ſignifies a piece of wood faſtened to an animal's foot to prevent its doing miſchief.

CLOGHEEN, in *Geography*, a market and poſt-town of the county of Tipperary, Ireland, on the great road from Dublin to Cork. The ſurrounding country is fertile; and there are ſome good flour mills in and near the town, on a ſmall river that falls into the Suire. It is 93 miles S. W. from Dublin, and 31 N. by E. from Cork.

CLOGHER, a ſmall poſt-town, or rather village, of the county of Tyrone, Ireland, though ſometimes dignified with the name of city, as being the ſeat of a biſhopric, and having before the union returned two members to parliament. There was a rich abbey here, which with its revenues was annexed by James I. to the ſee of Clogher. Some antiquarians ſay that this was a Druidic ſanctuary, and that the ſtone of divination was kept here from which its name is derived, ſignifying the place of the ſtone. St. Patrick is alſo mentioned as the founder of the ſee, before he went to Armagh. The barony to which it gives its name has land of as good a quality as any in Ireland, and is very rich in limeſtone. Clogher is 77 miles N.W. from Dublin. M'Evoy's Tyrone. Dodd.

CLOGHER, an Iriſh biſhopric in the province of Armagh, which ſtretches 60 miles from N.W. to S.E. by a breadth of 20, and compriſes ſome portion of the counties of Donegal, Fermanagh, Tyrone, Monaghan, and Louth. It contains 41 pariſhes, of which only two are united; and there are in theſe no leſs than 49 churches. The cathedral, which is alſo the pariſh church, is a plain handſome modern ſtructure. The biſhop's palace is large, with a remarkably fine park and demeſne. Mr. Young ſtates the income of this ſee to be 4000 *l.* being the next in value to Derry. At preſent it muſt be much more conſiderable. Beaufort. Young.

CLOGHER-HEAD, a cape on the eaſt coaſt of Ireland in the county of Louth. N. lat. 53° 47'. W. long. 6° 12'.

CLOGH-JORDAN, a ſmall poſt-town of the county of Tipperary, Ireland, 70 miles W.S.W. from Dublin.

CLOGHNAKILTY. See CLONAKILTY.

CLOHARS CARNOET, a town of France, in the department of Finiſterre, and diſtrict of Quimperlé; $1\frac{1}{2}$ league S. of it.

CLOISTER, CLAUSTRUM, an habitation ſurrounded with walls, and inhabited by canons, or religious.

In a more general ſenſe, cloiſter is uſed for a monaſtery of religious of either ſex. In a more reſtrained ſenſe, cloiſter is uſed for the principal part of a regular monaſtery, conſiſting of a ſquare built around; ordinarily, between the church, the chapter houſe, and the refectory; and over which is the dormitory, which ſee.

The cloiſters ſerved for ſeveral purpoſes in the ancient monaſteries. Petrus Bleſenſis obſerves, that it was here the monks

monks held their lectures; the lecture of morality at the north side, next the church; the school on the west, and the chapter on the east; spiritual meditation, &c. being reserved for the church.

Du Cange concludes, that all these different exercises were performed in the cloister itself; but by mistake.

The church, the chapter-house, and the school, were not parts of the cloister, but buildings adjoining to it.

Lanfranc observes, that the proper use of the cloister was for the monks to meet in, and converse together, at certain hours of the day.

The form of the cloister was square; and it had its name *claustrum* from *claudo, I shut, or close*, as being inclosed on its four sides with buildings. Hence, in architecture, a building is said to be in form of a cloister, when there are buildings on each of the four sides of the court.

CLOISTERED MONKS. See MONK.

CLOLUGH, in *Geography*, a river of Ireland, which rises in the Commeragh mountains, in the county of Waterford, and passing by Curraghmore, runs into the Suire. Pearl-muscles are found in this river. Smith's Waterford.

CLOMANNORUM *Civitas*, in *Ancient Geography*, a town of Asia, towards Babylonia.

CLOMPANUS, in *Botany*, minor and major: Rumph. See STERCULIA.

CLONAKILTY, or CLOGHNAKILTY, in *Geography*, a market and post-town of the county of Cork, Ireland. It was incorporated by the interest of the first Earl of Cork in 1605, and sent two members to parliament before the Union. It is situated near the sea, but this, says Dr. Smith, affords it more pleasure than profit, as the mouth of the harbour, being choaked with sand, prevents vessels of burden from coming to it. M'Kenzie describes this harbour as fit for small vessels only; and very dangerous sailing in or out, when the wind is at the southerly quarter. There is a pretty good market for linen yarn and coarse linens, which is attended by the Bandon merchants. In the neighbourhood is a mine, which contains some good lead ore, of the kind called galena, and abundance of black blende; but the working of it was soon dropped, from want of sufficient capital to proceed, as it was not immediately productive. Clonakilty is 145 miles S. W. from Dublin, and 22 miles S.W. from Cork. N. lat. 51° 37'. W. long. 8° 42'. Smith. M'Kenzie.

CLONARD, a post-town of the county of Meath, Ireland. It was formerly of some importance, having been a bishop's see, which was consolidated with several others in 1152, this being the residence of the bishop; but in 1216, they were formed into the present see of Meath. There was an abbey here, the ruins of which show it to have been extensive, and the endowments of which were great. The old town is now gone to decay, and the new one which has a bridge over the Boyne, is a place of no trade. It is 26 miles W. from Dublin, on the road to Mullingar, and very near the place where the royal canal crosses the Boyne. Thompson's Meath, &c.

CLONEGALL, a small post-town of the county of Carlow, Ireland, on the confines of Wexford, 47 miles S. by W. from Dublin.

CLONES, a market and post-town of the county of Monaghan, Ireland, the weekly sales of linens at which is estimated at 700*l.*, and its other trade thriving. There are ruins of two or three religious buildings in and near this town. It is 62 miles N.W. from Dublin.

CLONEY, a small lake in Glaneroughy Kerry, about ten miles from Nedeen, and communicating with Kenmare river, which is said to possess all the charms of Killarney in miniature. Beaufort.

CLONFERT, an Irish bishopric, under the metropolitan see of Tuam. It was founded near the close of the sixth century, and was united to the see of Killmacduagh in 1602. There are in this united see sixty parishes, all of which, except three, are in the county of Galway. These are by unions reduced to fifteen benefices, and fourteen of them have churches. The cathedral and parish church are the same, and the bishop has a palace in the neighbourhood; but Clonfert is so small as not to deserve even the name of a village. Beaufort.

CLONIA, in *Ancient Geography*, a marsh of Africa, in Interior Libya, near mount Risadius. Ptolemy says that the marsh is formed by the river Stachir.

CLONMACNOISE, or CLUAIN-MAC-NOIS, i. e. *the retirement of nobles*, in *Geography*, a place in the King's county, Ireland, once the see of a bishop, and at present remarkable for the extent of its monastical ruins. An abbey was founded here by St. Kiaran, in 548, which afterwards became a cathedral; this presided over nine other churches, in one church-yard, as it were, for they were within less than the compass of two Irish acres; and at the west end of this space the bishop's palace was erected. It was situated on the banks of the Shannon, ten miles from Athlone, raised above the river on ground composed of many small elevations. The abbey, which belonged to the regular canons of St. Augustine, was peculiarly and universally esteemed, was uncommonly extensive, and was enriched by many kings and princes. Its landed property was so great, and the number of cells and monasteries subjected to it so numerous, that almost half of Ireland was said to be within its bounds. This was also the *Iona* of Ireland, where the princes of the country were buried; and it was imagined that all who were interred there had insured an immediate ascent to heaven. Several of the churches are supposed to have been erected as places of sepulture. Yet, notwithstanding the opinion of its sanctity, the abbey was often plundered and destroyed by despoilers of every kind, by the unpolished Irish desperado, by the barbarous Ostmen, and, with concern it is added, by the English settlers. These, who ought to have conciliated the affections of the natives, and set them an example of obedience to the laws, and of a peaceable demeanour, too often joined in the greatest outrages, and, amongst other transactions of a like kind, repeatedly disturbed the retired seminary of Clonmacnoise. In 1568 the see was united to Merth by act of parliament, and the deanery alone remains of the ancient chapter. There are remains of several churches, and one is still used as the parish church. There are also two round towers. They are now surrounded by extensive bogs, and the appearance of the country is wild and uncultivated. Ware. Archdall's Monast. Hibern.

CLONMELL, a market and post-town of the county of Tipperary, Ireland. It is the shire town, large and opulent, where the woollen and cotton manufactures were formerly in a flourishing state, but, as in other places, have declined. Though very inconveniently situated for the assizes, at the extremity of so large a county, it is admirably seated for trade, on the banks of the Suire, which is so far navigable for large boats, the tide flowing a little way above the town. The adjoining country is uncommonly fertile, and there are in and near Clonmell a number of boulting mills, from which flour is sent to Dublin. The county-court house is a new and handsome building; and the jail, which is also of late construction, was built on Mr. Howard's plan. Clonmell was formerly a place of strength, and was able to make some stand against Cromwell, who besieged it in person. Before the

the Union it ſent two members to the Iriſh houſe of commons, and has at preſent one repreſentative in the Imperial parliament. It is 84 miles S.W. from Dublin; N. lat. 52° 21′. W. long. 7° 43′. Beaufort, &c.

CLONMINES, a village of the county of Wexford, on an arm of the ſea, not far from the place where Strongbow landed. Some ruins bear teſtimony to its former importance, and until the Union it ſent two members to parliament. It is 81½ miles S. from Dublin, and about 15 W. from Wexford.

CLONTARF, a village in the county of Dublin, Ireland, on the ſtrand between the city of Dublin and Hoath. It is much frequented for ſea bathing, and is a pleaſing object to thoſe entering the harbour. Clontarf is remarkable in the hiſtory of Ireland for a battle fought, in the year 1014, between the Danes, or Oſtmen, and the Iriſh, in which Brien Boronche, who commanded the latter, loſt his life, though his troops gained a deciſive victory. It is 3 miles from Dublin.

CLOPPENBOURG, a town of Germany, in the circle of Weſtphalia, and biſhopric of Munſter, the principal place of a bailiwick; 64 miles N.N.E. of Munſter. N. lat. 52° 53′. E. long. 7° 35′.

CLOSE, a term in *Heraldry*, uſed to expreſs the wings of the eagle, falcon, kite, &c. being kept cloſe to their bodies, but muſt not be uſed to the peacock, dunghill-cock, or any others not addicted to flight. It is alſo applied to a helmet with the vizor down.

CLOSE, in *Muſic*, ſimply means an end or termination to a movement, vocal or inſtrumental. See CADENCE, CADENZA, COUNTERPOINT, and COMPOSITION. But ſince the eſtabliſhment of the opera, or muſical drama, and ſingers of great abilities, taſte, and execution, have been employed and frequently left to themſelves, *ad libitum*, at a pauſe, or at the concluſion of an air, by a cloſe or cadenza is underſtood ſuch an extemporaneous effuſion of taſte and fancy, terminated by a ſhake, as could be executed in one breath. See Toſi, chap. viii. p. 126, and Italian Tour; Reflections on the length and abuſe of cloſes.

Long cloſes were a nuiſance in Italy thirty years ago. When it was obſerved that at Rome, Criſtofero, who ſung in Guarducci's poliſhed manner, though his cloſes were excellent, full of fancy and good taſte, yet they appeared too long; this fault was then general throughout Rome and Naples, where ſuch a long-winded licentiouſneſs prevailed in the cadences of every ſinger, as was always tireſome, and often diſguſting; even thoſe of great performers needed compreſſion, and thoſe made by performers of an inferior claſs, not only wanted curtailing, but correction. A few ſelect notes, with a great deal of meaning and expreſſion given to them, is the only expedient that can render a cadence deſirable, as it ſhould conſiſt of ſomething ſuperior to what has been heard in the art, or it becomes impertinent. This abuſe in making cloſes is not of very ancient ſtanding, for in a ſerious opera of old Scarlatti, compoſed in 1717, there is not a ſingle place for a cadence, *ad libitum*, to be found. But, to length is now added another complaint, by that part of an audience who have heard the great performers of former times; which is, the taking breath, ſometimes even more than once, before the concluding ſhake is made, after which the performer expects to be "welcomed home."

CLOSE, in *Rural Economy*, a ſmall incloſed field or paddock. A ſmall incloſure of any kind.

CLOSE-*Feeding*, the practice of eating graſs herbage down in a cloſe or bare manner, by ſheep or other animals. It is of much conſequence to the grazier, to have his paſtures kept in a ſtate of cloſe-feeding, as the animals are found to do much better under ſuch circumſtances: and at the ſame time to be capable of ſupporting a larger proportion of ſtock. Speaking of cloſe-feeding, Mr. Young has given the following uſeful remarks. "In the preceding trials there was not, through the thirty weeks, ſcarcely a bent to be ſeen; the paſturage was conſtantly ſhorn to the ground, and in that ſtate it was remarkable to ſee how conſtantly, and even rapidly, it ſprung, during the continuance of a drought that was deſtructive of all produce in fields on the ſame farm, ſuffered to run to bent, for hay or other views. The compariſon was the moſt deciſive that can be imagined. He had many fields, better than any there regiſtered, that yielded ſo contemptible a produce of hay, as to be ſcarcely worth mowing; and he was amazed to ſee in ſome of them how poor the *rouen* or after-graſs was, ſo that both united, or the entire growth of at leaſt forty weeks, has amounted not to the fourth of the value of the produce of ſimilar ſoils pared cloſe by ſheep." And he adds, "a Romney-marſh grazier would be ruined if he had ſo much graſs on his land," ſays Mr. Boys, in his Farming Tour, ſpeaking of a field underſtocked."—Annals, vol. xix. p. 118. "Nothing ſo bad," ſays another, "in Romney-marſh, as mowing, ſo that ſome landlords prohibit it." Pliny, ſays Mr. Young, knew this.—*Eſt enim in primis inutile, enaſci herbas ſementaturas.* Plin. Hiſt. Nat. lib. xviii. cap. 28. And of the fact he has not the leaſt doubt, from various experiments and obſervations; and there is no man but has remarked it, he thinks, in the caſe of ray-graſs, the produce of which is loſt if the bent be allowed to riſe. In all plants cultivated for paſturage, there is a great effort the moment the ſeed-ſtem runs, to which the whole growth of the plant is directed to form the ſeed; till then the growth is in the leaves: it is therefore palpable, that the way to have the greateſt abundance of leaf, is by feeding ſo cloſe as to prevent thoſe ſtems riſing at all. And he may further obſerve, that, on this ſyſtem of feeding, thoſe graſſes which yield a very great but coarſe produce, become ſweet, fine, and valuable, by thus keeping them cloſe fed. The *avena elatior*, or tall oat-graſs, is very coarſe, but in a field of that graſs, thirteen acres and half, it never was ſuffered to riſe, and conſequently was found, on examination, to appear as fine and pleaſing to the eye as any of the more delicate graſſes. It is with this view that he is cultivating it largely, and alſo the *dactylus glomeratus;* and both are remarkably early."

He ſuggeſts it as "an inquiry that deſerves attention, whether the ſuperior profit of grazing ſheep, on compariſon with oxen, does not depend very much on this point of cloſe feeding: for large cattle, the herbage muſt be kept to a good head to give a full bite; and conſequently innumerable ſeed-ſtems form, which tend to reduce the produce greatly." There can be no doubt of the great benefit and advantage of cloſe-feeding, in all ſtates where the lands are covered with a coarſe graſſy turf or ſward. See PASTURE and GRAZING.

CLOSE-*Teap*, a term ſometimes provincially applied to a ram, or male ſheep, where both the teſticles are within the barrel of the animal.

CLOSE, *Breach of*, in *Law*, a ſpecies of treſpaſs, denoting every unwarrantable entry on another's ſoil, which the law ſuppoſes to be *incloſed*, either by a viſible fence, or an inviſible boundary. Accordingly, the words of the writ of treſpaſs command the defendant to ſhew cauſe, "quare clauſum querentis fregit." Every ſuch entry, or breach of a man's cloſe, carries neceſſarily along with it ſome damage or other; for, if no other ſpecial loſs can be aſſigned, yet ſtill the

the words of the writ itfelf fpecify one general damage, *viz.* the treading down and bruifing his herbage. F. N. B. 87, 88. See TRESPASS.

CLOSE-*Rolls*, and CLOSE *Writs*, charters, or letters of the king, containing grants of lands, &c. fealed with his great feal, and directed to particular perfons, and for particular purpofes, which, not being proper for the public infpection, are *clofed* up and fealed on the outfide, and are therefore called *writs clofe*, *literæ claufæ*, and they are recorded in the *clofe rolls*. See LETTERS, and PATENT.

CLOSE *Field*. See FIELD.

CLOSE *Fights*, aboard a fhip, are bulk-heads put up fore and aft in the fhip, for the men to ftand behind in a clofe engagement, and fire on the enemy; or, if the fhips be boarded, to fcour the decks.

CLOSE *Fire*. See FIRE, and REVERBERATION.

CLOSE-*hauled*, in *Sea Language*, denotes the arrangement or trim of a fhip's fails when fhe endeavours to proceed in the neareft direction poffible to that point of the compafs from which the wind blows. The keel of larger fhips makes an angle of about fix points with the line of the wind: but floops and fmaller veffels fail almoft a point nearer. All veffels, when clofe-hauled, make nearly a point of lee-way, and this angle increafes with the increafe of wind and fea. The fails, in this difpofition of them, are all extended fideways on the fhip; and the term *clofe hauled* is then applied to it, becaufe her tacks are drawn clofe down to her windward fide, the fheets hauled clofe aft, and all the bow-lines are drawn to their utmoft extenfion, in order to keep the fails fteady.

CLOSE *Quarters*, denote ftrong beams of wood extended along a merchant-fhip in feveral places; as they are a place of retreat, when the fhip is boarded by an adverfary, they are fitted with fmall loop holes, through which the fhip's crew may fire fmall arms to defend themfelves, and annoy the enemy. They are likewife furnifhed with powder-chefts, filled with powder, old nails, &c. which may be fired upon the boarders.

CLOSE *Pound*. See POUND.

CLOSET, in *Heraldry*, is the diminutive or half of the bar.

CLOSET, *Clerk of the*. See CLERK.

CLOSET, *Water*, in *Architecture*. See WATER-*clofet*.

CLOSH, in our old cuftoms, an unlawful game, forbidden by ftat. 14 Edw. IV. c. 3. and 33 Hen. VIII. c. 9. It is faid to have been the fame with our *nine-pins*, and is called *clofh-coyls* by the 33d. Hen. VIII.

CLOSTER NEWBURG, in *Geography*, a town of Germany, in the archduchy of Auftria; 11 miles N.N.W. of Vienna.

CLOSTER-SEVEN, a town of Germany, in the circle of Lower Saxony, and duchy of Bremen, famous for a convention or capitulation, called the treaty of Clofter-feven, by which the duke of Cumberland, commanding 38,000 Hanoverians, was obliged in 1757 to furrender to the French under the duke de Richelieu, and to lay down their arms. It is diftant 19 miles S. from Stade, and 24 N.N.E. from Bremen.

CLOSTERMAN, or KLOOSTERMAN, N., in *Biography*, a portrait painter, who was born at Hanover in 1656, and was much efteemed in his time. It is not known from whom he firft received inftructions, but he came to London in 1681, and for fome time affifted Riley in the draperies and other acceffoiial parts of his pictures. After the death of his mafter, Clofterman got into vogue, and was employed to paint the portraits of many of the principal nobility.

In the year 1696, he was invited to Madrid to paint the king and queen of Spain, together with the principal grandees of the court; he returned, loaded with riches and honour, to England; foon after which he painted a whole length portrait of queen Anne in her robes, a rich and ftriking picture, which was afterwards placed in Guildhall. He died in the year 1713, aged 57, having previoufly to his death been robbed of all his hard-earned wealth by an infidious miftrefs. Defcamps. Pilkington.

CLOSTRA, in *Ancient Geography*, a maritime place of Italy, between Antium and the promontory of Circé.

CLOT-*Bird*, in *Ornithology*, a name by which the common OENANTHE is called in many parts of England.

CLOTAIRE I. king of France, in *Biography*, was the third fon of Clovis, by his wife Clotilda, and born A. D. 497. When he was only 14 years of age, he inherited as his patrimony the kingdom of Soiffons. In 516, he united with two of his brothers in declaring war againft Sigifmond, king of Burgundy, and his brother Gondimar. The latter they put to flight, but Sigifmond, with his wife and children, they took prifoners. In this expedition Clodimir, one of the three, was killed, having firft caufed the king of Burgundy to be deftroyed, and Clotaire, with his brother Thierri, took poffeffion of his dominions as guardians to the fons of the unfortunate monarch. They afterwards invaded Thuringia, in which Clotaire fhewed great military prowefs, but from certain jealoufies that fubfifted between the brothers, he narrowly efcaped affaffination at a conference. Clotaire and his brother Childebert feized their nephews, the fons of the deceafed Clodimir, two of whom the favage Clotaire ftabbed with his own hands; and the third efcaping, he caufed all the tutors and even domeftics of the young princes to be facrificed at the fhrine of his mad ambition. Clotaire and Childebert invaded and ranfacked the Italian territories of the Romans and Oftrogoths. In 543 they attacked Spain, and penetrated as far as Saragoffa, but on their return with confiderable booty, they were defeated and plundered by the Goths. The death of Thierri placed the fceptre wielded by that monarch in the hands of his natural fon Theobalde; and on the demife of that prince, his fubjects agreed to acknowledge Clotaire as their fovereign, who, by the fubfequent deceafe of Childebert, united the dominions of Clovis under his fole government. Clotaire was not permitted long to enjoy in peace his ill-gotten power and dominion. His eldeft fon, Chramnes, twice took up arms againft him, but being defeated, and compelled to feek for mercy, he was once reftored to favour, but the fecond time Clotaire ordered his fon with his wife and children, to be burnt to death in his prefence. As an atonement for crimes of which his own confcience muft have been a perpetual monitor, the bloody Clotaire made very confiderable prefents to the church, which he frequently accompanied with fuch acts of devotion as the ignorance of the times prefcribed. He died in the year 561, having reigned fifty-one years. He had been married to fix wives, and left four fons, who divided his kingdom among them.

There were three other princes of France of the fame name, of whom we fhall only notice the fecond.

CLOTAIRE II. was but four months old when he fucceeded to his father Chilperic's kingdom. In his youth he fpent much of his time in warfare, and by his conduct to his kinfmen, two of whom he caufed to be murdered, he fhewed himfelf entitled to the name of Clotaire. When, however, he had gained the great object of his ambition, and was become the fole monarch of the Franks, he feemed anxious to atone for his former cruelties by the exercife of a

mild

mild and juſt government. He ſubmitted the civil and eccleſiaſtical affairs of his kingdom to a council compoſed of people celebrated for their high rank and attainments in wiſdom. He inſtituted a kind of parliaments in his own palace, the powers of which, though not now to be clearly aſcertained, were probably exerciſed for the benefits of the people. Clotaire attained to conſiderable celebrity as a warrior. In 627 he routed the Saxons, who had revolted from him, on the banks of the Weſer, with great ſlaughter. The next year he died in the height of reputation, having acquired the titles of the *Great* and *Debonair*. Du Freſnoy. Hiſt. Univer. Hiſt. de France.

CLOTH, in *Commerce*, in its general ſenſe, includes all kinds of ſtuffs woven or manufactured on the loom, whether their threads be of wool, hemp, or flax.

CLOTH is more peculiarly applied to a web, or tiſſue of woollen threads interwoven; whereof ſome called the *warp*, are extended lengthwiſe, from one end of the piece to the other; the reſt, called the *woof*, are diſpoſed acroſs the firſt, or breadthwiſe of the piece.

CLOTHS, *Superfine*; the beſt of theſe are made entirely of Spaniſh wool; the fineſt ſorts of which are the Leonera and Segovia.

Of Engliſh wools, thoſe of Hereford and Suſſex approach the neareſt in fineneſs to the Spaniſh, and from the choiceſt of theſe are manufactured ſuperfines of an inferior ſort. From the reſt of the Engliſh wools are made the ſeconds, liveries, and coarſer cloths, varying in price according to their qualities.

The goodneſs of cloth conſiſts, 1ſt. In the fineneſs of the wool. 2d. In the clearneſs, richneſs, and beauty of the colour. 3d. In its being evenly ſpun, always obſerving that the thread of the warp be cloſer twiſted, and one-fourth part ſmaller than that of the woof. 4th. In the cloth's being well wrought and beaten on the loom, ſo as to be in every part equally cloſe and compact. 5th. In being milled or fulled evenly, clean ſcoured, and of a proper thickneſs or ſubſtance. 6th. In being well dreſſed, ſo that the hair or knap of the wool be fully and evenly drawn out and ranged on the ſurface, and in being ſhorn cloſe, yet without laying the ground or threads bare. 7th. In its not being overſtretched in the rack, or pulled farther than is neceſſary to ſet it ſmooth, and bring it to its juſt length and breadth. Laſtly. In the cloth itſelf appearing ſmooth and neat on the face, free from ſmall knobs, ſpots, and other imperfections; in being firm yet pliable, and feeling ſoft and fine to the touch.

CLOTH, *manufacture of*. A detail of the manner in which ſuperfine cloths are manufactured in Wiltſhire, may ſerve for the whole; the inferior ſorts differing little, but in the coarſer and leſs delicate modes of performing the ſame operations.

It is previouſly to be obſerved, that all the cloths which are deſigned for ſcarlets, greens, and blacks, as well as many of the moſt lively and delicate colours, are manufactured white, and dyed in the piece after they are finiſhed.

The wool, being taken out of the bale, muſt firſt be picked, to clear it from the pitch which adheres to it, and from the other extraneous ſubſtances with which it abounds. It muſt then be ſcoured, by putting it into a furnace containing a liquor compoſed of three parts of water, and one of urine. After it has been well ſtirred about therein, and the greaſe it contains diſſolved, it muſt be taken out, drained, and waſhed in running water, and in that ſtate it is fit to be committed to the dye-furnace.

After dyeing it muſt be again waſhed and well dried, when it muſt be beaten with rods on wooden hurdles, to free it from the dye-ſtuff, which ſtill hangs about it; or elſe the ſame effect is produced by putting it into a wool mill, formed of a four-flapped vane or fan thinly ſet with iron ſpikes, and ſwiftly revolving within a hollow cylinder, compoſed of ſmall wooden rods or ſtaves, ſufficiently wide apart to ſuffer the duſt to fall through, as the wool becomes ſlightly ſeparated by the motion of the fans. It is then once more carefully picked, in order to take out the locks which are unevenly dyed, and alſo the lint, and other filth with which wool in this ſtate generally abounds.

In making mixed cloths, wool of the different colours, being weighed out in their requiſite proportions, are firſt ſhaken well together; they are then further mixed by being well turned in the wool mill, and by being afterwards *twice* paſſed through the ſcribbling engine inſtead of *once*, they are generally found to be ſufficiently intermixed.

The wool, thus prepared, muſt now be ſpread abroad on a floor, and oil of olives (in the proportion of 3lb. to 20lb. of wool), evenly ſprinkled over it, and beat into it with heavy rods, when it is in a proper ſtate to be carried to the ſcribbling engine.

This is a machine compoſed of ten or more wooden cylinders, of various ſizes, covered with cards, the teeth or wire of which are of different degrees of fineneſs, and bent or hooked in oppoſite directions. Theſe are combined in a ſtrong wooden frame, and ſo fitted as juſt to touch and work againſt each other, as they ſwiftly revolve on being ſet in motion by a common handle, adapted to be turned either by men's labour, or any ſort of mill work. By paſſing through this engine, the locks of wool, which before were cloſe and matted together, are drawn abroad, the fibres are ſeparated, and it is formed into light flakes; it is then taken to the carder, which is a ſmaller engine of the ſame kind, only covered with finer cards, and with the addition of a fluted roller revolving in a trough at the tail of the machine; by which the wool, after being ſtill finer and better mixed and carded, is formed, as it drops out, into ſeparate and ſmooth rolls of 28 inches long, and half an inch in thickneſs, which are immediately taken by boys, and joined or attached to the ſpindles of the roving or ſlubbing machine.

This is a contrivance, by which 50 or more iron ſpindles, being ſet upright in a wooden frame, are twirled by one motion, yielding their threads to a common ſlider, at every move of which the 50 rolls of wool are drawn out and formed into as many large ſlightly twiſted threads, and at the ſame time wound off into balls of a ſize and ſhape adapted to the next operation, or ſpinning.

This is performed by a machine called the *ſpinning jenny*, which alſo is a frame containing 70 or more upright ſpindles, twirled like the former by a common motion, and yielding their threads to one and the ſame ſlider; by this the large hollow threads are further twiſted and drawn out to the degrees of ſmallneſs and ſtrength requiſite for the different purpoſes for which they are deſigned. The threads, being thus ſpun, are reeled into ſkains and prepared for the loom. The larger ſort, deſtined for the woof, is wound on ſpools, which are ſmall tubes, ſo formed as to be eaſily placed in the eye or hollow of the ſhuttle. That for the warp is wound on large wooden bobbins, from which, by the warping bar, it is conveniently formed into the proper lengths and diviſions, and ſo arranged and diſpoſed as to form the chain or warp of the piece.

The chain, thus prepared, muſt be ſtiffened by a ſize, which is made by diſſolving 3lbs. of glue (the beſt ſort of which is made from ſhreds of parchment) in a quantity of water ſufficient to moiſten and ſaturate the whole, and when dried it is ready to be turned on the loom.

In weaving broad-cloth, there are two weavers in a loom, one on each ſide, who at the ſame time tread alternately on the ſame treadle, *i. e.* now on the right ſide and now on the left, which raiſes and lowers the threads of the warp equally, between which they throw, tranſverſely, the ſhuttle from the one to the other. At each time that the ſhuttle is thrown (and ſo a thread of the woof inſerted within the warp), they ſtrike it conjointly with a moving frame, wherein is faſtened the ſlay, which is a kind of comb, compoſed of thin pieces of cane, between whoſe teeth the threads of the warp are paſſed, repeating the ſtrokes ſix or ſeven times with the warp open, and again as many times after it has croſſed and cloſed on the woof. The whole warp being filled with woof, the cloth is finiſhed.

Being next taken to the fulling-mill, it is there ſoaked with urine or hog's dung, and afterwards ſcoured with clean water; it is thus freed from the oil and filth contracted in dyeing, and delivered perfectly clean, in a ſtate fit for the next operation, which is burling.

By this proceſs (performed by women with little iron nippers) the cloth is cleared from all the knots, lint, ſmall ſtraws, and leſſer filth; and if, by the careleſſneſs of the ſpinner, it contains any large uneven threads, they muſt now be gently taken out; and if any ſmall hole or rent is made, it muſt be carefully drawn up, and mended with ſome of the warp-yarn of the ſame cloth.

But that compactneſs and denſity which diſtinguiſh woollen cloth from all other manufactures, and renders it ſo peculiarly adapted to our wear in theſe northern climates, are derived from the next operation, which is fulling, or milling, by which a cloth of 40 yards long, and 100 inches wide, being firſt ſprinkled over with a liquor prepared from 5lbs. of fine ſoap (made from the oil of olives) diſſolved in hot water, is laid in the mill-trough, and there pounded or ſtamped on by two heavy wooden hammers, alternately raiſed and depreſſed by the cogs of a mill-wheel. By this proceſs it becomes by degrees (generally in about 8 hours) ſo thickened and ſhrunk up, as to be reduced to 30 yards long and 60 inches wide, which renders it of the proper ſubſtance and thickneſs of common ſuperfine cloth. During this operation, it muſt be taken out from the trough from time to time, to have more ſoap added, and to be ſmoothed from the wrinkles and creaſes which it would otherwiſe contract.

This faculty of being rendered thicker by compreſſion, is peculiar to woollen ſubſtances. In vain may fabrics of ſilk or cotton be ſubjected to the ſame proceſs; they would not, in any length of time, be rendered thicker by it, or more compact in the ſmalleſt degree. To account for this, it has been obſerved, that the ſingle hairs of wool, when viewed in a microſcope, are diſcovered to be thickly ſet with rough and jagged protuberances, adapted to catch and entangle with each other. Whence it ſeems probable, that during the violent agitation the cloth undergoes in the mill-trough, the fibres being, at every ſtroke of the mill hammer, ſtrongly impelled together, and driven into the cloſeſt poſſible contact, at length hook into each other, drawing cloſer and cloſer as the proceſs continues, till they become thus firmly and inextricably united; each thread, both of the warp and the woof, being ſo joined and compacted with thoſe that are contiguous to it, that the whole ſeems formed into one ſubſtance, not being liable, like other fabrics, when cut with ſhears, to unravel and become ragged at the edges.

The cloth, thus milled to its proper thickneſs, muſt be ſcoured with clean water till it be perfectly free from the ſoap. In this part of the proceſs, a preparation of fullers-earth and bullock's gall is found very ſerviceable, rendering the cloth at the ſame time ſoft and mellow.

The cloth muſt now be taken to the cloth-worker, in order to be dreſſed, which is performed by firſt properly drawing out, and arranging in one direction, all the hairs or fibres of the wool that can poſſibly be brought to the ſurface, and then ſhearing it as cloſe as it will admit, without diſcovering the ground of the cloth, or laying the threads bare.

The inſtruments employed in this operation, are the wire cards, and teazels, to raiſe and draw out the hair, and the ſhears to cut off what is too long and ſuperfluous. (The teazel is a large kind of thiſtle, with the points growing very ſtrong and hooked; to uſe them the heads are cut off, and ſet cloſe together in ſmall wooden frames called *handles.*) Theſe inſtruments, although hitherto worked by men's hands, with great labour and expence, have of late been ſo ingeniouſly adapted to machinery turned by mill-wheels, as to perform the ſame operations with much more preciſeneſs and effect, as well as great ſaving in point of expence; and the machines for this purpoſe are various, and continually improving. The method hitherto employed is generally as follows.

The cloth being drawn over a frame, conſtructed of boards laid ſloping, and covered with hair-cloth, is, during its paſſage, in order to raiſe the wool, regularly ſcraped, or rubbed from one end to the other, with the cards or teazels, being all the time kept as wet as poſſible by continually pouring water upon it. It is then laid on the ſhearing boards, which are made of wooden planks covered with coarſe cloth, and forming a kind of hard cuſhion, where the wool thus raiſed is cut off with long heavy ſhears, which are preſſed cloſe to the cloth with leaden weights, and gradually ſlide forward at every motion or cut, till they have proceeded from one liſt to the other. The cloth is then returned to be again ſcraped or rubbed; theſe operations are repeated three times, every time with finer cards, or teazels, when the wool becomes ſufficiently raiſed. It muſt now be taken to the rack, on which being faſtened by the liſts with ſmall hooks or tenters, it muſt be drawn or ſtrained thereon, until it be of an even breadth throughout; when dry it is returned to the ſhearing boards, on which the cutting is repeated three times more on the right ſide, and once on the other or back ſide. After this it is given to the cloth-drawers, who, having firſt, with ſmall picking irons, made very ſharp at the points, drawn out all the ſmall ſtraws and bits of lint which have before eſcaped notice, carefully fine-draw or mend the ſmall holes or rents, if any ſuch have been made in it.

Nothing now remains to be done but preſſing; preparatory to which, the cloth being doubled and laid in even folds, a leaf, or ſheet of glazed paſteboard, is inſerted between each fold or plait of the cloth; it is then laid in the preſs, and covered with thin wooden boards or fences, on which are laid iron plates properly heated, and on the whole (by means of a lever turning a ſcrew) the top of the preſs is brought down, with the degree of force judged neceſſary to give it the proper gloſs. When cold, it may be taken out of the preſs, in order to be folded and packed, ready for ſale.

The ſtatute book contains a variety of laws relating to the *woollen manufacture*; the principal of which will be recited under that article: we ſhall here ſubjoin an account of the moſt important laws pertaining to cloth and clothiers. Every fuller of cloth ſhall uſe tayſels, or teazels, and no cards, deceitfully impairing the ſaid cloth, on pain of double damage, to be determined by a juſtice of the peace, mayor, maſter, warden, bailiff, portreeve, conſtable of hundred, and ſteward of leet, who may commit the offender to the next gaol till payment; information may be made by any perſon not grieven to any of the above magiſtrates or officers; and the offender

ſhall

ſhall forfeit to the king, or to ſuch perſons as ſhall be intitled to fines or amercements within their juriſdiction, 3*s.* 4*d.* 4 Edw. IV. c. 1. No cloth, not fulled, ſhall be exported, on pain of forfeiting the ſame, half to the king and half to him that will ſue. 7 Edw. VI. c. 3. For the meaſuring of cloth, the ſtatutes generally provide that the yard ſhall conſiſt of a ſtandard yard, and the breadth of a man's thumb; or 37 inches in the whole. In every pariſh or hamlet where cloths are made, two juſtices ſhall appoint overſeers for taking care that the ſtatutes relating to the regulation of cloth be obſerved. 3 and 4 Edw. VI. c. 2. 39 Eliz. c. 20. 43 Eliz. c. 10. Theſe overſeers are empowered to ſearch or try the cloth, and perſons refuſing or reſiſting ſearch ſhall, on conviction at the ſeſſions, forfeit for the firſt offence 10*l.* for the ſecond 20*l.* and for the third, ſtand upon the pillory in the next market town; of the forfeitures one third ſhall belong to the overſeers, one third to the king, and one third to the poor. 39 Eliz. c. 20. The length, breadth, and weight of the ſeveral ſorts of cloth are ſettled; allowance in weight, for dyeing, dreſſing, roving, and chaſing, in broad cloth 4lbs. in long cloth 5lbs. and ſo in proportion, is adjuſted, and an increaſe of weight by any liquid is forbidden on pain of 40*s.* half to the king, and half to the buyer that ſhall ſue, by 4 Jac. I. c. 1. c. 2. Before ſale the maker ſhall fix his ſeal of lead to the ſame, containing the length and weight, to be tried by the water, and the overſeer ſhall fix ſuch ſeal to the cloth, with the word "ſearched." 39 Eliz. c. 20. On the penalty of his recognizance he ſhall ſet his chriſtian and firname upon the ſeal, and no other ſhall be good. 21 Jac. c. 18. Any perſon ſetting any ſeal to cloth, or taking any ſeal away, without warrant, ſhall on conviction at the ſeſſions, for the firſt offence forfeit 10*l.* for the ſecond 20*l.* and the pillory; one third of the forfeitures to the overſeers, one third to the king, and one third to the poor. Cloth offered to be ſold unſealed ſhall be ſeized by the overſeers. 39 Eliz. c. 20. For each of the cloths under the ſealed meaſure in length, 6*s.* 8*d.* per yard ſhall be forfeited, beſides abatement of the price for what is wanting; for every yard of the ſaid cloth above the lengths, 10*s.* ſhall be forfeited; and for the ſame wanting breadth throughout, ſhall be forfeited 20*s.* wanting for half the length 10*s.* under half, 5*s.*; and for every pound wanting above 2lbs. in weight ſhall be forfeited 10*s.* Jac. c. 20. For the encouragement of dreſſing and dyeing of cloth, no perſon ſhall export any white woollen broad cloth, until he have paid duty of 5*s.* for every ſuch cloth, on pain of forfeiting the ſame, or value; half to the king, and half to him that ſhall ſeize, inform, or ſue. 6 Ann c. 8. The legiſlature has enacted other laws with regard to dyeing of cloth, for which ſee Dyeing. No perſon ſhall have or uſe any tenter, with a lower bar, &c. for ſtretching any rough and unwrought woollen cloth, on pain of 20*l.* half to the king, and half to him that ſhall ſue. No perſon ſhall ſtretch (or ſell the ſame ſtretched) any wrought woollen broad cloth above one yard in length, and half a quarter in breadth; or half cloth, above half a yard in length, and half a quarter in breadth, &c. on pain of forfeiting the ſame, half to the overſeer or informer, and half to the poor. 43 Eliz. c. 10. If any cloth remaining on the tenters be ſtolen in the night, and the ſame is found on any perſon, on a juſtice's warrant to ſearch, ſuch offender ſhall forfeit to the owner treble value, leviable by diſtreſs and ſale, or be committed to gaol for three months, or till the fine be paid; but for a ſecond offence he ſhall ſuffer ſix months impriſonment; and for the third offence, he ſhall be guilty of felony, and tranſported for ſeven years. 15 Geo. II. c. 27. No woollen cloth ſhall be exported, till it be barbed, rowed, and ſhorn, on pain of forfeiting the ſame, half to the king, and half to him that will ſue. 5 Hen. VII. c. 11. No perſon ſhall uſe iron cards, or pickards, in rowing of cloth, on pain of forfeiting the cards, and 20*s.*; nor ſhall any perſon put any flocks, chalk, flour, or ſtarch, or other deceivable thing on cloth, on pain of 40*s.* 3 and 4 Edw. VI. c. 2. No cloth ſhall be rowed or raiſed with oil, greaſe, or any liquid, except on the edge of the ſhears with ſemet or oils, on pain of 13*s.* 4*d.*; and there ſhall be no cutting of wool from the backſides of cloth, except with ſhears, in pain alſo of 13*s.* 4*d.*; nor ſhall any liquid be uſed on the ſide of the cloth, to make it look better than the inſide; nor ſhall the ſides be raiſed, fulled, rowed, or ſhorn, better than the middle, on the like penalty. 4 Jac. c. 2. No perſon ſhall preſs cloth with a hot preſs, on pain of forfeiting the ſame or value. 5 and 6 Edw. VI. c. 6. And preſſing of cloth with hot boards ſhall be puniſhed with like forfeiture. 21 Jac. c. 18. With regard to mixed or medley broad cloth, it is provided by 10 Ann. c. 16. and 1 Geo. ſt. 2. c. 15. that the fulling miller ſhall take an oath before a neighbouring juſtice, to duly meaſure ſuch cloth fulled at his mill, when fulled and wet, affix to it a ſeal of lead, marked with a crown, and ſtamped with his name; together with the length and breadth of the cloth; for which he ſhall have one penny, and enter in a book the marks, ſort, number, length, and breadth of it; under a penalty of 20*l.* on conviction in 40 days, before one juſtice, or on oath of one witneſs, leviable by diſtreſs; or, in want of diſtreſs, commitment to the gaol or houſe of correction for three months. Counterfeiting, defacing, or altering the ſeal incur the ſame forfeiture of 20*l.* Selling cloth before it is ſo ſealed ſubjects to a forfeiture of one-ſixth part of the cloth. If the buyer is not ſatisfied with the meaſure, he may have it again meaſured in the water, within eight days after delivery; the buyer and ſeller chooſing each a meaſurer; and if it does not contain the quantity ſpecified in the ſeal, the owner or ſeller ſhall forfeit one ſixth part of the value. By 13 Geo. c. 23. inſpectors of mills and tenters ſhall be appointed by juſtices at Eaſter ſeſſions, in the counties of Glouceſter, Wilts, and Somerſet, for examining and ſealing cloths; and millmen ſending home cloths before inſpection ſhall forfeit 40*s.* perſons refuſing entrance to the inſpector ſhall forfeit 10*l.*; and the inſpector acting againſt his oath, ſhall forfeit 20*l.* Such inſpectors ſhall be paid 2*d.* for each cloth by the clothiers; the Yorkſhire manufacture is ſubject to peculiar regulations by 11 Geo. II. c. 28. 5 Geo. III. c. 51. 6 Geo. III. c. 23. No foreign woollen cloth ſhall be imported, on pain of forfeiture, and further puniſhment at the king's will. 11 Edw. III. c. 3. 4 Edw. IV. c. 1. Woollen manufactures ſhall be exported cuſtom free. 11 and 12 W. c. 20. By 12 Geo. c. 34. if any weavers of cloth enter into any combination for advancing their wages, or leſſening their uſual hours of work, or depart before the end of their terms agreed, return any work unfiniſhed, &c. they ſhall be convicted by two juſtices of peace to the houſe of correction for three months; and clothiers are to pay their work-people their full wages agreed upon in money, under the penalty of 10*l.* &c.

Cloth, *Caſting of Lead on.* See Casting.

Cloth, *Cocking.* See Cocking *cloth.*

Cloth, *Frizing of.* See Frizing, and Cloth.

Cloth, *Green.* See Green.

Cloths, *Hair*, in *Military Affairs.* See Hair.

Cloth, *Houſewife's.* Se Housewife.

Cloth, *Incombuſtible.* See Asbestos, and Linum *Incombuſtibile.*

Cloth, *Painting on.* See Painting.

Cloth, *Sear.* See Sear-*Cloth.*

Clotho, in *Mythology*, the youngeſt of the Fates, Deſtinies,

nies, or Parcæ. It was her office to ſpin the thread between her fingers; that is, to give and prolong life. She is repreſented as holding the ſpindle, dreſſed in a long gown of ſeveral colours, and having a crown on her head with 7 ſtars.

CLOTNIZA, in *Geography*, a town of Poland, in the palatinate of Lublin; 15 miles W.S.W. of Lublin.

CLOUD, a viſible aggregate of minute drops of water ſuſpended in the atmoſphere.

The word is probably derived from the Anglo-Saxon Lehlod, *covered, hidden*, the face of heaven being ſo in thoſe parts where clouds appear. The ſame aggregate, which in this ſituation is called cloud, obtains the name of miſt, when ſeen to ariſe from the earth or waters; and fog, when it envelopes and covers the obſerver. Yet the two latter, viewed from a greater diſtance or elevation, preſent all the appearances of clouds; while theſe, in their turn, become miſts and fogs, in proportion as we approach and penetrate them. It may be proper, therefore, for the ſake of preciſion, that the term cloud, in philoſophical language, ſhould be made a general one, comprehending all ſuch aggregates, however ſituated.

It is concluded, from numerous obſervations, that the particles of which a cloud conſiſts are always more or leſs electrified. The hypotheſis, which aſſumes the exiſtence of veſicular vapour, and makes the particles of clouds to be hollow ſpheres, which unite and deſcend in rain when ruptured, however ſanctioned by the authority of ſeveral eminent philoſophers, does not ſeem neceſſary to the ſcience of meteorology in its preſent ſtate; it being evident that the buoyancy of the particles is not more perfect than it ought to be, if we regard them as mere drops of water. In fact they always deſcend, and the water is elevated again only by being converted into inviſible vapour.

Clouds, *Natural Hiſtory of*. Since the general introduction of accurate inſtruments for determining the changes of denſity, temperature, humidity, and electricity, which continually occur in the atmoſphere, our knowledge of its conſtitution and properties has been conſiderably advanced. It is nevertheleſs true that the philoſopher of the preſent day is not more weather-wiſe than his predeceſſors in ancient times. He is ſtill obliged to yield the palm in the ſcience of prognoſtics to the ſhepherd, the ploughman, or the mariner; who, without troubling his head about the reaſons of things, has learned, by tradition and experience, to connect certain appearances of the ſky with certain approaching changes; of which thoſe appearances are, in fact, a commencement or continuation, diſcoverable while the cauſe is yet at a diſtance. Undoubtedly the union of theſe two kinds of knowledge would beſt deſerve to be entitled the ſcience of meteorology; and it muſt tend, equally with the invention or perfection of philoſophical inſtruments, to the improvement of this ſcience, could we reſtore to its place the ancient and popular branch of it, now too much neglected by philoſophers, which is founded wholly on natural phenomena. If we except the changes of the wind, ſome indications of moiſture and dryneſs, and a few others of leſs importance, the whole of theſe may be traced to one common origin in the product reſulting from the decompoſition of vapour; which remains, during a certain interval, in a ſtate of ſimple diffuſion or ſuſpenſion in the atmoſphere. To give to the extenſive collection of facts, which it is eaſy to make on this ſubject, a communicable and uſeful form; to render that attainable in a ſhort time, which has been hitherto the excluſive treaſure of the adepts of long experience, is the object of the writer of the following ſyſtematic nomenclature and natural hiſtory of clouds.

Clouds are ſuſceptible of various modifications. By this term is intended the ſtructure or manner of aggregation, in which the influence of certain conſtant laws is ſufficiently evident amidſt the infinite leſſer diverſities reſulting from occaſional cauſes.

Hence the principal modifications are as diſtinguiſhable from each other, as a tree from a hill, or the latter from a lake; although clouds, in the ſame modification, compared with each other, have often only the common reſemblances which exiſt among trees, hills, and lakes, taken generally.

There are three ſimple and diſtinct modifications, which are thus named and defined.

1. Cirrus. *Def.* Nubes cirriformis tenuiſſima, quæ undique creſcat.

The Cirrus. A cloud reſembling a lock of hair, or a feather. Parallel flexuous, or diverging fibres, unlimited in the direction of their increaſe.

2. Cumulus. *Def.* Nubes denſa cumulata, ſurſum creſcens.

The Cumulus. A cloud which increaſes from above in denſe, convex, or conical heaps.

3. Stratus. *Def.* Nubes ſtrata, aquæ modo expanſa, deorſum creſcens.

The Stratus. An extended, continuous level ſheet of cloud, increaſing from beneath.

There are two modifications, which appear to be of an intermediate nature; theſe are:

4. Cirro-cumulus. *Def.* Nubeculæ ſubrotundæ connexæ vel ordinatè poſitæ.

The Cirro-Cumulus. A connected ſyſtem of ſmall roundiſh clouds, placed in cloſe order, or contact.

5. Cirro-ſtratus. *Def.* Nubes extenuata, ſub-concava vel undulata. Nubeculæ hujuſmodi appoſitæ.

The Cirro-ſtratus. A horizontal or ſlightly inclined ſheet, attenuated at its circumference, concave downward, or undulated. Groups or patches having theſe characters.

Laſtly, there are two modifications, which exhibit a compound ſtructure, *viz.*

6. Cumulo-ſtratus. *Def.* Nubes denſa, quæ baſi cumuli ſtructuram patentem cirro-ſtrati, vel cirro-cumuli ſuperdat.

The Cumulo-ſtratus. A cloud in which the ſtructure of the cumulus is mixed with that of the cirro-ſtratus, or cirro-cumulus. The cumulus flattened at top, and overhanging its baſe.

7. Nimbus. *Def.* Nubes denſa, ſupra patens et cirriformis, infra in pluviam abiens.

The Nimbus. A denſe cloud, ſpreading out into a crown of cirrus, and paſſing beneath into a ſhower.

Of the Cirrus.

This is always the leaſt denſe, and commonly the moſt elevated modification. It is ſometimes ſpread horizontally through a vaſt extent of atmoſphere; the whole breadth of the ſky being inſufficient to ſhew where it terminates. In this caſe, its parallel bars appear, by an optical deception, to converge in oppoſite points of the horizon. At others, it is exhibited in unconnected perpendicular bundles, of the moſt minute ſize. Between theſe extremes, it may be traced in every degree of extent and inclination to the horizon. In a ſerene ſky the cirrus is firſt indicated by a few threads, pencilled in white, on the azure ground. Its increaſe takes place in various ways, and may be compared ſometimes to vegetation, more often to cryſtallization. Thus, 1. Parallel threads are added to each other horizontally, and occaſionally other ſtrata of the ſame, croſſing the firſt at right or oblique angles, until a delicate tranſparent veil is formed. 2. Parallel threads are collected into diſtinct groups, lying at various angles with the horizon. 3. Flexuous and diverging

verging fibres are extended from the original ftem, forming the refemblance of crefts of feathers, locks of hair, &c. 4. The firft-formed threads become, as it were, the fupports from whence others obliquely afcend or defcend into the atmofphere. Laftly. A denfe nucleus is fometimes formed, and fhort fibres fhoot out from it in all directions. The great elevation of the cirrus has been afcertained by geometrical obfervations. "The fmall, white ftreaks of condenfed vapour, which appear on the face of the fky, I have found," fays Dalton, "by feveral careful obfervations, to be from three to five miles above the earth's furface."

Viewed from the fummits of the higheft mountains, they appear as diftant as from the plains. A more eafy and not lefs convincing proof of their elevation may be deduced from their continuing to be tinged by the fun's rays in the evening twilight with the more vivid colours of the prifm, while the denfer clouds, having already paffed through the fame gradation, are in the deepeft fhade.

The duration of this cloud varies according to its ftation in the atmofphere; and the prefence or abfence of other clouds; it is long, extending fometimes to thirty-fix hours, when it appears alone, and at its greateft elevation; but fhorter, or even very tranfient, when formed lower, and in the vicinity of the cumulus.

By an inexperienced obferver the cirrus would be pronounced abfolutely motionlefs. On comparifon with a fixed object, however, it is fometimes found to have a confiderable progreffive motion. The propagation of the cirrus, and the variable direction of its flexures, merit attentive obfervation, as being intimately connected with the variations of the wind, although undoubtedly not produced by the mere motion of the air.

The general principles, which the imperfect notice hitherto beftowed on it feems to point out, are the following:

1. Its appearance is a general indication of wind; and it is moft confpicuous and abundant before ftorms.

2. It is often a leeward cloud; or, when a group of cirri appears on the horizon, it feems to invite a current towards it; and the wind very often fhifts into that quarter towards which the points are directed.

3. Horizontal fheets of the cirrus, more particularly thofe which carry ftreamers pointing upward, are among the indications of rain approaching, while the fringe-like depending ones are found to precede fair weather.

Of the Cumulus.

Clouds in this modification are commonly of denfe ftructure. They are formed in the lower atmofphere; and move with the wind, or more properly with that current which flows next the earth. The phenomena of the cumulus are ufually thefe: In the latter part of a clear morning, a fmall irregular fpot appears fuddenly at a moderate elevation. This is the *nucleus*, or commencement of the cloud, the upper part of which foon becomes convex and well defined, while the lower continues irregularly plane. On the convex furface the increafe vifibly takes place, one heap or protuberance fucceeding another, and again lofing itfelf in a fubfequent one, until a pile of cloud of an irregular hemifpherical form is raifed; which floats along, prefenting its apex to the zenith, while the bafe, or rather the lower furface of the bafelefs fabric, continues parallel to the horizon.

When thefe clouds are of confiderable magnitude, they remain at proportionately great diftances. When fmaller, they croud the fky by a nearer approach to each other. In each cafe the bafes range in the fame plane; and the increafe of each keeps pace with that of its neighbour, the intervening fpace remaining clear.

The cumulus often arrives at its greateft magnitude early in the afternoon, when the temperature of the day is at its maximum. As the fun declines, it gradually decreafes, retaining its character till towards fun-fet, when it is more or lefs haftily broken up, and evaporates, leaving the fky clear, as in the early part of the morning. Its tints are often vivid, and pafs through the moft pleafing gradation during this laft hour of its exiftence.

The preceding phenomena form the hiftory of the pure cumulus, as it may be termed, when no other modification appears along with it. They are both the accompaniments and prognoftics of the faireft weather.

Of the Stratus.

The ftratus has a moderate degree of denfity. It is the loweft of the modifications, being formed in contact with the earth or water. It comprehends thofe level creeping mifts, which, in calm evenings, fpread like an inundation from the valleys, lakes, and rivers, to the higher ground.

Unlike the cumulus, which belongs to the day, and rarely furvives the fetting fun, this cloud accompanies the fhades of night, and commonly vanifhes before the afcending luminary. The evaporation commences from below. At the moment of the feparation of the ftratus from the earth, its character is changed, and it puts on the appearance of the nafcent cumulus.

The nocturnal vifits of the ftratus have been always held a prefage of fair weather. Thus Virgil:

"At nebulæ magis ima petunt campoque recumbunt."

Then mifts the hills forfake and fhroud the plain.

The meteorological axioms of this great poet were probably felected from the popular ones of his age, as confirmed by his own experience. Hence they ever agree with that of his readers. There are few days in the whole year more calm and ferene than thofe whofe morning breaks out through the ftratus. They are the halcyon-days of our autumns; an interval of repofe beween the equinoctial gales and the ftorms of winter.

Of the Cirro-cumulus.

The intermediate nature of this cloud may be afcertained by tracing its origin, as well as inferred from its ftructure. The cirrus, in its flow defcent through the air, may be feen to pafs into this and the next modification; although its previous appearance does not feem abfolutely neceffary to the production of either.

Moft of our readers will recollect the appearance of the icy efflorefcences on the panes of windows, gradually melting into an affemblage of drops, which adhere to the glafs, retaining fomewhat of the fame figure, deprived of its right lines and angles. Such is the change of form which the cirrus undergoes, in paffing to the ftate of the cirro-cumulus. And, as the water on the windows is occafionally converted again into fpiculæ of ice, fo thefe fmall rounded maffes fometimes fuddenly refume the forms of the cirrus. In the oblique denfer tufts of the latter, the change to the fpheroidal form often begins at one extremity, and proceeds gradually to the other, during which the cloud refembles a ball of flax, with an end left unwound and flying-out. All the cirri in the fame group, and frequently all thofe in view, obferve the fame law in thefe changes.

The cirro-cumulus forms a very beautiful fky. Numerous diftinct beds are fometimes feen floating at different altitudes, which appear to confift of fmaller and ftill fmaller clouds,

clouds, as the eye traces them into the blue expanse. It is most frequent in summer; is the natural harbinger of increased temperature; and, consequently, one of the best indications of fair weather, when permanent or frequently repeated. A more transient display of it is, however, frequent in the intervals of warm showers, and in winter. There are also certain forms of it, more deep and dense than ordinary, and arranged on a curved base, which enter into the peculiar features of thunder-storms.

It is usually found to accord with a rising barometer.

Of the Cirro-stratus.

This is a multiform cloud, and can only be detected in its various appearances by an attention to its distinctive characters. It is always an attenuated sheet, or patch, floating on the air, in a position nearly or quite horizontal. As we have compared the cirrus to dry flax, we may here consider it as drenched in water, and having its spreading fibres reduced to a closer and recumbent form. Viewed over head, it is remarkable for its uniform hazy continuity, and in the horizon for its great appearance of density, the consequence of its being seen edgewise. In this situation, also, it sometimes cuts the sun's or moon's disk across with a dark line; of which Virgil,

> " Ille ubi nascentem maculis variaverit ortum
> Conditus in nubem, medioque refugerit orbe,
> Suspecti tibi sint imbres: namque urget ab alto
> Arboribusque, satisque notus, pecorique sinister."
> Georgic. lib. i.
>
> Or should his rising orb distorted shine
> Thro' spots, or fast behind a cloud's dark line
> Retire eclipsed; then let the swain prepare
> For rainy torrents; a tempestuous air,
> Swift from the southern deep, comes fraught with ill,
> The corn and fruits to waste, the flocks to chill.

The cirro-stratus is the natural indication of depression of temperature, wind and rain. In order to make a proper use of it in this respect, it is necessary to attend to the time of its appearance, to its continuance, and its accompaniments. This cloud sometimes alternates with the cirro-cumulus, either at different intervals of the day, or in the same sky, or even in the same stratum, which may consequently be seen successively in each modification, and at intervals, partly in one, partly in the other. In this case the prognostic is doubtful, and regard is to be had to that which ultimately prevails.

Again, there is a transient appearance of the cirro-stratus, which often accompanies the production of dew in the evening, and denotes an atmosphere but lightly surcharged with vapour. Not so when it appears earlier in the day, or at sun-rise (according to the preceding quotation), and attended with the rudiments of the cumulus. In general, the weather may be suspected of a strong tendency to wind and rain, as often as the sky is both hazy, and deformed with numerous small patches of cloud, in which the extenuated character predominates; and these appearances, together with an abundance of cirro-cumulus, indicate thunder. Before storms of wind, there is in particular a feature of cirro-stratus, often very slightly expressed, and in one quarter only, which resembles the architectural cyma.

But the most formidable appearance of the cirro-stratus, is that of extensive sheets, descending from the highest regions of the atmosphere, and scarcely discernible for a time, but by the prismatic colours which they assume in the vicinity of the sun's or moon's place. These are the skreens on which are described the immense circles of halos, forming, by their occasional intersections, parhelia, and paraselenia, mock suns and moons, which sometimes vie in splendour with the luminaries themselves. It is easy for those who are acquainted with the principles of optics, to conceive how these intersecting circles are produced by light passing through sheets of cloud placed at different heights and angles.

Consistent with this is the prognostic of foul weather commonly deduced from the appearance of the halo. After a solar halo in spring, or the early part of summer, a series of wet and cold weather may be expected, although it should not commence for some days; during which, nevertheless, the same state of the atmosphere subsists, as is often manifest from the repetition of the halo. Those which surround the moon in clear nights, indicate rain or snow, according to the season of the year.

In mountainous and even hilly countries, the cirro-stratus is frequently seen adhering to the more elevated points of land. In winter it also visits the plains, in the form of a very wet and durable mist, the drops of which are nevertheless too small to be visible, and which, unlike the stratus, is more dense on rising grounds than in the valleys.

The cirro-stratus usually accords with a sinking state of the barometer.

Of the Cumulo-stratus.

The formation of the cirro-cumulus, or cirro-stratus, by condensed vapour, descending from the higher atmosphere, does not prevent the cumulus from being produced out of the water, which, in the mean time, evaporates, from the earth and ascends to the middle region. In this case, the two modifications after a while come into contact, and present to the attentive observer a succession of curious appearances.

While the cumulus is rapidly increasing upward, a delicate fleece, of a structure visibly different, sometimes attaches itself to its summit; where it reposes as on a mountain. This fleece is a cirro-stratus; and the materials of which it is formed are brought by a superior current overtaking or meeting the cumulus. Frequently, the cumulus in its increase breaks through the cirro-stratus, and appears again above it, but with a visible change in the aggregation, which now becomes rocky, perpendicular, and, finally, overhanging. If the cirro-stratus should itself increase too fast to be swallowed up by the cumulus, the latter after a while extends its protuberances laterally, and attaches itself by them to the superior mass of cloud.

When the cirro-cumulus, in like manner, occupies the superior place, a cumulus rising beneath it is susceptible of the same union by mutual attraction; the result of which, as in the former case, is a large, lofty, and dense cloud, which often subsists through the day; and in the evening undergoes the usual evaporation.

It is not, however, absolutely necessary to the production of this cloud, that either of the superior modifications should be previously formed. In a favourable state of the atmosphere, the cumulus itself, after having arrived at a certain magnitude, suddenly begins to over-grow its base, and produces a cloud, which, in regard both to its form and its rapid growth, may be compared to a mushroom.

The cumulo-stratus usually prevails in the completely overcast sky. In this it presents appearances not easy to be described, but which may be classed by a due attention to the theory of this cloud. At present it is intended to comprehend under it every mode of union between different strata, which is not productive of rain. Future investiga-

tion

tion may point out diſtinctions, which at preſent we are not prepared to make.

This modification is moſt frequent during a mean elevation of the barometer, or that which is denominated *changeable*, when the wind blows from the weſt, with occaſional deviations towards the north and ſouth. In reſpect to temperature, it has a wide range, and may uſher in a fall of ſnow, as well as a thunder-ſtorm. Of the latter, indeed, it is among the regular harbingers, but with peculiar appearances. During the ſuffocating calm which prevails before the firſt diſcharge of the atmoſpheric electricity, it may be ſeen in different points of the horizon, rapidly ſwelling to a ſtupendous magnitude, moſt curiouſly wreathed and curled, "fretted and emboſſed" in its ſubſtance, and flanked at different heights by the delicate opake ſtreaks of the cirro-ſtratus. The whole preſents a ſpectacle of peculiar magnificence, in contemplating which, one may imagine an inviſible agent collecting in this immenſe laboratory the energies of the ſtorm, and arranging innumerable batteries for the ſubſequent exploſions.

It will appear by what we have already ſtated, that the cumulo-ſtratus affords in general a doubtful prognoſtic. When it is formed in the morning, the day often proves fair, though overcaſt; and if the cirro-ſtratus has contributed to its formation, there will probably enſue heavy ſhowers on the ſecond or third day. When it ſubſiſts a long time, the character of its ſuperior ſpreading part may be conſulted, which, if it be decidedly either that of the cirro-ſtratus, or cirro-cumulus, the uſual reſult of their appearance may be expected.

Of the Nimbus.

To have a correct notion of this cloud, the reader has only to take the opportunity of examining a ſhower in profile as it approaches from the horizon. He will ſee the denſe gloom, which experience teaches him to regard as a maſs of deſcending rain, loſing itſelf above in a cloud which commonly ſpreads in one continuous ſheet to a great diſtance all around the ſhower; inſomuch that while the latter is on the horizon at ſeveral miles diſtance, the edge of the cloud has frequently arrived in the zenith. He will perceive that this ſpreading crown of the ſhower advances regularly before it, and that, whether viewed from a diſtance or over-head, it exhibits in a greater or leſs degree the fibrous ſtructure of the cirrus. After the ſhower has paſſed over, he will commonly obſerve the ſame appearances in the part of the cloud which follows it; and in ſqually weather he will ſometimes be able to repeat theſe obſervations on many different ſhowers appearing ſucceſſively; or at the ſame time, in different quarters. The term *nimbus* is intended ſtrictly to denote no more than this inverted cone of cloud, from which a ſudden or denſe local ſhower, whether of rain, ſnow, or hail, for the difference is not eſſential in either caſe, is ſeen to deſcend. As it riſes to a great height in the atmoſphere, it may be ſeen from a diſtance of many miles; and ſo conſtant is the reſult of a ſhower arriving with it, that though, in a few inſtances, perhaps from the ſmall quantity of the rain, we have not been able to diſcover the uſual obſcurity beneath it, while at a diſtance, we believe it may be laid down as a general rule, on as good grounds as in moſt other caſes, that rain, ſnow, or hail, is falling on the tract over which it is ſpread.

> "Qualis ubi ad terras abrupto ſidere *nimbus*
> It mare per medium, miſeris heu preſcia longé
> Horreſcunt corda agricolis." Virgil.

> So while far off at ſea the ſtorm-cloud lowers,
> And on the darken'd wave its fury pours,
> Mid crops unreap'd the hapleſs peaſants ſtand,
> And ſhuddering view its rapid courſe to land.

There is a great difference, at different times, in the proportion which the inverted cone of cloud bears to the column of rain, &c. in which it terminates; and in a very turbid and moiſt atmoſphere, the character of the upper part often approaches more nearly to the cirro-ſtratus than the cirrus. The more perfectly diſtinct and local the ſhower, and the clearer the reſt of the air from other clouds, the more perfect the crown of cirrus, which, indeed, ſometimes aſſumes an almoſt geometrical preciſion in its form and internal ſtructure; the threads of the cirrus tending from all ſides directly towards the top of the column.

The pure nimbus commonly moves with the wind, and from the rapidity of its paſſage affords but little to the rain-gauge. But it often happens, that it is formed in the midſt of cumuli which have already arrived at a great ſize. In this caſe the latter may be ſeen to enter ſucceſſively into the focus at the top of the column, from whence they never emerge; being viſibly converted to the purpoſe of ſupplying materials for the irrigation, which thus becomes more abundant; and the ſhower is alſo occaſionally thus propagated in a direction oppoſite to the wind.

The nimbus, moreover, does not always originate in a cirrus. The cumulus, and more often the cumulo-ſtratus, may be ſeen to expand at their ſummit into a cirroſe ſheet, while the lower part is reſolved into rain. On the contrary, the rain ſuddenly ceaſing, and the nimbus remaining entire, the ſharp extremities of the crown often retire into it; the ſides aſſume the ſwelling folds, and the character is exchanged for that of cumulo-ſtratus. When the ſhower has expended itſelf, and the ſheet breaks, the ſuperior portions uſually turn to the cirro-cumulus or cirro-ſtratus, and the lower to the cumulus. When a total evaporation of the remaining cloud follows a ſhower, it is a very favourable prognoſtic. A nimbus is frequently accompanied by a cirro-ſtratus or two lying near it, and on a level with the denſeſt part of the cloud. The nimbus of thunder-ſtorms has many of theſe, as before obſerved of the cumulo-ſtratus, arranged at different heights; which, with the groteſque form of each cloud, and the hazy ſtate of the medium, are ſufficiently characteriſtic of the high electric ſtate of the air at ſuch times, and want only an attentive peruſal (in nature) to enable the obſerver to aſcertain it on future occaſions. It appears that the cumulo-ſtratus paſſes to the nimbus by a ſudden change in its electricity: for in tracing the progreſs of a thunder-ſtorm, through a long range of theſe clouds in the horizon, we have been ſatisfied, that the clouds, which had ceaſed to afford exploſive diſcharges, had undergone this change in their ſuperior part, and were pouring down rain; while others, among which the lightning ſtill played, or which were ſituated beyond it, retained their ſwelling and rounded forms ſome time longer.

Of the Origin, Suſpenſion, and Deſtruction of Clouds.

Theſe aggregates conſiſt of water, raiſed by evaporation, and become viſible by condenſation in the atmoſphere. Reſpecting evaporation, and the ſtate in which vapour ſubſiſts, there has been much diverſity of opinion: and, of the ſeveral theories propoſed, there is not one comprehenſive enough to merit excluſive adoption. A number of general principles, however, have been eſtabliſhed; which we ſhall employ, with the aid of thoſe of electricity (hitherto not enough confidered in its filent and gradual effects), to explain, though in an imperfect manner, the principal phenomena of clouds.

Evaporation confifts in the union of water with caloric, and the efcape of the compound as an invifible fluid, which we fhall exclufively denominate *vapour*.

The folvent action of the air, to which this effect has been attributed by chemical philofophers in general, has been proved by comparative experiments on the force of vapour in air, and with air excluded, to have no perceptible fhare in it. The laws which govern the natural procefs, (for thefe alone here intereft us) may be thus briefly ftated. The force by which water is converted into vapour is directly as its temperature, other things being equal: but this force has to overcome an oppofing one, of the fame nature, inherent in the vapour which already exifts in the atmofphere. For fuch vapour, by its elaftic property, tends to exclude from the fpace it occupies every additional portion; and confequently to prevent the efcape from the water of new vapour. Hence the temperatures being equal, the quantity of vapour produced will be lefs, the greater the quantity already diffufed in the air.

But though the *chemical* action of air is imperceptible, its *mechanical* effect is great. A moving atmofphere may double or triple the rate of evaporation, according to its velocity. For not only is the furface, from whence only the vapour efcapes, thus enlarged and changed; but the nafcent vapour itfelf, which would otherwife hover a while upon it, to the obftruction of the procefs, is immediately brufhed away and diffufed.

By applying thefe principles, we may explain to ourfelves various natural phenomena: as for inftance; why the wind, after rain, becomes colder than even the rain which fell; being robbed of its caloric by the evaporation of the floating and depofited water, with which it is in contact: why fnow fometimes totally difappears without melting, and the furface of ice becomes fenfibly wafted and channelled; for thefe are warm, compared with the dry and frofty air which blows at fuch times, and confequently evaporate freely. In what manner, again, a ftrong wefterly wind in fummer or autumn brings up clouds, which on its ceffation defcend in rain: for it promotes evaporation by its mechanical effect, and the vapour efcapes into an atmofphere already too moift to carry it off to any great diftance. This will be evident by recurring to the principle before ftated, that the vapour efcapes by the force of the temperature of the water out of which it is formed; and, confequently, into a colder atmofphere it will ftill efcape, though continually decompofed thereby.

Vapour is decompofed by air, in confequence of the fuperior affinity of the latter to caloric. This happens in two ways. 1. When vapour efcapes or is propelled into air colder than itfelf; the refult being a local denfe cloud. 2. When a mixture of air and vapour is cooled; in which cafe there enfues a general turbidnefs, which we fhall exclufively denominate *haze*. It is occafioned by minute floating particles of water; the caloric which, united to thefe, formed tranfparent vapour, having paffed into the air.

Out of this haze clouds may be afterwards formed, by fimple aggregation, or by electrical attraction. It abounds in the atmofphere during moft part of the year, occupying fometimes the higher, fometimes the lower, part thereof. The quantity in which it exifts may be judged of, at fome periods, by the appearance of diftant objects feen horizontally: at others, by the degree of intenfity of the blue colour of the fky, which becomes paler by it, if indeed the bluenefs is not wholly due to this part of the medium.

Of the Nature of the Stratus.

This cloud is an example of the decompofition of vapour thrown into air of a lower temperature. The earth or water on which it repofes is always warmer than the cloud, as is alfo the clear air above. Thus, in a ftratus, formed over a field with ponds, the temperature of the earth juft below the turf was 57°; of the water, 59°; of the air, at an elevation of thirty feet, 55°; while that of the cloud, at four feet from the ground, was 49.5°. Hence this cloud preferves a level furface; and hence it uniformly vanifhes, or begins to be driven upward, as foon as its temperature becomes equal to that of the earth. It is confequently due to the decompofition (in a fmall portion of the atmofphere) of the vapour which the earth and water continue to emit, after funfet, by the force of a temperature previoufly acquired. But the change in the lower air, which gives occafion to this local decompofition, is not fo eafily to be explained: for it appears that very often, in the evening of a clear day, the decreafe of temperature in the atmofphere takes place in the fame order in which the increafe did in the morning: *viz.* beginning from the furface of the earth and proceeding upward. If the air never became colder, on thefe occafions, than the contiguous foil, the effect might very well be afcribed to the abforption of a quantity of caloric by the latter. But we fee that, in the prefent inftance, it became colder by feven degrees, though vapour was ftill decompofing: and this in a perfect calm, which, in a great degree, forbids another fuppofition, of the exchange of a quantity of heated air below, for as much cold air from the higher atmofphere; otherwife this would feem a fufficient account of the matter.

The electric charge of the ftratus, which is always pofitive, and fometimes highly fo, notwithftanding the contact of its lower furface with the earth, feems to prove that a cloud is not even fo good a conductor as has been fuppofed, and that the fluid, in certain cafes, may be very gradually tranfmitted through it. Pofitive electricity being that proper to the atmofphere in fair weather, we fhould naturally expect to find it in this cloud.

It might be worth while to examine the air above, with a view to difcover whether there exifts in the latter a negative counter-charge. It will appear, from a confideration of the principles before ftated, why this cloud is almoft peculiar to the autumn. The gradual decline of the fun, at this feafon, keeps the atmofphere conftantly furcharged with vapour, which is ultimately difpofed of in rain; and hence follow gales of wind. The ftratus, therefore, though an immediate indication and accompaniment of fair weather, affords an unfavourable prognoftic in the early part of fummer; as it fhows that a tendency has already begun to extenfive precipitation, at a time when the ufual predominant feature is increafing drynefs.

Of the Nature of the Cumulus.

The heating effect of the fun's rays on the atmofphere is greateft near the furface of the earth, and diminifhes gradually in afcending. The diminution proceeds in fair weather at the rate of about one degree for each hundred yards, as appears by obfervations with the thermometer on ftations of known difference in altitude.

This inequality appears to give rife to the cumulus, on the fame principles as thofe of the ftratus, but the effects are more complicated. Vapour is generated, as before, at the furface of the earth, but it is thrown into an atmofphere heated by the fun. Here it maintains its elaftic ftate, and, in proportion to the fupply from below, the whole quantity exifting in the atmofphere is compelled to rife. In doing this, it changes its climate, and arrives among air of a lower temperature, where a portion is continually decompofed, filling the middle region with haze. Of this, fmall aggregates begin to be formed, the increafe of which is at firft determined by no particular law. But the aggregate is not in equilibrium with the air. It tends to fubfide, and in the mean time the increafe of temperature is proceeding upward. Hence the lower part foon finds a pofition in a plane of air fufficiently warm to evaporate it: and as this effect is regulated, in general, by the elevation alone, we fee thefe aggregates affume each a flat bafe, refting as it were on the fame plane, parallel to the earth's furface. The remainder of the cloud fports in all the varieties of the fpheroid, and more rarely of the cone; according to the courfe of the fhowers of minute particles of water, which we may confider (though invifible in their progrefs) as defcending upon it. The vapour generated at the bafe is, probably, in part condenfed on the furface of the colder particles of the cloud above. While the fupply from the haze exceeds the wafte by evaporation, the cloud increafes: when the latter has begun to prevail, it may be traced through various ftages of diminution to its final wreck, on finking wholly into the warmer atmofphere. This happens commonly about fun-fet; becaufe the afcending current of vapour, the fource of the phenomenon, then flackens or ceafes; and the lower air parting with its redundant caloric to the higher, we unexpectedly fee the denfe clouds evaporate, at the very time when the chill of the evening is felt below, and the dew falls.

But it does not appear that the caufes we have hitherto enumerated are fully adequate to the phenomenon. The increafe of the cumulus is often more rapid than confifts with the notion of fimple attraction, exercifed between diftant particles of water, in a refifting medium. When a cumulus is thus increafing, the fmall aggregates in its way do not ufually join it, but feem to vanifh before it. Laftly, the cumulus itfelf, however denfe, never defcends in rain. It is difficult to conceive that fo powerful an attraction could exift for many hours, without bringing the particles together into larger and larger drops, until they were too heavy for longer fufpenfion. If we fuppofe, however, that, from the commencement of its aggregation, the cumulus becomes a pofitively electrified mafs, thefe difficulties vanifh. This mafs may electrify negatively, and attract into itfelf, from great diftances, both the difperfed particles of water and thofe which have already united in much fmaller maffes. Its particles muft be mutually repulfive, and cannot come into contact without a change of ftate: the fame may be faid of the refpective clouds in this modification, when they do not differ too much in furface.

Of the Nature of the Cirro-ftratus.

When a portion of the atmofphere, charged with vapour, is brought over a tract of land of lower temperature than itfelf, its caloric is abftracted in fufficient quantity, ufually to occafion a decompofition of fome of the vapour, and a confequent general turbidnefs.

The fweating, as it is improperly called, of walls and pavements in a thaw, and when rain is about to come on, is from this caufe; the vapour being decompofed on their furfaces. The mift which enfues at thefe times obfcures diftant objects, and occafions the trees, againft which it is borne by the wind, to drip plentifully. It is in fact a cirro-ftratus in contact with the earth, and no phenomenon is more familiar to the inhabitants of hilly tracts. The fame general depreffion of temperature may happen in another way, and higher in the atmofphere. When a cold and moift air flows over a warmer vaporous one, it is obvious that the former may be warmed, and become more tranfparent, at the expence of the latter; which, from the fame caufe, muft become turbid. The haze thus produced will not fubfide with the uniform motion of dew, but rather in fheets, becoming more denfe as they defcend, both from the approximation of their particles, and addition from the vapour they meet with. But the cirro-ftratus is far from affuming always the fimple form, to which the mere effects of gravity might be fuppofed to give rife. It exhibits changes, which can only be attributed to the acquifition, or paffage through it, of fuch fmall portions of electricity, as in a humid medium we may conceive a cloud to be fufceptible of. On thefe occafions it tends either to the ftate of cirrus, or that of cirro-cumulus, of which we fhall treat prefently.

The reafon of the prognoftic afforded by the cirro-ftratus will now be evident. It gives us notice of a change in the ftate of the fuperior atmofphere, which we could not otherwife be certain of, until the current, in its courfe of propagation downward, had begun to affect the denfer clouds, thrown up by the fuperficial evaporation. It is not very uncommon to fee the cirro-ftratus evidently brought by a wind, moving in a different direction from that wherein the cumuli are immerfed on which it fettles. In this cafe the latter are fpeedily arrefted by it, and affume the new courfe, or defcend in rain, by a change of their electricity.

Of the Nature of the Cirro-cumulus.

Let us now reverfe the former cafe, and confider the upper current as both vaporized, and warmer than the air below.

It is probable that the upper is then cooled by that part of the lower which is next to it, though very flowly, from the difficult tranfmiffion of caloric downward. The decompofition of the vapour in the upper current by this means may give origin to the cirro-cumulus; and the peculiar aggregation of this cloud, as diftinguifhable from that of the cirro-ftratus, may be the refult of its acquiring electricity in its defcent in a much greater degree. Such, at leaft, is the inference we may deduce from its abundance before thunder-ftorms; when it is occafionally feen to arrive with the wind in extenfive flocks or ftrata, moving with unequal velocity, and by confequence overtaking each other, until they form a denfe ftationary mafs.

This explanation of the origin of the cirro-cumulus is principally deduced from an obfervation, which we have now fo often repeated, as to regard it as a meteorological axiom; *that the temperature of the day following, exceeds that of the day on which it appears.* Hence, when it continues to recur daily, the weather ftill grows warmer, until a thunder-ftorm, in fome quarter of the heated tract, puts a period to the infulation of the clouds.

Of the Nature of the Cumulo-ftratus.

In attempting to affign caufes to phenomena fo complicated, as thofe which this modification prefents, we may be in danger of admitting a greater number than are really neceffary. It is apparent, however, that in the ftate of things moft favourable to the production of the cumulo-ftratus, there exifts a precipitation, independent of that which gives rife to the cumulus, and fituated in a higher region. As this precipitation affords fometimes the cirro-cumulus, at others the cirro-ftratus, we need not affign to it any other caufe than the one already mentioned, *viz.* a fuperior vaporized current of air. It is not inconfiftent with the

the principles we have laid down refpecting the cumulus, that this cloud fhould alfo be produced at the fame time; it being requifite only that there exift a fufficient action of the fun on the earth's furface, or a fufficient temperature derived therefrom. The inofculation of thefe two orders of cloud, the fingular union which follows, and the eftablifhment of a new centre of attraction, towards which the whole future increafe tends, is the prominent feature in this modification, and the chief fact which remains to be accounted for. As this effect is not conftant and uniform, it cannot be afcribed to gravity alone. Reafoning from analogy, rather than from direct experiment, which it is not eafy here to apply, we may attribute it to a difference in the electric charge of the refpective clouds; which difference, though fmall, ought to produce the ufual appearances of bodies charged plus and minus; *viz.* mutual approach and contact. This effect however appears to enfue rather with regard to the maffes than to the individual particles.

The effect of the highly vaporized ftate of the higher atmofphere is often difcernible in the cumulus from its earlieft appearance; and it is eafy to determine, at certain times, that this cloud, if it continue long, will pafs to the prefent modification. The effect we mean to point out is the uneven growth of the cloud; numerous fmall maffes attaching themfelves to its furface, and giving it an appearance not unlike the curls of a fleece of wool; particularly when feen beneath the fun, in a fituation where the projecting parts may catch the light. If we admit that the cumulus acts, as well by electrical attraction, as by that of gravity, on the furrounding materials, we may here confider them as arriving by fubfidence in too great plenty to be immediately affimilated; in confequence of which they tend to unite among themfelves. A ftill greater quantity of haze, in the region next above the cumulus, gives rife to the curious phenomenon of the *cloud-capped* cloud; when the cumulus is covered at its fummit with a cirro-ftratus; in the fame manner as, in mountainous tracts, this cloud repofes on an elevated point of land. The caufe is probably alike in each cafe, whether it be a lower temperature on a diminifhed electricity which determines to this particular fpot, the commencement of the aggregation of the cirro-ftratus. We may next confider the cumulo-ftratus perfectly formed, and endeavour to affign a caufe for its occafional long continuance: which, however, exceeds the day of its formation only on the approach of thunder: this cloud, as well as the cumulus, very commonly vanifhing about fun-fet, and re-appearing the next day, for fome time. The two ftrata of the atmofphere, which form the fuperior and inferior boundaries of the cloud, are probably, during this time, in fomewhat different ftates of electricity; the one alfo depofiting water, the other receiving it; the broad furface of the cumulo-ftratus may be regarded as a coating, applied to the upper ftratum; and receiving from it a continual acceffion of charged particles of water, the electricity of which is flowly tranfmitted, through the intermediate portion, down to the bafe of the cloud, which is often fome hundred feet below; and where a continual evaporation counteracts the increafe above. Here, while the mafs continues in this modification, the progrefs of the electricity downwards is arrefted by the dry air: for although the infulated rod is found fometimes to be affected with pofitive, fometimes with negative figns, while the bafe of fuch clouds is over it, this effect is commonly influential; and the rod is not charged, as by the paffage of the nimbus. How the electricity of this cloud is affected by the conftant evaporation of a portion at the bafe remains to be afcertained; and the fame may be faid as to the cumulus.

Of the Nature of the Cirrus.

It was neceffary to defer the confideration of the nature of this cloud, until we had developed, in a confiderable degree, the principles on which our theory proceeds. The reader will have feen that we affume the fact of the flow tranfmiffion of the electric fluid through clouds: which in this, as in a former inftance, we apply rather analogically than by induction; the modification in queftion being ufually fo high in the atmofphere, that the electric ftate of the latter, above and below it, cannot eafily be found by actual experiment. Proceeding, however, on this affumption, we fuppofe that the cirrus refembles in its ftate a lock of hair, or a feather, infulated and charged; or rather, that its arrangements refult from the fame caufe with thofe of the coloured powders, which electricians project on a cake of wax, after having touched it with the knob of a charged phial, and which fall into a variety of configurations on the furface. Thus the cirrus may be formed in the air, out of fuch floating particles of water as are prefent, and may ferve the purpofe of collecting and tranfmitting the electric fluid. It is during the prevalence of variable winds that the cirrus moft abounds; and it is reafonable to conclude, that the portions of air, which at thefe feafons are tranfported from place to place, gliding over or interfecting each other, ufually differ fufficiently in temperature to occafion a flight decompofition of the vapour of one of the currents, and in their electric charge fufficiently to induce a communication by means of the conducting medium fo formed. Again, in the gradual cooling of a perfectly calm plate of air, fituated at a great elevation, and confequently free from the occafional caufes of difturbance which prevail below, it is not improbable that the feparation of the caloric from the vapour, and the collection of the electrifed water from the air, may go on together, by a procefs fimilar to the cryftallization of falts, in which much caloric is liberated into the medium. This opinion at leaft feems to be advanced by Kirwan, in his "Effay on the Variations of the Atmofphere," and we may confider the vegetating cirrus as the proper example of it.

Another conjecture might yet be ftarted as to the cirrus. It might be regarded as a cloud wholly formed of minute fpiculæ of ice; fince the air, at a certain elevation, is fufficiently cold throughout the year for this effect. But if it fhould be found that the particles of clouds are fufceptible of a rectilinear arrangement in any cafe at a temperature exceeding 32°, there would be no neceffity for this fuppofition.

If the appearances of the cirrus are as frequent and various at fea as on land, it cannot be doubted that intelligent mariners would find their account in keeping a regifter of them, as connected with the changes of wind, &c. making due allowance for the change of ftation in different obfervations when under fail.

The buoyancy of the cirrus feems to be moft perfect during its firft increafe. It always follows, at length, the common courfe of gravity, and the change to the cirro-cumulus, or cirro-ftratus, which certainly depends on the ftate of the medium it falls into, may be afcribed to the retention or lofs of the electricity.

Of the Nature of the Nimbus.

This phenomenon may be thought to be improperly denominated a modification of cloud, fince it confifts ufually of a column of defcending rain, fnow, or hail, feen in connection with the cloud affording it. As the concluding link in the chain of atmofpherical precipitation, it feems, neverthelefs, moft advantageoufly placed here; and its hiftory,

tory, though far from including all that we may obferve, and could wifh to have explained, on the fubject of rain, is more decidedly illuftrative of the nature of clouds in general than that of any other modification. Moreover, it is fometimes obferved to be formed before the rain begins, which affords fufficient ground for confidering it as a diftinct modification of cloud. We owe to the bold and penetrating conjecture of Franklin, on the identity of lightning and the electric fpark, the invention of a method of inveftigating the electricity of clouds; which, in the hands of experimentalifts, has fince brought out a mafs of facts abundantly fufficient to eftablifh that propofition; and which alfo throws confiderable light on the theory of rain, and other depofitions from the atmofphere. By this method the ftructure of the nimbus may at any time, when it paffes over us, be demonftrated to be that of a natural conductor, by which the pofitive charge of the higher atmofphere is brought down to the earth. For this purpofe, there is provided a rod of iron, or other metal, well infulated on a pillar of varnifhed glafs, the latter being defended from rain by an inverted funnel, foldered or cemented to the part of the rod next above it. The rod fhould be furnifhed with feveral points of wire, a few inches long; and it need not be an elevated one for this purpofe, provided the extremity is clear of other objects capable of drawing off the fluid. The charge is afcertained by pith balls, of a larger or fmaller diameter, to fuit the occafion, fufpended by flaxen threads, on a wire fixed into the lower part of the rod, and terminating in a ball. Near the latter, it is proper to have another ball fixed on a ftout wire, paffing into the ground, to which the fluid, when abundant, may efcape in fparks. This inftrument exhibits a charge of the fame kind with that of the air in which it is immerfed; or, in cafe of rain, &c. the charge of the latter, as compared with that of the air. We will give, in the firft place, the appearances which we have recently obferved during the paffage over the rod of a nimbus of the moft fimple ftructure, having neither a cumulus nor a cirro-ftratus attached to it; which moved along with the lower current through the clear atmofphere, and difcharged a fhower of large opaque hail, the air below being very dry. During the approach of the cloud from the north-eaft, the pith-balls remained clofe until the fpreading crown, which characterifes this modification, had arrived in the zenith. At this time, and while the fhower itfelf was ftill three or four miles diftant, they opened negative. As the cloud came nearer, their divergence increafed until it amounted to full two inches, at which time fparks of confiderable ftrength might be drawn from the rod. After this the negative charge gradually went off, and the balls touched again. In a few moments the edge of the fhower, mixed with a few drops of rain, arrived at the conductor, and the balls inftantly opened pofitive, the charge gradually increafing until fparks were emitted more freely than before. This charge continued during the paffage of the hail, and went off gradually as foon as it was clear of the inftrument. After having clofed, the balls opened again negative, and this charge increafed to a confiderable intenfity, as the fhower receded towards the fouth and fouth-weft, after which it gradually went off: the balls clofed, and finally were left flightly pofitive. From thefe facts, the reader, who is converfant in electricity, will deduce the ftructure of the lower part at leaft of the fhower. He will fee that the defcending hail formed a column pofitively electrified. This, which might be fix or feven miles in diameter, was furrounded with a cylinder of negative electricity, probably extending in every direction three miles further, and refulting from the action of the pofitive centre on the dry atmofphere, in which it was moving. Now the amount of the hail, when melted, was confiderably lefs than $\frac{1}{100}$th of an inch in the rain gauge; and could the defcent of the electric fluid, through the whole fpace, have been rendered as obvious to our fenfes as that of the hail, we fhould probably have faid that the fhower confifted of fire more truly than of ice.

The queftion that naturally prefents itfelf is, Whence came this flood of electricity which accompanied the hail? It was not from the circumftance of the water being frozen, fince a hard fhower of rain equally exhibits a charge, but with this remarkable difference, that whereas fnow, fleet, and hail, are always pofitive, rain is found fometimes pofitive, fometimes negative. The reader may confult, on this head, an extenfive collection of facts in Read's Journal of Atmofpherical Electricity. "Phil. Tranf." vol. lxxxii. The probable fources of negative rain will be prefently mentioned; but to return to the queftion of the origin of the pofitive charge; if we attentively confider the ftructure of the nimbus, it is precifely that which, from the known properties of the electric fluid, we fhould propofe for a conductor formed to acquire the latter. If we detach from it the falling column, and extraneous clouds which ufually attend its progrefs, it will be found to confift of a clofe collection of fibres, diverging from the region of the cumulus, (where it appears the rapid union of the particles into drops is accomplifhed,) to a vaft height and extent in the fuperior atmofphere. The conducting-line, therefore, may be confidered as prolonged from the top of the column, to the very extremity of each of thefe fine fibres of cloud, which are often extended, in all directions, as correctly as thofe of a lock of hair infulated on a charged conductor. The intention in this cafe feems to be not fo much the precipitation of water, as that of the electric fluid which keeps it in fufpenfion. This purpofe accomplifhed, (and the reader may conceive how great a difcharge muft be effected by a number of fuch machines acting at once on a fmall tract of country,) the water unites into larger drops through the whole extent of the atmofphere; it fubfides in a continuous fheet, under which the condenfed product of the fuperficial evaporation moves along, in the form denominated *fcud*; and the rain comes down freely and generally, until the atmofphere is difburthened, or until the partial vacuum which is formed brings in a drier air from the northward.

Negative, as well as non-electric rain (which fometimes falls, though ftrong pofitive and negative figns precede or follow it in the clear air) muft neceffarily refult from the action of a central mafs of cloud, in which a ftrong pofitive charge exifts, on the clouds of lefs extent which fall in its way; and it is to be confidered alfo, that rain, at the elevation in which it is formed, may be perfectly non-electric, (*i. e.* it may refult from the union of clouds differing in electricity, and hence uniting in rain,) yet at the moment of arriving at the earth, it may differ fo much in its charge from the atmofphere below, the only ftandard of comparifon, as to be ftrongly negative or pofitive with refpect to the latter. But thefe confiderations belong more properly to the fubject of atmofpheric electricity.

We fhall conclude with a brief review of the modifications; afcending from the ftratus, formed by the condenfation of vapour, on its efcape from the furface, to the cumulus, collecting the water arrefted in the fecond ftage of afcent; both probably fubfifting by virtue of a pofitive electricity. From thefe proceeding, through the partially conducting cumulo-ftratus, to the cirro-ftratus and cirro-cumulus; the latter pofitively charged, and confiderably retentive of its charge; the former lefs perfectly infulated, and, perhaps,

conducting

conducting horizontally; we arrive thus at the region, where the cirrus, light, elevated, and extended, obeys every impulse or invitation of that fluid which, while it finds a conductor, ever operates in silence; but which, embodied and insulated in a denser collection of watery atoms, sooner or later bursts its barrier, leaps down in lightning, and glides through the nimbus from its elevated station to the earth. See ELECTRICITY ATMOSPHERICAL, EVAPORATION, RAIN, METEOROLOGY.

CLOUDS, *Magellanic.* See MAGELLANIC *clouds.*

CLOUD-BERRY, in *Botany.* See RUBUS *Chamæmorus.*

CLOUD'S-HILL *Lime-works*, near Bredon on Charnwood Forest, in Leicestershire. The lime produced from the rock in this part is often called Barrow-lime, and is in such general repute for water-works, that rail-way branches have been constructed to these works, from two different navigations in opposite directions, *viz.* from the *Ashby-de-la-Zouch* canal, a branch of 6¾ miles, and from the *Leicester* navigation, a branch (including a water-level) of 12 miles in length; while a third rail-way therefrom, to be called the *Bredon* rail-way in another direction, was in contemplation at the time that the *Derby* canal was formed, with which and numerous others it was intended to connect; see our article CANAL.

CLOVE, in *Commerce*, is used for the two and thirtieth part of a weigh of cheese, or barrel of butter, *i. e.* eight pounds avoirdupoise $= \frac{1}{14}$ cwt. $= \frac{1}{15}$ quintal, (120 lb.) $= 9.78$, &c. lb. troy. 9 Hen. VI. cap. 8. A clove of wool weighs 7 pounds, and 2 cloves make a stone $= \frac{1}{4}$ tod $= \frac{1}{16}$ cwt. $= \frac{1}{52}$ sack, $= 8.5069$ lb. troy.

CLOVE *Cinnamon.* See CINNAMON.

CLOVE *islands*, in *Geography.* See MOLUCCA.

CLOVE-*july-flowers*, a species of caryophyllus, greatly recommended as cordials, and given in disorders of the head, palpitations of the heart, and in nervous complaints of all kinds. See DIANTHUS CARYOPHYLLUS.

CLOVE-*Pink*, in *Botany.* See DIANTHUS CARYOPHYLLUS.

CLOVE-*tree.* See CARYOPHYLLUS.

CLOVE-WATER, is prepared of brandy, and cloves bruised therein and distilled.

CLOVER, in *Botany.* See TRIFOLIUM.

CLOVER, in *Agriculture*, is the name of a well known plant of the artificial grass kind, of which three sorts are cultivated in the field; the red clover, the middle clover, or cow red clover, and the white clover. The red clover (*trifolium pratense*) is a biennial perennial plant, which rises to a considerable height, has a long tap root, and flowers from May to September.

It has been remarked by Mr. Bannister, in his "Synopsis of Husbandry," that it is "in some places called broad clover, and is distinguished by a large leaf, and blows, as its name implies, with a red blossom. It delights in a rich earth, and of a stiffish nature, but will prosper well on gravels, sands, or chalks. It probably, however, thrives best in clayey or strong deep loamy soil. And the above author thinks, that the most convenient time for sowing this grass is with the oats in February or March, or among the green wheat in those months; though it is not unfrequently sown with the barley in April; but in this latter case, there is danger of its growing to such a height among the corn, as to occasion the barley to lie so long abroad at harvest that the clover may be withered, and hence great mischief may accrue to the barley, if much rain should fall ere it can be brought into the barn; or the barley may be much lodged, so as to destroy the clover; either of which are inconveniencies that one would wish, he says, to avoid; and for these reasons, clover is rarely sown among barley on good lands; but on thin soils these accidents are less to be apprehended."

But Mr. Young says, "there are several methods of sowing this seed, which is so profitable upon almost every farm, that it must be had if possible. 1st. In the drill husbandry, it may be sown and harrowed in, at the time the barley is sown broadcast; a pair of light harrows at the same time following the drill machine, to cover the clover seed. 2dly. It is sown before the roller, when the barley is four inches high; and 3dly. It is hand or horse hoed in, when the corn receives either of these operations, if the farmer is in the practice of giving them.

"These are the methods most commonly used. But Mr. Ducket, he says, drilled the seed in the same drills as the barley, but that way is very uncommon. Another way he has known, has been that of scarifying the barley stubble in harvest on light soils, and sowing the seed alone then." But "of these methods, the first is, he thinks, the surest for a crop, and the most to be recommended, notwithstanding the admitted evil which sometimes takes place in a wet season, of the clover growing so luxuriantly as to damage the barley. The second succeeds well, if rain follows in due time, and would perhaps generally succeed, if the farmer ventured to harrow it in, which he might safely do. In the third method it often succeeds, but it also often, as he says, fails; nor is it necessary, in many cases, to hoe the barley."

It is further stated, that, "in regard to the quantity of clover which the farmer sows, he has several considerations to govern his determination. In the first place, it is in many situations, and on many farms, as profitable a crop as any other he commonly reaps. On tolerably good land, he may expect, at two mowings, three tons of hay; on good, three and a half, and even four; or, if he applies it to soiling his teams for want of lucern, the produce, in a different way, is equally striking. This produce is also gained at a very cheap rate; cheaper than he gets any other crop. Add to this, that it forms an excellent preparation for either beans or wheat. Still, however, the quantity to be sown will depend in some measure, on his having lucern, saintfoin, or a great plenty of meadow land. If he is deficient in these, it becomes more than useful; it is essential." But, says he, "the unfortunate circumstance which attends clover is, its being extremely apt to fail, in districts where it has been long a common article of cultivation. The land, to use the farmer's term, becomes sick of it. After harvest, he has a fine plant, but by March or April, half, or perhaps more, of it dead. This makes a new course of crop necessary. Instead of its occurring once in four years, in the common Norfolk course, it becomes necessary to sow it only," he says, "in the second round alternately, beans after barley, in one course, and then clover in the next. This has been found to answer. This observation, however, should be made not without observing, that on a farm at Merton in Surry, Mr. Arbuthnot, by means of deeper ploughing than common, and ample manuring, succeeded well with clover every third year in this course: 1. beans; 2. wheat; 3. clover; on land that was said to be sick of it, though sown before only once in four years. He viewed his crops in that new course during three rounds, and never saw finer." Much caution is necessary in repeating it frequently, as various facts in the different surveys of the kingdom fully show.

In respect to the proportion of seed that may be necessary, the same able writer states, that from "ten to twelve pounds an acre is the usual quantity of seed, but that fifteen is better;" and that "as clovers are liable to decline or go off," very early in April, and in some seasons in March, the young clovers should be carefully examined, as a full plant in autumn

autumn often dies away in winter and ſpring; ſo that, by this month, the farmer is in doubt whether he ſhall let it ſtand or plough it up. In this caſe, it is highly adviſable, he thinks, to dibble into all the vacant ſpots ſpring tares, which thus take extremely well, and between clover and tares a very ample crop is produced," and that of a ſort that is of the greateſt utility to the farmer.

But it has been ſtated by Mr. Donaldſon, in his account of the preſent ſtate of huſbandry in Great Britain, that in the northern diſtricts, "the quantity of ſeed allowed to the Engliſh acre, when it is intended to plough up the field after the firſt or ſecond year, is from ten to fifteen pounds; to which is commonly added about a buſhel of rye graſs ſeed. It was formerly, he ſays, conſidered improper to ſow graſs-ſeeds of any kind along with oats, barley, or other white-corn crops. This opinion, however, has been clearly and ſatisfactorily proved to have been ill founded, and muſt have been at firſt promulgated by thoſe who were better acquainted with the theory than with the practice of agriculture. Every practical farmer now knows," he adds, "that if a crop of graſs be the principal object in view, there is a greater chance of its proving abundant when the ſeeds are ſown with barley particularly, than when ſown alone. This fact is ſo completely eſtabliſhed, that there are, it is preſumed, few inſtances where the method above mentioned is ſtill adopted. The general practice is to ſow, not only red clover, but all other graſs-ſeeds, with oats or barley in the ſpring. When the ſeeds are ſown, which is uſually done as ſoon as the grain is harrowed in, the field is again gently harrowed, and afterwards rolled, ſo as to cover the ſeeds, and ſmooth the ſurface of the field, that the ſcythe may paſs eaſily over it the following ſeaſon. Red clover, when the ſeed is ſown along with, or rather immediately after, barley, and at the rate of twelve or fifteen pounds to the acre, frequently overtakes, or overtops, the crop of barley ſo much, as materially to injure it. Were the clover ſeeds not ſown till the barley had vegetated to the height of three or four inches, he thinks this loſs and inconvenience would in all probability be avoided; at the ſame time the crop of barley would rather be improved than injured by a light harrowing at that ſtage of its growth, while the clover-ſeeds would vegetate as freely, and the crop of graſs prove as abundant, as if the ſeeds had been ſown at an earlier period, or at the time the grain was put in. As it is an eſtabliſhed rule or regulation in many diſtricts, eſpecially in Scotland, for an entering tenant to pay the one who removes a certain ſum, as from 10*s.* to 20*s.* the acre, for liberty to ſow graſs-ſeeds along with the outgoing tenant's barley; it is fair to preſume, he conceives, that this rule has been eſtabliſhed on proper principles, and that the payment ſo made, is no more than an equitable compenſation for the injury which the removing tenant ſuſtains by granting this permiſſion. "If ſo," ſays Mr. Donaldſon, "the average loſs of 15*s.* the acre, which is incurred by ſowing red clover along with barley ſeed, muſt appear of conſiderable magnitude to thoſe who ſow a fourth, a fifth, or a ſixth part of their farms every year with barley and red clover-ſeeds. The method above ſuggeſted for obviating this loſs and inconvenience, cannot poſſibly be attended with any bad conſequences to either of the crops in queſtion; and as it would in all probability prevent this evil, which is ſo generally complained of, it certainly merits the conſideration of thoſe who, having repeatedly ſuſtained heavy loſſes from the failure of their crops of barley, are of courſe more immediately intereſted."

The practical writer we have firſt mentioned has remarked, that "on farms where there are kept large flocks of ſheep, there is an abſolute neceſſity of ſowing annually many acres of this graſs, that there may be no want of food for the flock during the ſummer months. For this reaſon, clover is often ſown on land that is improper for its cultivation; in which predicament may be ranked ſuch poor fields where the juices of the ground have been exhauſted by repeated crops of corn. But, though large burthens of clover cannot be expected from ſuch worn out ſoils, yet the farmer, in the circumſtances above alluded to, acts a prudent part in ſowing the ſeed, for this will conſiderably improve his grattens in the following autumn, and furniſh the ſheep with food during the firſt part of the winter; and if the clovers may not have taken ſufficiently thick to ſtand for a crop, or that the ground be intended to come in courſe for corn that year, or for a fallow, ſuch mode of huſbandry may be purſued without an apprehenſion of the leaſt damage to accrue from the growth of the clover. On theſe accounts, it will redound much to the intereſt of a farmer who keeps a large flock, not only to raiſe many acres of this graſs annually, with the expreſs view of reſerving it for a crop to ſupply the ſtock with green meat throughout the ſummer; but in particular caſes, as when from the abundance of the crop the ſeed is but of inferior value, or there is a probability of there being required on the farm a larger ſupply of ſheep-keeping than uſual, to ſow a ſprinkling of clover-ſeed in a variety of fields among the wheat, oats, and barley, though ſuch ground be intended for tillage the following ſpring."

It is added that "the beſt clover ſeed is that where the purple colour chiefly prevails, and which is moſt free from the ſeeds of weeds, of whatever kind. When clover is deſigned to ſtand for a crop, the beſt method of preparing the land for this uſe is to allow a liberal quantity of dung on the turnip fallow, and the turnip ſeed being thus ſown on fallows, properly conducted, will, in all likelihood, produce a good crop of that root; and if the ſpring ſhould turn out kindly, the turnips may be eaten off, and the ground reduced to a tilth for ſowing the oats and clover ſeed in March. Three buſhels of oats in this caſe is a proper quantity to the acre: if more ſeed were allowed, the crop from the extraordinary tillage beſtowed on the land would probably throw out too great a quantity of ſtraw ſo as to be early lodged, by which the welfare of the clover would be endangered. As it is of conſequence that the ground ſhould work kindly at the time of ſowing this and all other graſs ſeeds, the utmoſt care ſhould be taken to get it into a due preparation for that purpoſe; and as the turnip ground is frequently baked very hard by the treading of the ſheep in a wet winter, ſo that ſuch ground is apt to break up in large clods at the firſt ploughing in the ſpring: in this caſe, two ploughings will be required previous to ſowing the oats and clover, which will not only diſpoſe the field to work kindly, and to lie ſmooth and level, ſo that the ſmall fibrous roots of the clover will meet with leſs reſiſtance, and the graſs will form its ſucceeding ſhoots with greater facility; but this kindly diſpoſition of the ground at ſeed time, will enable the oats likewiſe more ſucceſsfully to withſtand the drought of the ſpring, or other accidents. As it is of eſſential conſequence that the clover ſeed ſhould be ſown in a bed of well pulverized earth, and at a time when the ground may be worked to the greateſt advantage with the harrow, care ſhould be taken to fix on a tolerably dry time for this work, otherwiſe much of the ſeed will not vegetate, and that which may grow will ſuſtain infinite prejudice: for in a wet ſeed time the ground becomes beaten down ſo very cloſe, that the ſeed is prevented from ſending forth tender fibres; and in conſequence from ſhooting forward with vigour; whence the crop languiſhes in its ſeveral progreſſive progreffive ftates, and fails to produce a return nearly adequate to what might have been expected from land in that improved ftate; and this fhows the neceffity of breaking up fuch ground which is meant to be fown with clover feed, in the early part of the fpring, that there may be time to give the field a fecond ploughing, if it fhould be found requifite; and hence alfo appears the neceffity of fowing the feed before the dry weather fets in, and this may generally be brought about, if the turnips are fed off by the latter end of February, or beginning of March. Though an early fowing, as fome time within the month of March, is by far the moft likely method of infuring a good crop of clover on thin foils, yet in the cafe above mentioned, there will be no time loft in waiting till the land has been twice ploughed, though from this circumftance, if the weather fhould prove unkindly, the feed time may be protracted till April, as it will be far more prudent to wait till that time, than to fow the feed in a rough and ill cultivated bed. Neither can fuch early fowing often be complied with on ftiff foils, as this ftubborn ground does never work kindly under the barrow, till the fpring is farther advanced, and always requires a fecond ploughing for the Lent corn, fo that the clover is rarely fown on thefe foils till the middle of April, and very frequently this bufinefs is procraftinated till May; but this fhould by no means be brought into a precedent; fince on moft grounds, as obferved before, the early fown clovers have a much fairer chance of fucceeding, than thofe which are fown later in the fpring feafon. The feeds of clover, being very fmall, require only a fuperficial covering, and the ufual method is to fow the clover previous to the laft harrowing of the oats, by which the feed will be introduced to a proper depth; and this method of tining the feed in with the harrows is, in his opinion, greatly to be preferred to putting it in with a bufh or only rolling in the feed, as is the practice with many people; for though this feed, being of a diminutive fize, will eafily take root, and if harrowed in at too great a depth beneath the furface, would be in danger of not coming up at all: yet there is a medium to be obferved, and the fowing of it previous to the crofs harrowing of the corn, appears, he fays, a more likely way of defending it from the cafualties of the weather, than the flight covering by a bufh or roller. Clover feed is often fown amongft green wheat in the fpring, and covered with the fmall harrows, and the ground afterwards rolled, except when the wheat is fo thin upon the ground, and fo loofe at the root, as not to admit of this practice, which fometimes happens; and in this cafe we muft content ourfelves with the ufe of the bufh-harrow and roll," as it would be dangerous to have recourfe to any other method.

It is well known that clover, in its infantine ftate, and before it has attained its rough leaf, is very apt to be eaten by the fly or flea, which is another reafon for fowing early, that the plants may get into rough leaf before the approach of dry weather; and this is likewife an argument for reducing the ground to the fineft poffible tilth, that this infect may not have fo proper a nidus to generate in; fince it is found by experience, that the fly or flea, which is the fame infect that preys on the feed leaf of the turnip, and on the firft fhoot of the hop, is more frequently met with, and commits more fatal depredations on ground that is rough and cloddy, than on thofe fields which have been reduced to a fine tilth by the harrow. There is, the fame writer fays, a very common error which farmers are apt to run into at clover feed time, by which they are often confiderable fufferers in the future crop; and this is, to fow a larger quantity of ground than they are able to harrow in the fame day, fo that if there happens a glut of rain, that they cannot get on their land till feveral days after it has been fown, the feed muft either lie uncovered, or a great part of the clover be torn up by the harrow after it has begun to vegetate. It is, he fays, a very ufual method for the feedfman to continue fowing clover or other grafs feeds in the afternoon after having fown the barley in the morning, by which management the farmer thinks he is gaining time, as this ground may be harrowed the next day with the odd horfes, whilft the team horfes are covering in the barley or oats. And were there a certainty of fine weather, this would doubtlefs be a very prudent and commendable practice; but as this is not to be depended on, it feems to him to be an experiment fraught with too much hazard, in fuffering a dozen or fixteen acres of clover ground to lie uncovered, which would be utterly fpoiled if wet weather fhould intervene, fo as to prevent it being harrowed within three or four days, a fpace of time fufficient for the feed to have ftricken root. Nor is this the only mifchief likely to follow from this practice; for the feeds of clover, as well as trefoil, being of a diminutive fize, their veffels foon become overcharged with moifture, and when this happens, great part of the feed will in courfe never vegetate; fo that on every account it feems to be highly imprudent to purfue this method, unlefs the weather be fuch as to promife a dry day or two, which however, in our infular fituation, and at this time of the year, can rarely be depended on with any degree of certainty.

It is obferved, that "though clover feed will grow at two years old, it is by far the moft fecure method, to fow that of the laft year, which is not only quicker in vegetating, but the plants likewife fhoot away with greater expedition, and fooner attain their rough leaf; a confideration of no fmall moment, fince the fly is fo peftilent an enemy to this grafs in its infantine ftate." It is always a matter of great importance, in thefe crops, to have well ripened frefh feed.

And it is further remarked, that, "in a dripping fummer, the clovers grow to a confiderable height amongft the corn, and in this cafe, the barley often fuffers after a wet and tedious harveft. Oats take lefs damage by wet, and wheat, being reaped, may generally be cut above the clover. When it happens that the clover grows to fo large a head during the fummer, the ftubbles will be found to produce great ftore of food in the autumn, either for horfes or cows, efpecially if warm dripping weather fhould happen at that time: and when the large cattle are removed, their places may be fupplied with fheep, and by this management a very confiderable advantage is gained; for thus the working horfes are maintained in good heart at that time when there will be but a fmall fupply of green meat remaining, the cows will be fupplied with a wholefome food that will caufe them to yield abundance of milk, and the fatting cattle will be greatly improved in flefh: old ewes, or indeed fatting fheep of whatever denomination, will thrive in this keeping, and if they fhould not be perfectly ready for the butcher when taken out at Michaelmas, will however be in much better condition to be driven into the turnip field, than if they had at that time been bare of flefh: fuch fatting lambs as are yet unfold, may likewife be brought into flefh on thefe young clovers. In fhort, among the various advantages to be derived from the cultivation of this grafs, it is none of the leaft, that in the autumn after it is fown, it will produce a fupply of valuable food, which may be turned to fo many different purpofes, and, with the help of the faintfoin lays, preferve the turnips untouched till Chriftmas, if the early part of the winter fhould prove mild and open.

 To

To such farmers who pursue the mode of suckling lambs, the young clovers are exceedingly useful, affording a valuable pasture for the ewes, and causing them to spring abundantly in their milk. But with all these advantages, there is some discretion to be used in the feeding young clovers, both with respect to the cattle and the grass. Beasts which are of the ruminant tribe, it is well known, are apt to feed with that greediness and avidity when turned on succulent pasture, as to occasion a repletion; which, among the farmers, is technically called *hoving* or *blowing*. Many sorts of food will occasion this malady, and none has a greater tendency towards it than clover; for which reason the horned cattle should not be turned into the field till towards nine or ten o'clock in the morning, especially in wet weather; and whilst they are feeding, they ought to be carefully watched, though there will be less need of these precautions when they have been some few days accustomed to the food, and have eaten down the rankest part of the grass. The like precautions it will be necessary to take with respect to sheep, when they are depastured with the cows; but if these latter are not permitted to graze on the clovers till the large cattle shall be removed, they will run little or no risk of hoving." See HOVEN.

It may be necessary also to observe, that "this, as well as other sown grasses, is much injured by being depastured too low. It will be necessary with respect to feeding clovers in this period of their growth, to take the stock off them before the close of the year, as it would be a specimen of very ill husbandry, Mr. Bannister thinks, to suffer the cattle to remain in the field after Christmas, at which time the clover should be left a tolerable height; for if eaten down too close, a great part of it would be destroyed, and the spring shoot would be languishing and weakly, which should never be the case in this sort of grass.

The same writer has sometimes known young clover, mown in the circumstances above mentioned; but this method, he thinks, would be prejudicial to the future growth of the crop, since the cutting off the stalks with the scythe must cause the juices to evaporate, and thereby weaken the stocks. One advantage there is however, he says, which attends this practice: namely, the removal of the stubble, which when very strong, and where the corn has been cut high, is apt to deaden the scythe at the mowing of the clover in the following summer, when cut for the general crop."

It has been remarked, that, "with some it is the custom to apply manure over the clover land immediately after the grain has been taken from the land, which in soils that are not in a good state of fertility, may be advantageous in preserving and invigorating the plants; but under other circumstances, it is not necessary. There is, however, another case in which the use of what is termed long stable dung, when not in the state of fermentation, may be found useful, by preventing the plants from being too closely nibbled and eaten up by sheep, which is that where the land is in the state of commonage or not inclosed. And the writer thinks, that, "when the clovers are to be continued for two or more years, the application of a thin coat of manure, in the autumn or spring season, is a practice from which great benefit may be derived, especially on lands that are in the less perfect state of heart. In the drier sorts of soil, this business may probably be done with the greatest advantage, about the latter end of February; but where the lands are soft, retentive of moisture, and poachy, the early part of the autumn, while the ground is sufficiently hard, may be the most suitable season for the purpose. Well rotted dung is perhaps the most proper in these cases." By performing the work at this period, "there is less danger," Mr. Middleton thinks, "of the clover plants dying away in the winter than is the case under other circumstances." At whatever season the manure may be applied, it should be spread out over the surface in as even a manner as possible, and be beaten perfectly fine.

In the county of Hertford, "it is a pretty common practice to sow coal ashes in the months of January or February, on such of the young clovers as are intended for mowing in the next summer. This is a very good practice where the land is not either fertile by nature, or much improved by the dung cart; but where the ground is in good heart, there remains little necessity for this top dressing on the clover: the method with the Hertfordshire husbandmen is to sow thirty bushels of coal ashes on an acre, which they often fetch ten or fifteen miles, and purchase at fourteen or fifteen pence per sack, for the purpose. Those fields of clover which are intended for pasturage, unless in very late and unkindly springs, will have attained a sufficient length to that purpose by the middle of April, and will afford store of valuable feed throughout the summer, but if it should be thought proper to reserve any part of this growth for seed, the cattle must be taken out, towards the latter end of May, or early in June; and it is much more eligible to feed down those fields which are intended for this purpose, in the fore part of the summer, than to take off the primary crop for hay, as such repeated mowings have a great tendency to impoverish the land, and to render it improper for sowing with wheat the next year: besides, in the former instance, the farmer is not confined to a set time for laying in the field, as the stock may be taken out at an early period of the summer; whereas this advantage is lost, when the first crop is reserved for hay, and thus a dry time may set in and stop the growth of the rowens, so that the crop of seed clover may be protracted till late in the autumn, when bad weather may be expected, which will greatly injure the sample," and produce other inconveniences.

As it is found that "clover will not perfect its seeds, if mown for that purpose early in the year; it is necessary to take off the first growth either by feeding or with the scythe, and to depend for the seed on those heads that are produced in the early autumn. Seed clover is found to turn out to good account in those years when the crops are not injured by the blast, which is often fatal to them, or by the rains in the autumn, which sometimes prove their destruction: for the time of harvesting this seed falling out late, when rainy weather may be expected, renders it on that account a very tedious job. But where the seed has headed well, is not affected by the blast, has been properly harvested, and the sample is unadulterated by the seeds of dock or other weeds, it proves a very lucrative article to the farmer, since it is no uncommon circumstance to grow a sack on an acre, and to sell it from thirty shillings to two guineas per bushel. And the trouble attending it is but trifling. It is found that a bushel of good clover seed, in kindly years, will weigh near 70lb. but in bad seasons it seldom rises higher than 65lb. Such clover seed as is of a deep purple colour, and is free from seeds of weeds of every kind, but more particularly of dock, which of all others is the most pernicious, fetches a price at market out of all proportion larger than that of an inferior kind, or where the sample is adulterated with other seeds. It is therefore of great consequence, at the laying in a piece of clover for seed, to be careful that the land be such that is not prone to blast, and that it be free from weeds of every description, the dock especially, as without this it is impossible to produce clean seed."

It is remarked by the author of the "Present State of Husbandry in Great Britain" that, "when it is proposed to

save

ſave the ſeeds of red clover, the firſt crop of graſs ſhould be cut early, ſo that the ſecond, whence the ſeeds are procured, may be ready for cutting by the end of Auguſt, or beginning of September. The reaſon of making choice of the ſecond crop, is, he ſays, that it always branches out into more ſeed-bearing plants, or ſtalks, than the firſt crop, and conſequently a greater quantity of ſeed is procured from the ſame extent of land. Beſides, the hay of a firſt crop of clover, is more valuable than that of the ſecond; and as it is neceſſary to thraſh clover-hay very much, in order to ſeparate the huſks in which the ſeeds are incloſed from the ſtems, or ſtalks, the loſs of hay is, of courſe, leſs conſiderable in the one caſe, than it would be in the other, while the crop of ſeed is at the ſame time more abundant. A crop of clover, of which it is propoſed to ſave the ſeeds, ſhould, he thinks, be allowed to ſtand till the huſks become quite brown, and the ſeeds have acquired a degree of firmneſs. It ſhould then be cut, and harveſted in every reſpect like other hay; and the ſeeds thraſhed out at any period during the following winter, or ſpring, according to the farmer's convenience. The quantity, he ſays, commonly reaped, is from four to five buſhels the Engliſh acre; weighing, when thoroughly clean, from two to three hundred weight. The expence of thraſhing is, he ſays, conſiderable—not leſs than from 5*s.* 6*d.* to 7*s.* the buſhel. This great expence, which, from the laborious nature of the work, cannot be reduced while the operation continues to be performed by manual labour, may, he hopes, ſoon induce ſome intelligent mechanic to conſtruct a machine, by which the labour may be greatly leſſened, while the work may be as completely, and more expeditiouſly performed." See Clover *Threſhing-Machine.*

It has been ſtated that "the principal objections to the feeding of clover crops, are thoſe of their uncertainty, on account of the ſtate of the ſeaſon at which they become ripe, the trouble and expence of threſhing out the ſeed, and the injury which they produce in leſſening the fertility of the ſoil. The high value of the ſeed, in moſt ſeaſons, is however, he obſerves, a great inducement to the letting of clover crops ſtand for that purpoſe." And froſty nights, and hot, ſunny, dry days in May, are very prejudicial, Mr. Banniſter ſays, to the clovers, and prevent a ſucceſſion in the growth of thoſe which have been eaten down, as doth likewiſe dry and ſultry weather in June; ſo that in backward ſprings and hot ſummers the clovers produce but a trifling return either for feeding or hay, when compared to the growth of thoſe years wherein the ſprings and ſummers have been more kindly and propitious. During the weather above mentioned, the ſtalk and leaves are often ſo totally ſcorched, that he has known in the fields of this graſs, when advanced to ſome height, ſo as to have formed the heads for bloom, and to promiſe fair for a crop, that the leaves have univerſally dropt off, and the juices have been ſo much exhauſted by the parching heat of the ſun, that the utter deſtruction of the crop has enſued. When this diſaſter happens, and the weather continues dry and ſultry till the middle of June, the beſt way is to ſet on the mowers, without waiting any longer in expectation of rain, and to truſt to future ſhowers for improving the lattermath. But although on thin lands, ſuch as gravels, chalks, &c. the clovers are often ruined by a hot and parching ſummer, yet on loams there is not that danger to be apprehended from this contingency, as theſe grounds, being of a ſtronger nature, will puſh on the clovers with greater vigour in their progreſs. This diſpoſition in the clovers to burn in a dry ſummer on thin ſoils, ſhows the neceſſity of laying them in early for the ſcythe, and ſtrongly enforces the rule before recommended, not to winter feed this graſs with cattle of any kind after Chriſtmas. Clover begins to form its head for bloom towards the middle of June, and will continue in a growing ſtate till it becomes in full bloſſom, at which time it is in the higheſt perfection to mow for hay; but this graſs differs in this particular from ſaintfoin, that, when its bloſſoms are fully expanded, they continue much longer in that ſtate than the laſt-mentioned graſs, ſo that if the weather ſhould prove wet and unkindly for the haying, the clovers will wait a fortnight, after they become in bloſſom, without ſuſtaining any material injury, either by the ſhedding of the leaf or bloom; for the ſame weather which renders it improper to mow this graſs, continues it in a growing ſtate, and prevents the bloſſom from dying away. When the crops of clover are large and heavy, it is neceſſary that the ſwaths ſhould be turned over at the making, the ſtalks of this graſs being very replete with juices. This may be done the next day after the mowing, or the ſecond day after, as the weather is more or leſs favourable, obſerving that, as the chief virtue of this hay reſides in the leaf and bloſſom, the leſs theſe are diſturbed the more valuable will be the fodder; on which account the tedding of this hay abroad, as is practiſed by ſome people, cannot fail to be of the greateſt injury. From the wind-rows it ſhould be made up into graſs cocks, which, having enjoyed the influence of the ſun and air for a day or two, may be thrown into large cocks for carting. But if wet weather prevails during the ſeaſon for making this hay, it cauſes an infinite deal of trouble to the farmer, and the clover, from having been frequently ſhaken abroad, is deprived of its moſt nutritious particles, namely, the bloſſom and the leaf of the plants. See Hay-*making.*

The ſame author ſtates further, that "there is an accident which ſometimes happens to young clovers that cuts off all hopes of a crop, and obliges the farmer to plough up his land for wheat. This malady takes its riſe from a worm which gnaws off the graſs juſt within the ground, ſo that the blade withers and dies away. A gentleman of great knowledge and experience in every article that relates to country affairs, aſſured him that, in December 1777, he had ſuffered very conſiderably from this inſect, which in the preceding ſummer totally deſtroyed ſeveral acres of clover on his farm, and that this happened on the beſt of his land, worth more than 20*s.* per acre, whilſt that of inferior goodneſs, and thoſe fields which worked badly at feed time, eſcaped the diſaſter." It is obſerved that "clover is rarely ſuffered to continue longer on the ground than one year; after which the field is generally ſown with wheat at one ploughing, a mode of huſbandry exceedingly advantageous to the farmer, who thereby enjoys a crop during the fallow year, that yields him conſiderable profit, and leaves the ground in far better condition for wheat, than would have been the cleaneſt and beſt conducted fallow, there being no preparation ſo kindly for this grain as clover hay. It has been long ſince remarked, and every year's experience confirms the truth of the obſervation, that clover lays, which have been mown the preceding ſummer, do uniformly produce better crops of wheat, *cæteris paribus*, than thoſe which were depaſtured: whereas, on the firſt idea, one ſhould ſuppoſe the contrary would be the event, from a conſideration that the ſurface of the paſture had been improved by the dung of the cattle which fed on it. This preference in favour of the mown clover, he is inclined to think, ariſes partly from the ſhedding of the leaf, which acts as a manure to the ground, but it is chiefly owing to the ſhade which the land enjoyed, during the ſummer, from the ſcorching heat of the ſun, by which the nutritious particles were retained; whereas the field, which had been fed down cloſe, could participate of neither of theſe benefits;

and

and, with reſpect to the dung of the cattle, the moiſture of other nutritious matters having been exhaled by the ſun, but ſmall advantages could be derived from it. But thoſe who keep folding flocks generally begin to plough up their clover lays early in the ſummer, and having ploughed one day's work, ſet the fold on that part; and the whole of this ploughed ground being gone over by the ſheep, another journey is to be ploughed; and which buſineſs of ploughing and folding is to be continued till Michaelmas, when the whole field is to be broken up. By thus ploughing up the field at various times, a portion of feed is reſerved for the ſtock ſo long as the clover continues to grow, and the major part of it may be ploughed up ſome conſiderable time before the wheat ſeaſon, whereby the ground becomes ſufficiently cloſed, ſo as to guard againſt the ill effects of the worm: and this end is ſtill more eſſentially anſwered by the folding, which never fails to be of great advantage, and which he is inclined to think proceeds rather from the treading of the ſheep, whereby the ground is compreſſed to a texture more firm and compact, than from any virtue in their dung and urine, which can be of no material uſe in the heat of the ſummer: but when, after ſeed time, the ſheep are folded on the ground, this is undoubtedly of infinite ſervice, the invigorating moiſture of the dung and urine of the ſheep, being immediately waſhed down to the roots of the grain; for which reaſon this manner of folding claims a decided preference over all others, ſo long as the weather will admit of its being purſued with propriety.

The clover crops are often mown as a green fodder for the horſes in the ſummer, which purpoſe it anſwers extremely well, and, if the land on which it is raiſed be in good condition, will, in a kindly ſpring, be fit for the ſcythe ſome time within the month of May, and may be cut twice for this uſe; or the ſecond crop may be ſuffered to ſtand for ſeed, or be fed off, according as the farmer's exigencies may require. But ſince the culture of lucerne hath been brought into general practice, few farmers chooſe to be without a field of that valuable graſs, which in this reſpect has greatly the advantage of clover, being not only equally wholeſome and nutritious, but on good land may be mown three or four times in the courſe of the ſummer, and will remain many years on the ground. See Lucerne.

It has been remarked by a late writer, that though much advantage may be derived from the converting of clover crops into hay, and letting them remain for ſeed, it is probable that a ſtill greater benefit may be produced by the practice of cutting the crops green, occaſionally, as they attain a ſufficient growth; and conveying them, when wanted, to the horſes or other cattle, in the ſtables and fold-yards, in order to their being conſumed in the ſtalls. It is contended, he ſays, by an experienced agriculturer, that in this manner it will certainly ſupport more than twice the ſtock it would do, if fed off upon the ground where it grew; and the additional quantity of manure that will by this method be made in the ſtalls and yards, if they are kept well littered with any ſort of ſtraw, or even ruſhes or fern, will fully compenſate the farmer for this expence in cutting and bringing the clover into the yards. In caſes where lucerne cannot be grown to advantage, this may, without doubt, be the caſe.

It is ſuggeſted, that it is a method which experience, in many parts of the kingdom, has proved to be of the greateſt advantage, eſpecially where the buſineſs is not upon too extenſive a ſcale; but in large concerns, it is, perhaps, impoſſible to attend to it ſo fully as may be neceſſary for deriving the greateſt benefit from it. The reſult of an experiment ſtated by a writer of conſiderable accuracy, however, he ſays, ſhows, that even on an extenſive ſcale it is a practice which is attended with vaſt advantage. "In this trial ſeven acres of clover, cut green, were found to be ſufficient for twenty horſes, ſeven cows, five calves, and five pigs, for the period of ſeventeen weeks from the middle of May. They were fed in the ſtable and rick-yard, being taken twice in the day to water, and the horſes had neither hay nor corn." And in calculating the value of the crop, it is remarked that the horſes could not have been kept equally well for leſs than eight-pence a day; but as the uſual price at which they are taken in at, in that diſtrict, is two ſhillings and ſixpence the week, it may be better to take that as the principle of calculation.

20 Horſes, 17 weeks, at 2*s.* 6*d.* per week	42*l.*	10*s.*	0*d.*
7 Cows, - ditto, at 2*s.* 6*d.* per week	14	17	6
5 Calves, - ditto, at 1*s.* 6*d.* per week	6	7	6
5 Pigs, - ditto.	0	0	0
	£63	15	0
Or, per acre,	9	2	1

And, "the quantity of dung raiſed by the above ſtock, is ſuppoſed to be from four to five hundred loads, which is eſtimated at 2*s.* 6*d.* per load." But "the expence in labour for cutting and conveying the food to the ſtock, is not charged; which renders the experiment in ſome meaſure incomplete. The benefit of the practice is, however, fully eſtabliſhed." And the great ſuperiority and utility of this practice are exhibited in a ſtill more ſtriking point of view, by contraſting this with the conſumption of the ſame ſort of crop in the field, by an equal number of the ſame kinds of ſtock; as, in the time five acres had been uſed in the former method, thirty had been conſumed in the latter, and the horſe part of the ſtock left in much worſe condition. And it is added, that, "beſides the ſuperiority of the practice of ſoiling this ſort of crop in the economy of food, it has the important advantage, as has been ſeen, of affording much larger ſupplies of manure, eſpecially where the ſtalls and fold-yards are kept occaſionally well bedded and cleaned up, as the converſion of the materials proceeds, which muſt be greatly expedited from the vaſt increaſe in the urinary, as well as other diſcharges that muſt of neceſſity take place in this ſort of feeding.

The principal difference between feeding clovers off, on the land, and conſuming them in their green ſtate, in this manner, is ſuppoſed by Mr. Kent to be this; "the quick growth of the graſs, after mowing, ſhades the ground, and prevents the ſun from exhaling the moiſture of the land, ſo much as it would if fed bare; conſequently it continues to ſpring with more vigour; and the moment one crop is off another begins to ſhoot up. Whereas, when cattle feed it, they frequently deſtroy as much as they eat, and, beſides, bruiſe the necks of the roots with their feet, which prevents the clover from ſpringing ſo freely as it does after a clean cut by the ſcythe. In hot weather, which is the common ſeaſon for feeding clover, the flies too are generally ſo troubleſome to the cattle, that they are continually running from hedge to hedge to bruſh them off; by which it is inconceivable what injury they do to the crop. But when they are fed in ſtalls and yards they are more in the ſhade; they thrive better, and, at the ſame time, conſume the whole of what is given them without waſte." The author of "Practical Agriculture," however, remarks on this, that "though much of the ſucceſs attending this practice without doubt depends on theſe circumſtances, yet that the upper parts of the roots are leſs penetrated by moiſture, and fewer of the plants of course destroyed." He adds, that "by proper attention to this crop a very useful and abundant green food, for different sorts of live stock, may be provided at an early period of the spring, especially when the winters are not very severe." And it is advised by Mr. Middleton, "on the poorer sort of soils to have both the first and second crops of this plant to be eaten green upon the land by sheep and bullocks, being mown and given them to feed upon." In this way the cattle thrive better from their filling themselves sooner, and having more rest; and there is no waste. But in order to derive the greatest possible advantage from the soiling with this or other crops, convenient covers, sheds, or other suitable houses are necessary to be provided. See SOILING.

It is remarked, in addition, however, "that the practice of feeding down or pasturing clover crops with live stock, though it may be advantageous in many cases, especially where sheep-husbandry forms a principal object, always requires to be conducted with care and attention, both in respect to the plants and the animals that are to feed upon them." As from the tender nature of the clover plant it should seldom be eaten on the land by the heavier sorts of cattle, because, from the greedy manner in which they feed, many of the plants are pulled up, and others, as has been seen, greatly injured or destroyed by being bruised in their treading, especially as they protrude their young shoots. Horses are particularly objected to on this account by Mr. Parkinson. The most appropriate sort of stock is obviously that of sheep; but where the soils are of the drier kind, the lighter sorts of stock of other descriptions may be occasionally admitted, such as calves, foals, and young beasts. And, as pigs are fond of the clover plant, and thrive well upon it, they may sometimes be admitted with advantage. In the practice of lamb-suckling, it is an useful application of the young clovers to turn the ewes upon them, as they afford a sort of pasturage, which has much effect in increasing the flow of milk. They may, likewise, in the opinion of the author of the "Report of Middlesex," be applied to the fattening of sheep in April and May; and be fed by the sheep intended for turnips, in the autumn, till they are ready, with much profit and advantage. No sort of stock should, however, be kept upon crops of clover where the land is soft, wet, or poachy. Mr. Marshall says, that, in some of the southern districts, where it is the custom to eat down the young clovers by sheep, it is usual to choose a dry season for the purpose, the stock being removed in case the land becomes soft and wet. When this sort of stock is employed, it may be the most safe practice not to permit the animals to continue too long upon the land; as by eating the plants too closely they may sustain much mischief. It is contended by some, that treading the soil lightly where the lands are dry, may be of great utility to the clover plants, by forcing the earth to the roots, and in that way protecting and rendering them more capable of resisting the effects of frost in the winter season. It has likewise been suggested, that "the eating off the weak lateral shoots that were thrown out while under the shade of the grain crops, may be serviceable by increasing the strength of the plants, and enabling them to withstand the frosts, as well as to shoot more strongly in the spring." It may, therefore, be concluded that the most beneficial method, where the pasturing of this crop, either in the spring or autumn, is had recourse to, is not to suffer the lands to be fed upon when in a moist state, or to be too hard stocked, or with the heavier sort of animals, at any time while they remain upon it.

In the feeding down this sort of crops, as has been already seen, there is not only danger of injuring the plants, but the animals that consume them. Without proper management, cattle and other animals, on being turned upon them, often suffer great inconvenience, and are in danger of being destroyed by the vast distension of their stomachs which takes place. In this situation, the animals are, in the language of the farmer, said to be *blown* or *hoven*. The nature of the disease does not seem to be much investigated; but it probably arises in consequence of the large quantity of green succulent herbage being greedily devoured without due mastication, by which it undergoes an uncommon degree of fermentation in the stomach; and from this sudden decomposition, an unusual quantity of gaseous fluid, or *flatus*, is at once set at liberty, which ultimately overcomes the contractile power of the digestive organ, and the animal is destroyed. The supposition is rendered more probable from the circumstance of the affection being less apt to take place when the clovers or other similar herbage are fed upon in a dry state, as the stock in these cases are not able to consume them in so expeditious a manner, or in so large a proportion. It is added, that on these principles the practice of not suffering the cattle, or other sorts of stock, to feed upon them when they are wet, and there is a full bite, would seem to be perfectly correct. The advice of not turning the animals upon the crops before the sun dissipated the dew and moisture deposited in the night, is likewise judicious, and ought to be attended to, as well as that of keeping them in motion as much as possible when first turned in. With sheep the same precautions may be necessary, if they be put upon them with the other stock in their full growth; but when they are turned in after they have in some degree been fed down, there will be little danger of their being injured. Where the clovers are eaten off, as after-grass, in their soft, foggy, and young state of growth, there is, however, great danger of the stock being hurt in this way, unless these circumstances be attended to and carefully guarded against. See HOVEN.

It is observed to be the practice with some "when the land is intended for the purpose of early pasturage, and in some cases where the object is hay, to sow rye, rib, and other similar grasses with the clover. In the first intention the practice may be beneficial, as the rye grass rises early, and may contribute to afford a more full and better herbage for the stock at such periods, especially on the better sorts of soil; but with the latter view it should perhaps seldom be made use of, as the clover will in general produce a sufficiently abundant crop of itself; and from other sorts of plants being mixed with it, on account of their drying in an unequal manner, it may sustain injury as hay. It is probably, for some reason of this sort, that such clover-hay as is mixed with other grasses is less saleable, and of considerably less value in the London markets, than that which consists solely of clover. Some cultivators, however, suppose, that by blending rye-grass with clover in a small proportion, a strength and body is given to the crop." And it has been suggested as an improvement where rye grass is mixed with clover, to sow the latter a week or two before the other, as from the clover plants having a tender, weak stem in their early growth, they may in that way be prevented from being injured by those of the rye-grass clasping round and shading them. But when the crop is designed for cutting green for the purpose of soiling animals, it would seem to be the best method not to sow any other sort of grass with it, as no advantage can be gained in that way, while there may be danger of the crops being injured by it.

It is obvious, that "the chief disadvantage of this almost invaluable plant, is that of the shortness of its abiding or continuing in the lands, especially in those of the lighter and more free kinds, as hinted above. It is asserted by some, not to laft longer than two years, except on grounds that are perfectly frefh; and, in fome cafes, where it has been often repeated, not more than once. According to Mr. Marfhall, in fome of the fouthern counties, it is, however, found more durable on the calcareous foils, efpecially where not frequently repeated on the fame land, from its being better able to contend with weeds in its natural ftate of growth. Thefe facts fhow the neceffity of keeping it as far diftant as poffible in the courfes of cropping, efpecially on all the more light friable forts of foil, and the fuperior advantages of cultivating it on thofe of the calcareous kinds." And it is fuggefted as probable, that "its duration may be confiderably prolonged, by preventing the plants from fhooting up to feed ftems as much as poffible, either by keeping them cut by the fcythe, or by the feeding them down by ftock in a moderate degree, as in thefe ways they will be prevented from being fo foon exhaufted in their roots, as happens in many other forts of plants, as soon as they have perfected their feeds.

It is obferved in the "Hertford Survey on Agriculture," that the beft farmers about Ware mow the firft growth, and always feed the fecond: they confider it as good management to mow the firft, as it is, in their eftimation, bad to mow the fecond. However, he faw feveral fecond crops in full bloffom between Walkern and Stevenage, of a luxuriance that fpoke no bad management: nor is it a point at all to be afcertained. The practice of various other diftricts is in favour of mowing both. And Mr. Whittington has no doubt upon this point, thinking that better wheat will be after two mowings than after one. About Hatfield, and all that vicinity, they have cultivated clover fo long and fo repeatedly, that the foil is, as the farmers fay, fick of the plant. It matters not how fine a crop may be in autumn, it dies even fo late as in that month. Mr. Keate had a proof of the benefit of not fowing it in one or two courfes confecutively. Having part of a field for five or fix years under lucerne, when it was broken up, barley and clover were fown over the part which had been under lucerne, and alfo on a contiguous piece, where the clover-hufbandry had not been interrupted on the latter, the clover in 1801 failed and was ploughed up, but where the lucerne had grown, the clover was, as the writer faw, extremely fine, thick, and regular. This fhows, he thinks, that other graffes may be fubftituted, and yet the land refrefhed and prepared for future clover without a failure. The great price which hay has yielded of late years, has been an injury to the land; the farmers have been unwilling to vary the courfe, or to plough up a bad plant; and very foul fields are the confequence. Others finding clover crops apt to fail fow trefoil alfo. And this variation of trefoil is excellent management in his opinion.

It is added, that Mr. Clarke of Sandridgbury has had no clover fail till laft year, (1800.) If he intends feeding, he mixes trefoil, otherwife he fows clover alone. He mows fome twice for hay; fome once, and then feeds fheep on the land. His beft wheat is after two mowings, one for hay, and the fecond for feed; this he attributes to the great fall of the leaf, and to the plants covering the foil from the fun fo well and fo long. And Mr. Biggs, near St. Alban's, grows better wheat after mowing than after feeding; and better after two mowings than one, and this general fuperiority has, in his opinion, amounted to four or five bufhels an acre. And many others reap better wheat after mowing than after feeding the clover. And fome think, that the reafon is "the clover's being fed too clofe: were it kept to a confiderable growth before it were turned in, fo that all fhould not be eaten, but enough trod down to cover the land from the fun, then feeding would give the beft wheat." And in Norfolk, it is remarked, by the author of the report of that diftrict, that thirty years ago they had for fome time found their clover crop failing, from its recurring too often; this caufed the variation of fubftituting trefoil for one round, and the clover being fown but once in nine years, the evil was removed. And he now found the fame account every where in the fouth of the country, that the land (whatever the foil), was what they call fick of clover. Formerly it was fown every fourth or fifth year; but now if it returns fo often it fails for acres together; they therefore fow clover in one round, and then fubftitute white clover and trefoil, adding a little ray grafs, but as little as they can help. Whether the wheat is as good after thefe feeds as after clover, is rather an unfettled point. From Mr. Burton, a moft intelligent obferver upon this queftion, the writer found that he himfelf got as good wheat after white Dutch as after red clover, but that he believed the true change for the foil would be to fow no feeds at all; and he fhowed him a large field of red clover, part of which was very regular and good, and part inferior, the former was in a courfe where no feeds had been fown, and the latter where Dutch and trefoil were introduced: a ftrong confirmation of his remark. Mr. Fowel ufes fix pecks of ray, fix pounds of clover or trefoil, and four of white clover for two years.

And the land round Hingham is tired of producing this crop, and caufes the variation of fowing ray, trefoil, and white clover.

It is alfo obferved, that in Happing-hundred, they admit at Catfield, that "if clover recurs too often the land will not yield it, but their method is not an alternate fubftitution of other feed, or baulking the land for a round, but to take a fix courfe fhift inftead of a five, and mixing white clover and trefoil and ray, by which two precautions they fucceed well.

Thefe ftatements from different parts of the county clearly fhow the neceffity of caution in repeating crops of clover on moft forts of foil.

It may be obferved, that fince red clover has been cultivated in England, great improvements have been made in heavy clay-lands, which before produced little except rye-grafs and coarfe bents, but being fown with red clover, have produced more than fix times the quantity of fodder they formerly did, whereby farmers have been enabled to feed a much greater ftock of cattle than they could do before with the fame extent of ground, which has, at the fame time, enriched the foil, and prepared it for corn; and hence it is now common, where the land is kept in tillage, to lay down their ground with clover, after having had two crops of corn, whereby there is a conftant rotation of wheat, barley, clover, or turnips on the fame land.

And Mr. Donaldfon confiders the general introduction of clover and other cultivated graffes, as one of the greateft improvements in modern hufbandry. The commencement of improvements in the different fpecies of live ftock, in the modes of cultivation, and in the fuperior quality, as well as quantity, of the crops of grain, may all, he thinks, be dated from the period when the fowing of grafs-feeds was firft introduced into the different diftricts of the kingdom.

One acre of red or broad clover will go as far in feeding horfes or black cattle as three or four of natural grafs. And when it is cut occafionally, and given to them frefh, it will probably go ftill much farther, as no part of it is loft by being trodden down.

The red clover is a biennial, perennial plant, whofe roots decay after they have produced feeds; but by eating it down, or mowing it, when it begins to flower, it caufes the

the roots to fend out new fhoots, whereby the plant is continued longer than it would naturally do.

Clover, *Middle*, or *Cow-red* Clover *(Trifolium medium)*, is a plant of the clover kind, which rifes with a branchy ftem, and has a ftrong, deep, ftriking root. It is perennial, flowering in July. Its ftalks are much more branchy and flexuous than in the common clover.

It is a plant that grows naturally in high lands of a chalky quality, and in fuch gravelly foils as have a fubftratum of clay. It is a fort of crop that is fown in thofe improved diftricts, where the land is to continue in a ftate of reft for feveral years, being put in with the white clover. It is found to continue longer in the land, or to be more *abiding* than the common clover, and at the fame time almoft equally productive, efpecially on the poor calcareous defcriptions of land.

Clover, *White*, another plant of the clover kind, *(trifolium repens)* which has a fibrous root and creeping ftem, never rifing nearly fo high as the common or cow-clover. It is perennial, flowering from May to September. It has its name, probably, from its bearing a white flower. It is likewife fometimes denominated *Dutch clover*, from its having been principally imported from Holland. According to Mr. Amos, in the more fertile and moift foils, it becomes more branchy in the ftalks. He confiders it as the fweeteft grafs for all forts of ftock yet known, which makes the clofeft fward, and is very productive of foliage. Hence it is, he thinks, moft peculiarly adapted to laying down land to pafture. It flourifhes moft upon rich, dry, warm foils; but it will accommodate itfelf to moft kinds. It is feldom fown alone, unlefs it be to raife the feed, nor fhould it ever be mown for hay. In laying down rich foils, which are intended to remain in pafture for many years, this feed fhould predominate in the compofition or mixture that is made ufe of for the purpofe.

It grows naturally in moft of the paftures in England, and is generally known among the country people by the name of *white honey-fuckle*. This is an abiding plant, whofe branches trail upon the ground, and fend out roots from every joint, fo that it thickens and makes the clofeft fward of any of the fown graffes; and it is, as has been faid, the fweeteft feed for all forts of cattle yet known; therefore, when land is defigned to be laid down for pafture, with an intention to continue fo, it fhould, as juft obferved, be fown with a pretty full or large proportion of the feeds of this plant. There is an advantage in pafturing white clover, that does not ftrike farmers in general, which is, that each joint of the plant furnifhes a frefh root, and of courfe a frefh plant, whenever fuch joint comes in clofe contact with the foil, and confequently the more it is trodden, the thicker it will get upon the ground. The ufual allowance of this fort of feed is eight pounds to one acre of land; but it fhould never be fown with corn; for, if there is a crop of corn, the grafs will be fo weak under it, as to be fcarce worth ftanding; but fuch is the opinion of farmers in general, that they cannot be prevailed on to alter their old cuftom of laying down their grounds with a crop of corn, though they fhould lofe twice the value of their corn by the poornefs of the grafs, which, in fuch cafes, will never come to a good fward, and one whole feafon is alfo loft; for if this feed be fown in the fpring without corn, there will be a crop of hay to mow by the middle or latter end of July, and a much better after-feed for cattle the following autumn and winter, than grafs which is fown with corn will produce the fecond year. The feed of this fort of clover may alfo be fown in autumn, in the manner directed for the common red clover; and this autumnal fowing, if the feeds grow kindly, will afford a good early crop of hay the following fpring; and if, after the hay is taken off the land, the ground be well rolled, it will caufe the clover to mat clofe under the ground, and become a thick clofe fward.

It has been greatly depended upon by moft cultivators, in bringing lands into a ftate of fward, and is faid to be an extremely ufeful plant on the more rich and dry, fandy and loamy foils, as well as in the clayey and peaty defcriptions of land, where they have been well drained from moifture; but on the more wet and poorer forts of loamy and clayey lands, it is not by any means fo proper or ufeful, as it is not lafting, but gives place to plants of the aquatic kind, as well as others of an indifferent defcription. It is a plant fuppofed by fome not to afford fo fweet an herbage as broad clover, or many others, but in our trials it has, however, always been eagerly fed upon both by fheep and neat cattle; and where clofely fed down, there can be little doubt of its great utility. According to Mr. Goring, as ftated in the communications to the Board of Agriculture, that which comes up naturally by the application of manure is much more hardy than that which is fown, as well as more lafting in the foil. And it has been juftly remarked as a proof of good land, that it runs quickly, of its own accord, to this plant. It may be introduced with moft forts of feeds, and contributes greatly to the fuccefs of the cultivator in the improvement of his grafs lands.

White clover feed is annually imported from Flanders, by way of Holland; but it is not more a native of that country, Mr. Donaldfon fays, than of this, as it is very common in moift paftures, in every county in the kingdom; but the feeds were never collected for fowing in this country till of late years; nor are there many perfons here, even now, who make a practice of faving this feed; though it may be done if the fame method as is practifed for the red clover be taken with this fort; it therefore might be advantageous to farmers who are defirous of improving their land, to fow carefully an acre or two of this white clover for feed, which will fave them the expence of buying for fome years, when the price is high; and there will be a fure market for any quantity they may have to fpare.

By Mr. Young it is ftated as a very profitable article of cultivation, which has of late years been particularly attended to in the counties of Suffolk and Effex, by raifing it alone for feed. The firft growth, contrary to the cafe with red clover, is feeded. Some take a fpring-feeding firft. The returns depend, of courfe, on the price, which varies much, but it has proved a very profitable article, yielding from 7*l.* to 15*l.* an acre. And it is found that wheat fucceeds well after it in moft cafes.

Clover-*Hop*, another plant of the white clover kind *(trifolium procumbens)*, which has a wide-fpreading, flightly branched, procumbent ftem, or ftalk, and a thickifh, fhort, fibrous root. It is a fort of clover that bears a yellow flower, on which account it is called by fome *yellow meadow trefoil.* It grows naturally among the grafs in the upland paftures of this country; but the feeds are frequently fold in the fhops, and are by many mixed with the other forts of clover and grafs-feeds, for laying down ground to pafture. This plant grows with upright, branching ftalks, about a foot high, garnifhed with trifoliate leaves, whofe lobes are oblong and heart-fhaped, but reverfed, the narrow point joining the foot-ftalks. The flowers, which are yellow, grow from the fides of the ftalk, upon long foot-ftalks, collected into oval, imbricated heads, having naked impalements lying over each other like fcales, fomewhat like the flowers of hops, from whence the plant had the name of hop-clover, which grows naturally in this country. There is another variety which is a much ſmaller plant than this, and generally known by the name of none-ſuch, or yellow hop-trefoil. See NONE-*ſuch*.

This ſort of clover is ſtrongly recommended by the following circumſtances: 1ſt. Its not only growing but flouriſhing on the moſt barren ſands, and therefore being a very proper graſs to cultivate on ſuch unfertile ſoils, where any other graſs that is worth notice will ſcarcely grow at all. 2. Its not being apt to ſwell cattle as the red clover does. 3. Its continuing long in good ground, and bearing a very good ſeed, or crop; and, by its flouriſhing both on ſands and clays which have not been ploughed for many years, its being likely to continue long on any ſoil.

In Norfolk, this plant is called *red ſuckling*, and is cultivated about Norwich for the profit of the ſeed, and yields a large quantity, but is ſaid not to have any merit comparable to clover or to trefoil.

CLOVER-*Lay*, or *Ley*, a term which ſignifies the land from which clover has been taken, mown, or paſtured. It is a remark of Mr. Banniſter, that, "where clover-lays have been ſuffered to continue in that ſtate longer than one year, it is a very hazardous experiment to ſow the ground when broken up with wheat or oats, as from the length of time in which the ſurface has been covered with a turf, the worm becomes engendered therein, which often deſtroys the crops of corn; therefore, the ſafeſt way of procedure in the breaking up of theſe old clover-leys, is either to make a fallow of them, or to put them in with peas or other pulſe." From what has been remarked above, it is evident that theſe ſorts of lays require to be managed with conſiderable attention.

CLOVER *Reaping machine*, is an implement conſtructed for the purpoſe of reaping and collecting the heads of ſuch clover-crops as have been let remain for ſeed. Various contrivances of this ſort have been ſuggeſted by writers on huſbandry, but there is probably none that anſwers the purpoſe in a perfect manner.

It has been ſuggeſted by Mr. Marſhall, in the "Rural Economy of the Southern Counties," that, "as the great difficulty in the ſecuring of the clover for the purpoſe of ſeed, is that of getting the herbage ſufficiently dry, in the dewy and damp ſeaſon at which the ſeed becomes ripe, that light bags, formed of thin cloth or fine wire, might be uſeful for collecting, catching, and retaining the heads, which moſtly riſe above the herbage, by being fixed upon the handles of the ſcythes as they are ſwept off by them, being emptied as there may be neceſſity, as, in this way, the herbage by being left upon the ground, would be of three times the value of the muſty ſtraw afforded by ſeed-clover, either for the purpoſe of being eaten off, or turned down as a manure. Beſides, the heads, by being well dried in wet weather in the houſe, and in dry ſeaſons in the open air, the ſeed would, it is ſuppoſed, not only be preſerved with more certainty, but in a much better ſtate in reſpect to the ſample, and of courſe, in moſt ſeaſons, be of much greater value."

CLOVER *Threſhing-machine*, in *Rural Economy*, an implement contrived for the purpoſe of cutting off and collecting the heads of ſuch crops of clover as have been let remain in order to afford ſeed.

Various machines of this ſort have been invented at different times, but probably without being perfectly adapted to the buſineſs. Long ago an account was given, in "Bradley's Syſtem of Huſbandry and Gardening," of a machine employed for this purpoſe in Flanders, where this ſort of crop was introduced and cultivated at a much earlier period than in this country, and which he has deſcribed in the following manner. "He has ſeen," he ſays, "two or three ways of threſhing out clover-ſeeds by engines in that country, after the heads of the ſeeds are thraſhed off by common flails. The engine which he beſt remembers has a hopper at the upper end of a trough, ſo that the heads of the ſeed fall conſtantly from the hopper into the trough. The trough is about ſix feet long, and about two feet and a half over, and lies ſlopewiſe from the hopper, which is at the higher end, ſo as to drop at the other end about a foot. The bottom of this trough within-ſide is made rough by chiſſels, and upon it is a board made to draw backwards and forwards, which is cut in a rough manner like the inſide of the bottom of the trough. When the ſeeds fall into the trough at the upper end, the broad board, in its motion, draws them through the trough, and thereby breaks or opens the ſeed-veſſels, ſo that the chaff and the ſeeds run out of the lower end ready for winnowing. This motion is maintained by a water-wheel and crank, and anſwers the purpoſe it is deſigned for very well. He has alſo ſeen an engine of this kind where the bottom of the trough was a hurdle, more finely wrought than the common hurdles; and the ſliding part, which he calls the broad board, was a hurdle of the ſame make. In this he found, that moſt of the pure ſeed fell through the lower hurdle, and little more than chaff was diſcharged by the lower end of the trough, and conſequently muſt give leſs trouble in the winnowing or cleaning from the chaff. He has alſo ſeen another kind of mill, or engine, for this purpoſe, which ſomewhat reſembles the mills which tanners uſe in grinding bark. In the former, he ſhould have mentioned, that there is commonly a weight laid upon the upper hurdle, or board, the better to break the heads of ſeed that paſs between that and the bottom of the trough. And from the great ſimplicity of this machine, the author of the "Preſent State of Huſbandry in Great Britain" thinks it is ſurpriſing that ſome ſuch has not been long ſince erected for the purpoſe in England, where ſuch great quantities of clover-ſeeds are annually ſaved. Were threſhing-mills generally erected in this kingdom, it is highly probable," he ſays, "they might in time be made not only to thraſh off the heads of the clover from the ſtalks, but, by means of ſome ſuch machinery as above deſcribed, be made alſo to ſeparate the ſeeds from the huſks of the clover crops.

CLOUET, PIETER, in *Biography*, an engraver of ſome repute, native of Antwerp, who, after he had learned the firſt principles of his art, went to Rome, where he reſided many years, ſtudying under Spierre and Bloemart: having completed his ſtudies he went to Paris, where he lived ſome time, and from thence retired to the place of his birth, and there died aged 62 years. His prints, though ſomewhat deficient in harmony and effect of Chiaro-ſcuro, occaſioned by the too equal diſtribution of the lights and ſhadows, are engraved in a firm and bold manner, ſomething reſembling that of Pontius. He engraved many prints from Rubens, which are much eſteemed. Amongſt the beſt may be reckoned the Death of St. Anthony, a large upright plate; the Deſcent from the Croſs, the ſame; a Converſation, where ſeveral lovers are repreſented in a garden, a large plate length-ways, and a landſcape with a cottage, where the ſnow is repreſented falling; this, which is a large plate length-ways, makes one of a ſet of ſix: the other five were engraved by S. Bolſwert. Strutt. Heinecken.

CLOUET, ALBERT, nephew of the preceding artiſt, was born at Antwerp, and like his uncle, went to Italy to perfect himſelf in his art. He ſtudied ſome time under Cornelius Bloemart at Rome, and engraved ſeveral of the prints from the gallery of *Pietro* da Cortona, in the palace Pitti at Florence, with a near reſemblance to the ſtyle of his maſter. Beſides a great number of other portraits, he engraved

engraved thofe introduced in the lives of the painters by Bellori. The dates on his prints, cited by Heinecken, are from 1641 to 1675. Strutt. Heinecken.

CLOUGH, or *Draught*, in *Commerce*, an allowance of two pounds in every hundred weight for the turn of the fcale; that the commodity may hold out weight when fold out by retail.

Clough, or *Clogh*, in *Geography*, a fmall poft-town of the county of Down, Ireland, which has a fair for mountain fheep. There is a caftle built in a Danifh fort, which is very unufual, and which, from being too fmall for the refidence of a refpectable family, muft have been built merely for defence, for which its fituation is excellent. It is 69 miles N. from Dublin. Survey of Down.

There are other villages called *Clogh*, and fome places to which this word is a prefix, its fignification in the Irifh language being *a ftone*.

Clough, or *Clyfe*, is the fame with paddle, fhuttle, &c. being a kind of fluice or pen-ftock; ufed for retaining or letting go the waters of canals, ponds, mill-dams, &c.

Clough-*arches*, or *Paddle-holes*, in the conftruction of *canals*, denote the crooked arches, which convey the water from the upper pound into the chamber of the lock, when it is to be filled, and when the cloughs or paddles are drawn up. See *Plate* V. *Canals*, *fig*. 36 and 37.

CLOVIO, Don Giulio, in *Biography*, fo juftly celebrated for his aftonifhing miniatures and illuminations in miffals and other religious books, was born in Sclavonia in the year 1498. He was originally educated for the church, and took orders, but was afterwards fuffered to relinquifh the facerdotal habit by a difpenfation from the pope. Soon after the age of eighteen, his love of painting prompted him to travel to Rome, where he was taken into the fervice of the cardinal Grimani, by whom he was, for the fpace of three years, employed in making careful pen-drawings from the fineft medals.

He afterwards became the fcholar of Giulio Romano, and made confiderable advancement in oil-painting; but his mafter, perceiving the extraordinary talent which he evinced for miniature, fucceeded in perfuading him to apply himfelf entirely to that branch of the art; and it may with juftice be faid, that we owe to the fagacity of Giulio Romano, and the unexampled affiduity of Clovio, the moft exquifite and delicately finifhed performances of that kind in the known world; fince he not only far furpaffed all who went before him, but to this day ftands unrivalled, by all thofe who have fince attempted to walk in his footfteps. In addition to the inftruction which our artift received from the favourite fcholar of Raffaele, he derived great benefit from the works of Buonaroti, many of which he copied in a moft beautiful and finifhed manner; and he afterwards reaped great advantage from the friendfhip and experience of Girolamo da' Libri, a miniature painter of great note at Verona: the refult of all thefe ftudies was a ftyle of drawing, partaking of the purity of the Roman, and the grandeur of the Florentine fchool; united, not unfrequently, to the rich colouring of Titian or the ambient hue of Coreggio.

Amongft the furprizing labours of Don Giulio Clovio, defcribed by Vafari, that writer particularly dwells upon an *ufficio della madonna*, painted for the Cardinal Farnefe. In this work many portraits were introduced, and the figures, though in fome cafes no longer than fo many ants, were reprefented with as much diftinctnefs in all their parts, as if they had been drawn the fize of life.

A beautiful miffal, illuminated by Clovio, formerly belonging to Alexander Champernoun, efq. is now in the poffeffion of the Townley family. Several prints from the works of this mafter, are cited by Heinecken. He died aged 80, in the year 1578. Vafari. Lanzi, Storia Pittorica.

CLOVIS I., the firft Chriftian king of France, fucceeded his father Childeric I. in the year 481, when he was but 14 years of age. He was not long in freeing his country from a formidable domination, and in putting an end to the empire of the Romans in Gaul. In 486 he defeated Syagrius, the Roman general, at Soiffons, which he afterwards made the feat of his royalty. Syagrius fled to Thouloufe, claiming the protection of Alaric, king of the Vifigoths, by whom, however, he was finally given up to Clovis. The king, for fome time, amufed him with promifes of enlargement, and thereby obtained new conquefts; but at length caufed him to be beheaded privately. The power of the Romans being thus deftroyed, the French found themfelves mafters of all the provinces fituated between the Rhine and the Loire. At this period the rights of kings were of a very limited nature, which ill accorded with the haughty fpirit of Clovis; he felt that it was neceffary to fubvert the powers of the foldiers, in order to eftablifh and augment his own. An opportunity for this purpofe foon prefented itfelf. A rich vafe was taken from a church at Rheims, which the bifhop anxioufly defired might be reftored. Clovis was inclined to grant his wifhes, and at the divifion of the fpoil claimed the vafe as his own. "Hold," exclaimed a foldier, with his battle-axe raifed, "thou fhalt have no other than the fhare which may fall to thy lot." Clovis, at the time, diffembled his anger, but he fhortly after took occafion to charge the man with fome trifling offence, and telling him to recollect the vafe, ftruck off his head with a fingle blow. This act of authority, dictated only by the mean and favage fpirit of revenge, impreffed his army with reverence for his authority, and eftablifhed a fort of boundary between the rights of kings and thofe of the people. In 493, Clovis married Clotilda, daughter of Childeric, formerly king of Burgundy. She was a zealous Chriftian, and took every means in her power to convert the king. For three years fhe ftrove in vain, when, feeing himfelf in danger of a defeat, he invoked the God of the Chriftians, vowing an adherence to him, if by his affiftance he might be enabled to conquer his enemies. He rallied his troops, gained a complete victory, and was, with 3,000 of his fubjects, immediately baptized by the bifhop, for whom he had formerly endeavoured to fave the vafe. France became now a Chriftian country, and this revolution, from paganifm to Chriftianity, feems to have been effected with no more difficulty or difturbance, than any common regulations of the ftate. "Indeed," fays a good writer, "when a fierce and barbarous people received the Chriftianity of that age, they rather made its genius bend to their difpofition, than formed themfelves upon its precepts; and a compliance with fuperftitious rights and ceremonies, with fubmiffion to ecclefiaftical authority, and profufe liberality to religious foundations, conftituted the whole of their new obligations." The true genius and fpirit of the Chriftian religion were little underftood in that day. Clovis himfelf, when affected by a detail of Chrift's fufferings, exclaimed "Oh that I had been there I would have revenged his injuries." The king foon attained the high honour of being reckoned the only catholic king in Europe, all the other princes being Arians, and the emperor Anaftafius was regarded as not perfectly orthodox. Clovis meditated the moft extenfive plans, and was defirous of uniting under his domination all the territory which extends from Langres to Geneva, and from the Pyrenées to the banks of the Loire. He waged

 a fuca fuccefsful war againft his wife's uncle, Gondebaud, from whom he exacted a heavy tribute, on pretence that Alaric, whofe dominions he had long coveted, was guilty of herefy; he fell a victim to the ambition of Clovis. His career was, however, checked by his brother-in-law, Theodoric, king of the Oftrogoths, who defeated him at Arles. Clovis, rendered defperate by this mifcarriage, fell on, and deftroyed all that he encountered in his retreat. To facilitate his ambitious projects, he prevailed on Clodoric to affaffinate his own father, Sigebert, and then had the parricide put to death, that he might have fewer obftacles, with which to contend in invading his territories. Having taken by furprize a chief of one of the little ftates, by which his own dominions were furrounded, he caufed his head to be fhaved, becaufe he had the title of king, which he wifhed to belong exclufively to himfelf. Such was the ancient mode of declaring a prince incapable of wearing a crown. The fon of the infulted chief obferved to his dejected parent, "that the branches would one day fhoot out again, fince the trunk had not been divided." Clovis enraged at the fpeech ordered both father and fon to be beheaded. Having extended his conquefts from the mouth of the Rhine to Thouloufe, Clovis took up his refidence in Paris, which he made the feat of his empire, and which remained for fourteen centuries the metropolis of the French monarchy. He then adopted the policy of overthrowing the little independent ftates and royalties of Gaul, and bringing them all under his own authority, and in purfuing this plan he fcrupled not to employ treachery and affaffination. To expiate his crimes he founded feveral monafteries, and built a great number of churches, at the inftigation of his clergy, who perfuaded him that, by fuch acts of royal munificence, he would fecure the pardon of his fins. Clovis died in 511, at the age of forty-five years, in the thirtieth year of his reign, and was buried in the church of St. Peter and St. Paul, which is now called St. Genevieve. He left four fons, for each of whom he had prepared a kingdom. Clovis was author of the Salic law, which excludes the wife from any fhare of inheritance. It likewife gave rife to the exclufion of females from the fucceffion to the throne of France. See SALIC *Law*. Hift. Univer. Du Frefnoy.

CLOVIS II. king of France, fucceeded his father, Dagobert, in the kingdoms of Neuftria and Burgundy in 638, while he was a very young child. He is mentioned in this work on account of fome traits of humanity which are attributed to him; of thefe the moft remarkable was, that of ftripping the gold and filver plates which ornamented the coffins of St. Denis and his companions, in order to purchafe corn for the poor in a time of fcarcity. This action has been reprefented by fome monkifh writers as the caufe of an infanity, with which, it is faid, he was afflicted, and to which they impute the ftupidity of his defcendants. Clovis married a beautiful young girl, who had been purchafed of fome Englifh merchants by the mayor of the palace, and prefented to the fovereign; by her he had three fons, none of whom emerged from obfcurity. Of Clovis III. nothing is recorded meriting our notice.

CLOUS *d'Artillerie et de Travaux militaires*, nails for artillery and military works. Thefe are of different kinds, lengths, thickneffes, forms, and denominations, and are particularly defcribed in this work, under the feveral names or appellations they bear.

CLOUT, in *Agriculture*, is an iron plate put on the end of the axle-tree of a cart, or other carriage, to prevent its wearing.

CLOUT-*Nails*. See NAIL.

CLOUTED CREAM, in *Rural Economy*, fuch cream as is raifed by means of the milk being heated.

CLOUTS, in *Gunnery*, are thin plates of iron nailed on that part of the axle-tree of a gun-carriage, which comes through the nave, and through which the linfpin goes. See [illegible]

CLOWADOK, in *Geography*, a river of South Wales, which runs into the Ython, at Llanbadern in Radnorfhire.

CLOWES, WILLIAM, in *Biography*, an eminent furgeon of the fifteenth century, received his education under George Keble, whofe fkill in the art he ftrongly commends. He was for fome time furgeon in the navy, as he fays he was on board her majefty's fhip the Aide, in the year 1570, when the emperor's daughter married the king of Spain. He fome time afterwards fettled in London, and was made furgeon to Chrift's and Bartholomew's hofpitals. He appears to have been in high eftimation, and to have had a confiderable fhare of practice, as he fpeaks of cures performed by him on perfons at Town-Malling, in Kent, and other towns and villages in the vicinity of London. In 1586 he was ordered to go to the Low-Countries, to the affiftance of the army under the earl of Leicefter. On his return he was appointed furgeon to the queen. From various paffages in his publications, we find that a ftrict friendfhip fubfifted between him and Banifter, who was no lefs famous for his profeffional abilities. We learn alfo, from the fame fource, that he had ferved under the earl of Warwick, and had been a retainer to lord Abergavenny. At what time he died is not known. The lateft date in his works is in 1596, at which time he appears to have been in full practice. As an author he is deferving of confiderable credit. His works are in Englifh, and he ftrongly defends the practice of writing in our vernacular language; at the fame time, from his frequent quotations from Galen and Celfus, he fhews he had a competent fhare of learning. His firft publication is entitled, "A Brief and Neceffary Treatife touching the Cure of the Difeafe, now ufually called Lues Venerea," printed in 1585, reprinted in 1596, and again in 1637. He fpeaks of the increafed frequency of the difeafe, and fays, that in the fpace of five years he had cured more than a thoufand patients infected with it, at Bartholomew's hofpital. He ufed mercurial frictions, and occafionally turbith mineral, mercurius diaphoreticus, which he highly commends. He alfo gives formulæ for purging potions, diet drinks, fumigations, ointments, plaifters, cauftics, &c. His next publication, which appeared firft in 1588, and which has obtained for him the greateft credit, was an approved practice for all young chirurgeons, concerning burnings with gun-powder, and wounds made with gun-fhot, fword, halberd, pike, lance, &c. the refult of much practice and obfervation, while employed as an army furgeon, ftrengthened by obfervations from the moft approved writers, and containing all that was then known on the fubjects treated of. In the treatment of gun-fhot wounds, and of punctures of the nerves, he profeffes to ufe emollient and foothing applications, though they would hardly be efteemed fo at this time; they were, however, an improvement on what he had been accuftomed to fee in the early part of his practice. He relates the cafe of a perfon whofe fkull was fractured, in which he ufed the trepan fuccefsfully, and of a compound fracture of the leg, which he cured without amputating the limb. In fhort he may be juftly ranked among the reftorers and improvers of furgery. To the fecond edition of this work, publifhed in 1591, he added a tranflation of a treatife on the venereal difeafe, by John Alucenar, a Spanifh phyfician, and fome aphorifms relative to furgery, in Englifh and Latin. The firft of the pieces was delivered to him, he fays, by a friend; the latter he found among fome old books of furgery. Clowes was a rational practitioner, and appears to have

have had an enlarged, intelligent, mind. He every where laughs at quacks and impoftors, particularly at thofe juglers who pretended to charm away difeafes, and tells a merry ftory of one old beldam, who was put on her trial for ufing witchcraft in the cure of difeafes. The judges, who faw the ignorance, as well as the malice of the profecutors, told the dame, if fhe would divulge her charm fhe fhould be fet at liberty. This fhe readily did, to the no fmall diverfion of the court, when fhe informed them, that it confifted in repeating the following words, after receiving the ftipulated pay, a loaf of bread and a penny:

My loaf in my lap,
My penny in my purfe,
Thou art never the better,
And I am never the worfe.

But we have little reafon to laugh at the credulity of our anceftors, while we fuffer ourfelves to be impofed upon by ftories of the efficacy of tractors, and other equally infignificant and contemptible pieces of juglery and impofture. Aikin's Biograph. Memoirs.

CLOWEY, in *Geography*, a lake of North America, N. lat. 62° 20'. W. long. 106° 15'.

CLOWNS' ALL-HEAL, in *Botany*. See STACHYS *Sylvatica*.

CLOWNS' *Wound root*. See STACHYS.

CLOYE, in *Geography*, a town of France, in the department of the Eure and Loire, and principal place of a canton in the diftrict of Chateaudun; the place contains 1520, and the canton 10,751 inhabitants; and the territory includes 245 kilometres, and 15 communes.

CLOYED. The feamen, when any thing is got into the touch-hole of a great gun, fo that they cannot with a priming-iron make way for the powder to be put in to prime it, fay, *the touch hole is cloyed*; wherefore, when guns are nailed, &c. they fay they are *cloyed*.

CLOYNE, in *Geography*, a fmall town of the county of Cork, Ireland, remarkable only for being the fee of a bifhop. The cathedral is a fine old building, and within a fhort diftance of it there is a well preferved round tower. The bifhopric lies entirely within the county of Cork, extending eaft and weft near 50 Irifh miles in length, by a breadth of 23. It contains 137 parifhes, which have been reduced to 69 benefices; though they contain 539,700 Irifh acres. The patronage of the bifhop is confiderable; and the wardenfhip of the church of Youghel, and a union of parifhes near Cloyne being united to the bifhopric, this fee is ufually reckoned amongft the beft. The celebrated Berkley was one of its bifhops. Cloyne is within a fhort diftance of the fea, about 14 miles eaft from Cork.

CLUACA, in *Ancient Geography*, a town of Afia, in Media, according to Ptolemy.

CLUACARIA, or CLUCAR, a town of Africa.

CLUACINA, in *Mythology*, an epithet of Venus, derived, as fome fay, from *Cluo*, to hear, liften, or agree; or, according to others, fignifying to fight. Her image was erected in the place where peace was concluded between the Romans and Sabines.

CLUALE, in *Geography*, a town of America, in Georgia; 15 miles S. of Oakfufkee.

CLUANA, a maritime town of Italy, in the Picenum, fituated at the mouth of a river. Pliny.

CLUB *a battalion, to*, a low, vulgar, military phrafe, implying both the confufion which a body of men gets into by falfe directions given to its different component parts and a temporary inability, on the part of the commanding officer, to reftore them to their natural front in line or column. Officers, who are inexperienced, and but indifferent tacticians in the fubordinate parts, may frequently commit this error. The confufion, however, fometimes happens through an erroneous movement of a divifion or company, even when the word of command has been correctly given. An officer fhould know how to unravel the feveral parts immediately. But if he is puzzled, he fhould caufe the *difperfe* to be founded for the troops to repair in loofe and defultory order to fome rallying point, and there to re-affemble in their natural line of formation. A general, however, may be a perfect judge of pofitions, and underftand thoroughly the principles of attack and defence without having minutely ftudied or particularly attended to the drill and the mere mechanical arrangements of inferior movements; whereas one, whofe attention is chiefly directed to fuch objects, is feldom or ever fit to be entrufted with the command of an army on actual fervice, or in the field, where but few of the manœuvres ufually taught and attended to are either ufeful or can be advantageoufly put in practice. And it ought always to be remembered by thofe, who write or fpeak on the attack and defence of this country, though none of them feem to have fo much as once adverted to the fact, that neither the Pruffian nor German tactics can be made ufe of with advantage in either attacking or defending it. At the fame time it muft be acknowledged, that a general fhould attend to the minutiæ as well as to the fublimer parts of his profeffion, allowing, however, to each their juft and proportionate claim to his attention.

CLUB *antennæ*, in *Natural Hiftory*, a name given by naturalifts to fuch of the horns or antennæ of butterflies as reprefent a *club*, being larger at the extremities than at the origin.

CLUB-*foot*, or *club-footed*, a diftortion fo called. See FOOT, *Diftortion of the*.

CLUB-*haul*, in *Sea-Language*, denotes a method of tacking a fhip, when it is expected fhe will mifs-ftays upon a lee-fhore.

CLUB-*Mofs*, in *Botany*. See LYCOPODIUM.

CLUB-*Rufh*. See SCIRPUS.

CLUDRUS, or CLUDROS, in *Ancient Geography*, a river of Afia Minor, in Caria, according to Pliny, who fays that the town of Eumenia was fituated on its banks.

CLUE *of a Sail* See CLEW.

CLUGNY, in *Geography*, an ifland in the Southern Indian Ocean, difcovered by Kerguelen, near Kerguelen's land.

CLUIS DESSOUS, a town of France, in the department of the Indre, two leagues N.W. of Aigurande.

CLUIS *Deffus*, a town of France, in the department of the Indre, and diftrict of Chateauroux, 10 miles E. of Argenton.

CLUMP, in *Ornamental Gardening*, a detached portion of ground, dug up on lawns, or other parts of pleafure-grounds, fo as to be confiderably raifed in the middle for the purpofe of receiving different forts of trees, fhrubs, flower and other plants of the ornamental kind, in order to fhow them more fully, and produce a better effect. They differ from borders in being perfectly detached and feparate, as well as in being much more raifed in the operation of digging them over. This fort of ornamental compartment is not, however, at prefent fo much in ufe as formerly, except in very fmall defigns. But in extenfive grounds, where there is much mown grafs or lawn, when occafionally introduced, they have a good effect. It has been obferved by the author of "Ornamental Planting," that "detached maffes of wood, as well as groups and fingle trees, give a kind of animation to a fcene;

a ſcene; and this may be a reaſon why Brown was ſo laviſh of them: but that a crowd of clumps, as a profuſion of ſingle trees, muſt ever disfigure the ſcene they appear in."

In the forming of compartments of this nature, great care ſhould be taken to have them properly proportioned to the nature of the ſituation and extent of ground, as nothing can be more offenſive or diſguſting than clumps diſproportionately large. The diſtribution of them in the ground ſhould likewiſe be well attended to, in order that they may produce the moſt certain and ſtriking variety and effect: this is much aſſiſted by their being duly but irregularly intermixed with the other ornaments of the ſcite on which they are introduced.

In the buſineſs of planting them, the trees and large growing ſhrubs ſhould be conſtantly placed towards the back parts or middles, while the ſmaller ſhrubs and flower plants occupy the fore parts, being all properly intermixed according to their habits and methods, as well as times of flowering; as, by a judicious management in this reſpect, they produce a much better variety and effect, and continue much longer in beauty.

All the finer ſorts of flowering trees, ſhrubs, and other plants, are here proper, as well as a ſlight mixture of thoſe of the more common kinds.

The annual management of clumps is merely that of digging them over once or twice, trimming, and removing all the old ſtems and decayed parts of the plants and ſhrubs, raking them over neatly in the early ſpring ſeaſon, and putting in ſuch annual ſeeds as may be thought proper. See Bosquet.

Clumps, in *Agriculture*, are portions of land planted with different ſorts of trees in a cloſe manner, for the purpoſe of affording ſhelter and protection to the ground or live ſtock kept upon it.

CLUN, in *Geography*, a river of England, which runs into the Temde, 5 miles W. from Ludlow, in Shropſhire.

CLUNCH. By this name miners and well-diggers, &c. denominate a variety of ſtoney matters which they meet with in digging. In the clay which is met with below the ſand ſtratum, which crops in Leighton, Woburn, Ampthill, Sandy, and other pariſhes in Bedfordſhire, two remarkable layers of whitiſh ſtone called clunch are met with, near the part of the clay abounding with large perforated gryphites: theſe clunches are not much harder than chalk, and contain within them very beautiful and large ſpecimens of cornua ammonis, of ſmall bivalve ſhells called anomia or pundibs, and ſmall pieces of rotten wood, in a ſoft or almoſt pulpy ſtate: what is remarkable, and may tend to throw ſome light upon the bitumenization of wood in the ſtrata, is, that ſome ſpecimens of this ſoft wood taken out of the clunch being immerſed in a phial of water, were, after ſome months, ſhrunk very greatly, particularly in thickneſs, and were found hard, and their fracture to be ſmooth and ſhining like the bitumenized wood which is found in other ſtrata, particularly in the purbeck potters, or white pipe-clay ſtratum.

CLUNDERT, or Klundert, a ſtrong town of Holland, formerly called "Neuwervaert," ſeated on a river or canal, which runs from the Merwe, and forms the tract on which this town and Williamſtadt ſtand into an iſland. It was taken by the French in March 1793, and ſoon after evacuated; 10 miles W.N.W. of Breda. N. lat. 51° 39'. E. long. 4° 28'.

CLUNG, in *Rural Economy*, ſignifies cloſed up, or ſtopped; ſpoken of hens, when they do not lay. It is alſo applied to wood or any other thing that is ſhrivelled or ſhrunk up, when it is ſaid to be clung. Aſh-timber is ſometimes ſo much clung, that it cannot be ſplit into hoops or other ſimilar forms. And in this ſtate it is improper for the uſe of coopers.

CLUNIA, in *Ancient Geography*, a town of Hither Spain, S.W. of Numantia, which became a Roman colony and "conventus." Suetonius in his Life of Galba (c. 8.) informs us, that this prince governed Hiſpania Tarragonenſis for eight years, and that during this period Vindex revolted againſt Nero, and invited Galba to unite with him in reſcuing the empire from tyranny. It was in this town that a prieſt of Jupiter, admoniſhed in a dream, found in the ſanctuary of a temple a prediction, delivered 200 years before, which announced that a man ſprung from Spain would poſſeſs the empire of the world. This prediction, and the revolt of Vindex, determined Galba to ſeize the empire, under the modeſt title of lieutenant of the ſenate and of the Roman people. It was, moreover, at Clunia, that Galba, after receiving intelligence of the defeat and death of Vindex, received information, that the ſoldiers, ſenate, and Roman people had given him the title of emperor. This prince, in acknowledgment of theſe favourable occurrences, celebrated Clunia on his medals, by the name of Sulpicia, under which appellation it was honoured by Galba. On one medal the emperor is repreſented ſeated and receiving the victory preſented by the goddeſs of the city. This place is now denominated *Corunna* or *Corunna del Conde*.

CLUNIUM, a town of the eaſtern part of the iſland of Corſica, according to Ptolemy

CLUNY, or Clugni, in *Geography*, a town of France, in the department of the Saône and Loire, and chief place of a canton in the diſtrict of Mâcon, ſituated between two mountains on the Rhone. The church is ſuppoſed to be one of the largeſt in France, and the town includes three pariſhes. The place contains 3814, and the canton 15,567 inhabitants: the territory comprehends 262½ kiliometres and 23 communes; 3½ leagues N.W. of Mâcon, and ſeven S. of Châlons-ſur-Saône. In this place was a celebrated abbey of Benedictine monks, being the head or chief of a congregation denominated from them. It was founded by William, duke of Berry and Aquitain; or, as others ſay, by the abbot Berno, ſupported by that duke, in the year 910; but owed its diſtinguiſhed reputation to Odo, who, upon the death of Berno, was created abbot of Clugni in 927. This zealous eccleſiaſtic not only obliged the monks to live in a rigorous obſervance of their rules, but alſo added to their diſcipline a new ſet of rites and ceremonies, which, notwithſtanding the air of ſanctity that attended them, were in reality inſignificant and trifling, and yet at the ſame time ſevere and burthenſome. This new rule of diſcipline was productive of glory to its author, and, in a ſhort time, was adopted in all the European convents; for moſt of the ancient monaſteries, which had been founded in France, Germany, Italy, Britain, and Spain, received the rule of the monks of Clugni, to which alſo the convents, newly eſtabliſhed, were ſubjected by their founders. Thus it was, that the order of Clugni attained to that high degree of eminence and authority, opulence, and dignity, which it exhibited to the Chriſtian world, in the following century. Moſheim obſerves, (E. H. vol. ii. p. 413,) that the "order of Clugni," was not, as ſome have repreſented it, a new ſet of monks, ſuch as were the Carthuſian, Dominican, and Franciſcan orders; but ſignified only, *firſt*, that new inſtitution, or rule of diſcipline, which Odo had preſcribed to the Benedictine monks, who were ſettled at Clugni, and, afterwards, that prodigious multitude of monaſteries throughout Europe, which received the rule eſtabliſhed at Clugni, and were formed by aſſociation into a ſort of community, of which the abbot of

Clugni

Clugni was the chief. Towards the close of the 12th century a jealousy arose between the Cistercians and the monks of Clugni, which, after several dissentions, produced at length an open rupture, and declared war between these two ancient and powerful monasteries. The monks of Clugni accused the Cistercians of affecting an extravagant austerity in their manners and discipline; while the Cistercians, on the other hand, charged them, and on very just grounds, with having degenerated from their former sanctity and regularity of conduct. St. Bernard, the oracle and protector of the Cistercians, wrote, in the year 1127, an apology for his own conduct in relation to the division that subsisted between the two convents, and inveighed with a just, though decent, severity against the vices that had corrupted the monks of Clugni. He accuses them of luxury and intemperance at their table, of superfluity and magnificence in their dress, their bed-chambers, their furniture, equipage, and buildings. He points out the pride and vanity of the abbots, who appeared more like the governors of provinces than the spiritual fathers of humble and holy communities, whose original profession it was to be crucified and dead to the interests and pleasures, the pomps and vanities, of the present world. He declares, with a pious concern, that he knew several abbots, each of whom had more than 60 horses in his stable, and such a prodigious variety of wines in his cellar, that it was scarcely possible to taste the half of them at a single entertainment. This charge was answered with uncommon moderation and candour, by Peter Mauricius, abbot of Clugni; and hence it occasioned a controversy in form, which spread from day to day its baneful influence, and excited disturbances in several parts of Europe. It was, however, followed with a much more vehement and bitter contest concerning an exemption from the payment of tythes, granted among other privileges and immunities to the Cistercians, A. D. 1132, by Innocent II. This keen dispute was, in some measure, terminated in the year 1155. Mosheim, E. H. vol. iii. p. 67.

This order of monks was brought into England by William, earl of Warren, son-in-law to William the Conqueror, who built a house for them at Lewes in Sussex, about the year 1077. There were twenty-seven priories and cells of this order in England, which were governed by foreigners, afterwards made denizens.

CLUPEA, in *Ancient Geography*. See CLYPEA.

CLUPEA, in *Ichthyology*, a genus of abdominal fishes. The character of the genus consists in the head being compressed; mouth compressed and rough within; jaws unequal, the upper with serrated mystaces; tongue short, rough, with inverted teeth; eyes moderate, round, and marginal; gills setaceous; the gill-covers of either three or four plates; and the gill-membrane eight-rayed; body compressed, elongated, and covered with scales of moderate size; lateral line straight, near the back, and running in a parallel direction to it; belly carinated and generally serrated; ventral fins usually nine-rayed; tail forked.

Species.

THRISSA. Anal fin with twenty-eight rays; last ray of the dorsal fin long and setaceous.

This fish is about twelve or fourteen inches in length; the back bluish-green, with rows of brownish spots; the sides of the head green, and of the body silvery white. It inhabits the shores of America and India, and is considered poisonous.

SETICORNIS. Lateral bones of the upper jaw setaceous; anal fin with thirty two rays. A native of the Pacific Ocean. The body is of a lanceolate form, with the back bluish, and the belly silvery; the scales smooth, deciduous, somewhat of a rhombic form and obliquely imbricated.

CYPRINOIDES. Belly obtuse. Length less than twelve inches. The body is of an oblong form and silvery colour, with the back bluish, and the scales disposed in ten longitudinal series. A tropical fish. *Camaripugaucu* of Ray.

TROPICA. Tail cuneated, or wedge-formed.

Inhabits the coasts of Ascension island; the body is white, compressed, broad, and serrated.

SINENSIS. Outer ray of the gill-membrane truncated behind. A species which inhabits the coast of China; in its general figure, this fish is broader than the common herring, but in other respects resembles it.

MYSTUS. Body ensiform; anal fin joined to the tail. Linn. A native of the Indian seas.

ATHERINOIDES. Lateral line silvery. Gmel. This kind inhabits Surinam. The lower jaw is shorter than the other.

HAUMELA. Body lanceolate, naked, and destitute of ventral, anal, or caudal fins: dorsal fin extending the whole length of the back; tail linear.

This and the following species are described by Forskal as natives of the red sea; they seem both very doubtful.

DORAB. Ventral fins minute; upper lip two-horned, with extended teeth; lower longer, the teeth strong and erect.

VILLOSA. Lateral line prominent and rough. Müller. A native of the north sea,

TUBERCULATA. Lower jaw longer: on the snout a wart-like protuberance, and a red spot at the upper commissures of the jaws. La Cepede.

A small species observed by Commerson, in the Indian seas, and said to be an excellent fish for the table.

FASCIATA. Above, marked with semi-current dusky bands; below, with rounded spots. La Cepede. Inhabits the Indian seas, and was found by Commerson.

MACROCEPHALA. Above bluish, with the head elongated; upper jaw longest: fins red. La Cepede.

Described from a drawing, made by father Plumier, of a fish taken in the American seas.

ALOSA. Sides marked with a longitudinal series of spots; snout bifid.

This is the common shad, a fish which inhabits the Mediterranean and northern seas: it is of the marine kind, but at particular seasons ascends rivers for the purpose of depositing its spawn, and which it is observed to lay in the deepest part of the river. Towards autumn this fish returns again to the sea. Usual length from eighteen inches to two feet.

The young of this species has been very recently ascertained by us to be no other than the little fish known commonly by the name of white bait. The history of that heretofore ambiguous fish has excited the curiosity of so many naturalists, that we cannot refrain repeating, in this place, a few observations that have lately fallen from us on the same subject, in the "Natural History of British Fishes."—We have there observed that when the true character of the white bait becomes more generally understood, and the veracity of those remarks we shall offer in the sequel is sufficiently confirmed, by the observations of other naturalists, it will perhaps appear that it has remained with us to remove the mysterious veil that has hitherto enveloped the history of this little fish in obscurity. To what peculiar circumstances we are to attribute the errors that have prevailed among writers, respecting this fish, we cannot easily imagine: unless, as we must suspect, they never had an opportunity of examining it; but that they have actually been deceived, we are perfectly satisfied. This assertion is not advanced on slight surmises, for some pains have been taken by us to investigate the history of this heretofore ambiguous fish: we have examined

examined it repeatedly, and have now before us a variety of ſpecimens, elucidatory of the different tranſitions of its growth, from a diminutive ſize to the full length of three or four inches. Every one of theſe bears the moſt ſtriking ſemblance of the parent fiſh, and affords an incontrovertible evidence, that the white bait is really the fry of the common ſhad. We ſhall premiſe our enquiry by introducing the obſervations of Mr. Pennant concerning it, in the reſult of which he labours to prove, that the white bait is not the young ſhad, or even fiſh of the clupea, but one of the cyprinus genus, approaching near to the bleak, and ſhall conclude with ſtating our reaſons for diſſenting from an opinion ſo long eſtabliſhed, and ſo uniformly adopted by later writers.

"During the month of July (ſays Mr. Pennant) there appear in the river Thames, near Blackwall and Greenwich, innumerable multitudes of ſmall fiſh, which are known to the Londoners by the name of *white bait.* They are eſteemed very delicious when fried with fine flour, and occaſion, during the ſeaſon, a vaſt reſort of the lower order of epicures to the taverns contiguous to the places where they are taken at.

"There are various conjectures about this ſpecies, but all terminate in a ſuppoſition that they are the fry of ſome fiſh, but few agree to which kind they owe their origin. Some attribute them to the ſhad, others to the ſprat, the ſmelt, and the bleak. That they neither belong to the ſhad, nor the ſprat, is evident from the number of branchioſtegous rays, which in thoſe are eight, in this only three. That they are not the young of ſmelts is as clear, becauſe they want the *pinna adipoſa,* or rayleſs fin; and that they are not the offſpring of the bleak is extremely probable, ſince we never heard of the white bait being found in any other river, notwithſtanding the bleak is very common in ſeveral of the Britiſh ſtreams; but, as the white bait bears a greater ſimilarity to this fiſh than any other we have mentioned, we give it a place as an appendage to the bleak, rather than form a diſtinct article of a fiſh, which it is impoſſible to claſs with certainty. It is evident that it is not of the carp or cyprinus genus; it has only three branchioſtegous rays, and only one dorſal fin; and, in reſpect to the form of the body, it is compreſſed like that of the bleak. Its uſual length is two inches; the under jaw is longeſt; the irides ſilvery, the pupil black; the dorſal fin is placed nearer to the head than the tail, and conſiſts of about fourteen rays; the ſide line is ſtraight; the tail forked, the tips black. The head, ſides, and belly are ſilvery; the back tinged with green." Brit. Zool.

Dr. Shaw, in his "General Zoology," deſcribes the white bait as a ſpecies of the carp or cyprinus genus. It is obſerved, by this writer, that "this ſmall fiſh, which is extremely plentiful, at particular ſeaſons, in the river Thames, is ſuppoſed to be the young of ſome ſpecies of cyprinus, though it is not agreed to what ſpecies it ſhould moſt properly be referred." The white bait is introduced by Dr. Turton as a variety of the bleak, *cyprinus alburnus.* He deſcribes it as having the lateral line ſtraight. The general deſcription is to the following effect. "Pupil black; iris ſilvery; lower jaws longer; head, ſides, and belly ſilvery; back tinged with green; dorſal fin nearer the head than the tail, and with about fourteen rays; tail forked, the tips black." It will be proper to add, that no mention is made of this fiſh in the Gmelinian *Syſtema Naturæ,* and that Dr. Turton has inſerted it, to all appearance, on the authority of Mr. Pennant.

Our obſervations commenced with ſtating the white bait to be the genuine offspring of the ſhad, and conſequently of the clupea inſtead of cyprinus genus, as the preceding authors conſider it. This we ſhall have little difficulty in determining. To ſpeak with indeciſion on a point that admits of not the ſlighteſt doubt, would be ſuperfluous; when we deliver an opinion merely, it is becoming to expreſs it with diffidence; but ſurely diffidence and indeciſion are miſapplied to matters beyond the poſſibility of doubt, and ſuch is the fact preciſely with regard to white bait. Every circumſtance conſidered, we cannot avoid concluding that much of the prevailing errors reſpecting the white bait has originated from the incautious obſervations of Mr. Pennant on this ſubject; that this author never ſaw the white bait, and that ſucceeding naturaliſts, too implicitly relying upon his obſervations, have been inadvertently precipitated into thoſe errors, which the moſt caſual examination of the fiſh in queſtion would have enabled them to detect. If, however, contrary to this ſuggeſtion, Mr. Pennant ever did examine the fiſh, his ſpecimens muſt have been either in a moſt imperfect ſtate, or his inveſtigation of it unpardonably negligent. His figure conveys no juſt idea of the fiſh, and his critical animadverſions are laboriouſly intricate and defective. He tell us, for example, that the white bait "neither belongs to the ſhad nor the ſprat, as is evident from the number of branchioſtegous rays, which in thoſe are eight, in this (the white bait) only three." This remark is incorrect; the branchioſtegous rays were uniformly eight in number in at leaſt fifty ſpecimens we examined, with the view of aſcertaining the fact exactly. The number of thoſe rays determines at once that it cannot be of the cyprinus genus, which is diſtinguiſhed by having only three rays inſtead of eight. Mr. Pennant further remarks, that "it is impoſſible to claſs this fiſh with certainty," but in what reſpect this ambiguity conſiſts it is not for us to ſay. The white bait certainly poſſeſſes every criterion of the ſpecies as evidently as the parent, or full-grown fiſh; its outline is the ſame, the fins are alike; it exhibits the ſame ſerrations on the abdomen and cleft on the ſnout; and what is even remarkable in a fiſh of this ſmall ſize, the lateral range of duſky ſpots is perceptible through the beautiful ſilver ſcales, as in the larger fiſh; it exhibits, in a word, the moſt perfect but diminiſhed view of the common ſhad, not a ſolitary character excepted. Vide Donov. Brit. Fiſhes, pl. 98.

Harengus. Body without ſpots; lower jaw longer.

The common herring is a fiſh ſo generally known to every common obſerver, that we conceive it unneceſſary to offer an elaborate deſcription of it; the ſpecies is pretty accurately defined by the above character, which is that aſſigned to it by Linnæus in his "Fauna Suecica."

The importance of the herring to the inhabitants of Europe, and thoſe more particularly of the northern countries, is very great. The fiſhery of the herring, as may be naturally conceived, is very great. The Dutch who, in this reſpect, ſet an early example of induſtry to the reſt of Europe, were engaged in this fiſhery ſo long ago as the year 1164, and are ſaid to have carried it on for ſeveral centuries after, with the greateſt perſeverance and ſpirit. The method of pickling the herring, after the Dutch manner, is reported to have been diſcovered by William Beukelen, of Biervlet, near Sluys in Flanders, and his art, in a great meaſure, remains a ſecret to this day. The ſuperior excellence of the herrings pickled in this manner is generally allowed, and ſuch herrings bear a higher price than thoſe preſerved in any other way. The Britiſh pickled herrings are in little eſteem, except in our own country. Some attempts have been lately made to eſtabliſh a ſmall colony of Dutch fiſhermen on the coaſt coaft of Scotland, for the exprefs purpofe of pickling herrings in the fame manner as in Holland, but whether the laudable endeavours of thofe concerned will be ultimately fuccefsful, time alone can determine ; there feems to exift a general, and, no doubt, very unfounded prepoffeffion in the country, that they are ftill inferior to thofe pickled in Holland.

Many particulars related by authors, refpecting the periodical migrations of the herring from the northern regions towards the fouth of Europe, feem to admit of great difpute ; the beft informed ichthyologifts of the prefent time are inclined to think thofe accounts, in moft inftances, erroneous. It is fuppofed the herring, like the mackrel, remains, during the winter months, at no very great diftance from the fhores, which it moft frequents during the fpawning feafon ; the fame we have ourfelves obferved with regard to the fprat. In winter they inhabit the deepeft parts of the fea, or plunge beneath the foft mud at the bottom, from whence they rife at the fpring feafon, and approach the fhallows in order to depofit their fpawn in proper fituations. In proof of this, Bloch obferves, that herrings are found at almoft all feafons of the year about fome of the European coafts, and that the northern migrations, fuppofed by Pennant and others, are impracticable in the fhort period affigned by them, as the fifh, in its fwifteft progrefs, is utterly incapable of moving at a rate by any means fo rapid as the term allowed for thofe migrations would require. For this, and other reafons, Bloch is induced to think the long voyages of the herring exift only in the minds of its defcribers.

The herring is fuppofed to feed on marine worms, and the fmall fry of fifhes in general ; its greateft enemies are the various fpecies of whales, fome of which fubfift almoft entirely on this fifh.

Pilchardus. Nofe turned up ; dorfal fin in the centre of gravity ; fcales large and firm.

The pilchard is fomewhat allied in general appearance to the herring, but is thicker, or of a lefs compreffed form, the back more elevated, and the fcales very confiderably larger in proportion. It is alfo a fmaller fifh, rarely exceeding the length of eight inches. Pilchards, according to Dr. Borlafe, appear ufually in vaft fhoals off the Cornifh coafts, about the middle of July, and difappear again in the beginning of winter, though a few return again after Chriftmas. Their winter retreat is fuppofed to be the fame as that of the herring. The pilchard fifhery is a very productive concern on the coaft of Cornwall, where thofe fifh are cured for exportation. Oil is alfo extracted from them in great abundance.

Sprattus. Lower jaw longer than the upper ; dorfal fin about feventeen-rayed, belly ferrated.

The fprat inhabits the north of Europe, appearing at particular feafons in immenfe fhoals near the coafts ; it ufually fpawns in autumn.

Encrasicolus. Upper jaw longeft. Linn.

The general length of the anchovy is from three to four inches, or, at the utmoft, about four inches and a half ; though individual fpecimens have occurred of a ftill larger fize. The prevailing colour is filvery, with the back green.

This fifh is found in great plenty in the Mediterranean, Northern, and Atlantic feas, and, like the herring, is fuppofed to leave the deep receffes of the fea, and in fpring approach the fhores, for the purpofe of depofiting its fpawn. The great fifhery of anchovies is at Gorgona, a fmall ifle to the weft of Leghorn. They are taken in vaft quantities, and prepared for fale by falting and pickling ; the bones eafily diffolve in boiling. It is fuppofed to have been known to the ancient Greeks and Romans, who prepared from it a kind of garum for their table. The anchovy has been obferved, though very rarely, on the Englifh coaft. Vide Donov. Brit. Fifhes. See Anchovy.

CLUSES, in *Geography*, a town in the department of Leman, and chief place of a canton in the diftrict of Bonneville, feated by the fide of the Arve ; the place contains 2102, and the canton 10,330 inhabitants : the territory includes 190 kiliometres and 8 communes.

CLUSIA, in *Botany*, (fo called in memory of C. Clufius, or Charles de l'Ecclufe,) Balfam-tree. Linn. Gen. 1154. Schreb. 1584. Juff. 256. Vent. 3. 147. (Perepé Encyc.) Clafs and order, *polygamia monœcia*. Nat. Ord. *Guttiferæ*, Juff. Vent.

Gen. Ch. *Cal.* Perianth from four to fixteen-leaved, permanent, leaves concave, imbricated, the exterior ones gradually fmaller. *Cor.* Petals from four to fix, large, open, roundifh, larger than the calyx. *Stam.* Filaments from fix or eight, to a very great number, fimple, fhorter than the corolla. *Pift.* Germ ovate-oblong ; ftyle none, ftigma radiate, peltate, flat, obtufe, permanent. *Peric.* Capfule fpheroid, large, furrowed, from four to twelve-celled, opening from the fummit to the bafe into as many valves as there are cells, each terminated by a ray of the ftigma. *Seeds* numerous, fmall, covered with a fucculent pulp, affixed either to a central angular receptacle, or to receptacles adhering on the infide to the fummit of the valves.

Eff. Ch. Calyx from four to fixteen leaved. Petals from four to fix. Stamens generally very numerous. Stigma feffile, with diverging rays. Capfule from four to twelve-celled, opening longitudinally into as many valves. Seeds fmall, covered with a fucculent pulp.

Obf. All the flowers have ftamens and a piftil ; but in fome, the ftamens are abortive, in fome the piftil, and in others they are both perfect. All the fpecies are trees abounding in a vifcid juice, which becomes red when expofed to the air, and hardens into a gum or refin. In the female flowers, a nectary is formed by the coalition of the abortive anthers, including the germ.

Sp. 1. C. *rofea*, Linn. Sp. Pl. 1. Mart. 1. Poir. 1. Plum. Gen. 21. Jacq. Americ. 270. Pict. 231. (Cenchramidea, Pluk. Alm. 92. tab. 157. fig. 2. Catefb. Car. 2. tab. 99.) " Leaves veinlefs ; corollas fix-petalled." *Trunk* from twenty to thirty feet high ; branches fpreading. *Leaves* oppofite, quite entire, inverfely egg-fhaped, firm, coriaceous, even on their upper furface, marked underneath with oblique parallel nerves unconnected by veins, round, and fometimes a little emarginate at the fummit, narrowed at the bafe, on fhort peticles. *Flowers* large, rofe-coloured, axillary and terminal ; peduncles thick, fhort, fometimes fimple, more frequently two or three-flowered ; bractes fhort, obtufe, fcaly ; calyx-leaves fix, coloured, almoft round, concave, obtufe, open, fomewhat imbricated ; the two intermediate ones half the fize of the two interior ones, and twice the fize of the two exterior ones ; petals concave, very open, with a thick fhort claw ; ftamens very numerous, erect, awl-fhaped, the length of the germ, and furrounding it in two ranks ; in the female flowers, without anthers ; germ cylindrical, fhorter than the calyx, furrowed by the impreffion of the filaments ; ftigma with eight equal rays. *Capfule* greenifh, large, almoft round, obtufe, eight-celled, eight-valved. *Seeds* numerous, covered by a thick, foft pulp, attached to a very large central receptacle, the angles of which form the cells. A native of the Weft Indies, among rocks ; and it is alfo parafitic on the trunks or limbs of other trees, occafioned by birds fcattering the vifcid feeds, which take root like thofe of miffelto missleto, but not finding sufficient nutriment, the roots spread on the surface of the tree, till they find a decayed hole, or other lodgment, where there is a small portion of soil; the fertility of this being exhausted, a root is discharged out of the hole till it reaches the ground, though at forty feet distance; here again it fixes itself and becomes a much larger tree. The resin is used to cure sores in horses, and instead of tallow for boats. 2. C. *alba*, Linn. Sp. Pl. 2. Mart. 2. Poir. 2. Jacq. Amer. p. 271. tab. 166. Plum. Gen. 22. Icon. 87. fig. 1. "Leaves veinless; corollas five-petalled." In habit resembling the preceding species. *Leaves* also similar, except in being a little longer, not emarginate, and scarcely petioled. *Flowers* white, without scent, smaller and less elegant; calyx-leaves nine, in three ranks, of different sizes, as in C. rosea; petals twice as large as the internal calyx-leaves; filaments from five to eight, only half the length of the germ; germ a little shorter than the petals; stigma five or six-rayed. *Capsule* large, of a beautiful scarlet colour when ripe, five or six-celled, with the same number of valves. *Seeds* whitish, covered with a reddish pulp, attached to a large central receptacle. A native of Martinico. 3. C. *flava*, Linn. Sp. 3. Mart. 3. Poir. 3. Brown. Jam. 236. (Terebinthus; Sloan. Jam. 167. Hist. i. p. 91. tab. 200. fig. 1.) "Leaves veinless; corollas four-petalled." General habit, leaves and inflorescence similar to the two preceding. *Flowers* pale yellow; calyx almost quadrangular; composed of sixteen leaves in four ranks; the inner ones gradually increasing in size; petals egg-shaped, narrowed towards the claws, very thick, two larger than the others; stamens very numerous; filaments short, thick, nearly in four ranks round the germ; anthers with two separate lobes; germ very small; stigma thick, almost capitate, with four lateral appendages, twelve-rayed. *Capsule* twelve-celled, twelve-valved. *Seeds* numerous, attached to a very large, oblong, twelve-furrowed receptacle. It is said to vary in the colour of the flowers and fruit. A native of Jamaica, and of Cayenne, in South America, among rocks at the foot of mountains. 4. C. *retusa*, Poir. 4. Lam. Ill. tab. 852. "Leaves somewhat veined, egg-shaped, retuse; flowers six-petalled; fruit somewhat globular-compressed." *Leaves* six or seven inches long, and about three broad, opposite, petioled, very thick, completely retuse and round at the summit; marked with strong, transverse, parallel nerves, connected by very fine, scarcely perceptible, veins. *Flowers* axillary, towards the extremity of the branches, peduncled, often solitary; calyx-leaves eight, inversely egg-shaped, in two ranks; the outer ones not half the length of the others; bractes two, about the middle of the peduncles, and two others at the bifurcation, where there is more than one flower; short, egg-shaped, very thick, smooth, permanent; corolla much larger than the calyx; stamens very numerous, anthers simple, erect. *Capsule* globular, compressed at the two extremities, with at least sixteen or eighteen cells, and as many valves. A native of America. 5. C. *venosa*, Linn. Sp. 4. Mart. 4. Poir. 6. Plum. Gen. 21. Ic. 87. fig 2. "Leaves veined." Trunk more than thirty feet high. *Flowers* white; calyx-leaves four, roundish; two outer ones a little narrower, acute; petals four, egg-shaped, obtuse, very open, a little longer than the calyx; stamens very numerous; filaments straight, a little flattened; anthers erect, oblong; stigma five-rayed. Miller's plant, which seems to be a variety, has rose-coloured flowers, produced in long spikes at the end of the shoots. A native of the West Indies. 6. C. *sessiliflora*, Poir. 5. "Leaves inversely egg-shaped, somewhat veined; flowers sessile, clustered." *Stem* rugged, greenish. *Leaves* opposite, coriaceous, thick, sometimes emarginate, quite entire, narrowed at the base; petioles only two or three lines long, compressed, thick. *Flowers* small, axillary. A native of Madagascar, described from an imperfect specimen in the herbarium of La Marck, in which the parts of fructification could not be distinguished. 7. C. *sessilis*, Mart. 6. Forst. Fl. Aust. n. 391. "Leaves opposite, inversely egg-shaped and elliptic, quite entire, veined; flowers axillary, solitary, nearly sessile, four-petalled." A native of New Caledonia. 8. C *pedicellata*, Mart. 6. Forst. Flor. Austral. n. 390. "Leaves opposite, inversely egg-shaped, quite entire, veined; cymes axillary; flowers four-petalled. A native of Tongatabu.

Propagation and Culture. These plants are most advantageously imported in tubs from their native climates. They must be constantly kept in the stove, and sparingly watered, especially in winter. They may also be propagated by cuttings, which must be laid to dry for a fortnight or three weeks. The best time for planting them is in June or July, when the pots should be plunged into a hot-bed of tanner's bark. In winter they may be placed upon stands in the dry stove; but if they are plunged into the tan-bed in summer, their leaves will be larger and more beautiful.

C. *foliis venosis*, Fabric.—*Minor*, Rumph. See DECUMARIA *barbara*.

CLUSINA PALUS, in *Ancient Geography*, the name of a long marsh, formed by the waters of the Clanis, near Clusium.

CLUSINI FONTES, fountains of Italy, in Etruria, placed by the ancients near Clusium. They are now called "Bagni de S. Cantiano."

CLUSINI, a people of Italy, in Etruria; the *Clusini Novi* are placed by Pliny towards the sources of the Tiber, and he calls their town *Clusium Novum*; the *Clusini Veteres* are placed by the same author on a mountain, and he calls their town *Vetus Clusium*.

CLUSIUM, now *Chiusi*, a town of Italy, at a small distance to the west of Perugia, on the right bank of the Clanis. Its ancient name was "Camers." Its origin is traced to about the time of the siege of Troy; and some attribute its foundation to Clusius, son of Tyrrhenus, and others to Telemachus. In the time of the Romans it was considerable; and Porsenna held his court and was buried in this place. Pliny speaks of his tomb, and of a monument erected in honour of him, called the "Labyrinth." The Gauls besieged this place, but marched towards Rome without taking it. This place is now, on account of the insalubrity of the air, almost forsaken.

CLUSIUS, more properly DE L'ECLUSE, CHARLES, in *Biography*, a very eminent botanist, born at Arras, in the French Netherlands, February 19, 1526. He received the first rudiments of polite literature, with the knowledge of several modern languages, at Ghent; and afterwards bestowed some time upon the Greek and Latin classics at Louvain, where he likewise applied himself to the study of jurisprudence. He also took a degree in medicine; but it does not appear that he pursued either of these studies as a source of emolument. Having always had an ardent desire to visit foreign countries, he went to Germany at the age of 23; where he imbibed a taste for general science, especially geography and botany. He travelled into the south of France, but was called home by his father on account of the civil wars, about 1563. He afterwards found means to visit that kingdom again, as well as Spain, and great part of Portugal, chiefly with a view to the botany of those countries, which he has amply illustrated. He visited England at three several times. In all these journies he formed valuable acquaintances among the learned in his favourite science, who subsequently communicated their various discoveries to enrich his publications; his liberal, candid, and amiable disposition preserving him from all envy and rivalship. He not only collected and described a number of new plants, but made drawings of several with his own hand. In the year 1573, Clusius was invited to Vienna by the emperor Maximilian II., with whom, as well as with his son, afterwards the emperor Rodolphus II., he was in great favour, and was honoured by the former with the rank of nobility. He had always a great desire to visit Italy; but having three times been diverted from his purpose by various accidents, he concluded it was not the will of Providence that he should ever see that country, and gave up the design. In 1593, the 68th year of his age, Clusius was chosen professor of botany at Leyden, where he resided in great reputation till his death, which happened on the 4th of April 1609, in the 84th year of his age. He was honoured with a public funeral in St. Mary's church, Leyden, when a Latin oration in his praise was delivered by the rector of the university. He died unmarried. With respect to bodily health, Clusius was unfortunate beyond the usual lot of humanity. In his youth he was afflicted with dangerous fevers, and afterwards with a dropsy. He broke his right arm and leg by a fall from his horse in Spain, and dislocated, as well as fractured, his left ankle at Vienna. In his 63d year he dislocated his right thigh, which, being at first neglected, could never afterwards be reduced, and he became totally unable to walk. Calculous disorders, in consequence of his sedentary life, accompanied with colic and a hernia, close the catalogue of his afflictions. Yet his cheerful temper, and ardour for science, never forsook him, nor did any man ever enjoy more respect and esteem from those who knew him.

Clusius may be said to have held the botanical sceptre for a long course of years till his death. Although not, like his great contemporary, Conrad Gesner, a systematic genius, he was one of the best practical botanists. He discriminated plants very happily, and his histories of them are rendered interesting by innumerable remarks and anecdotes, which carry his readers along with him wherever he goes, to share his pleasures without his toils. When seated in his botanical chair at Leyden, his authority was respected on all hands, and all discoveries were laid at his feet. Our gardens are indebted to him for the cherry-laurel and horse-chesnut, now so common and so ornamental, which he received, among many other plants, from the imperial ambassador at the Porte, in 1576. All the rest of the cargo perished, but Clusius bestowed the greatest possible attention to preserve and increase these; for, unlike many selfish collectors, he delighted to disperse his treasures among those who took pleasure in their acquisition, and it is but just that his memory should be perpetuated along with those two beautiful trees, with which all botanists of taste ought for ever to associate his name, thus giving him a monument more lasting than brass or marble.

The principal publications of Clusius are the following:

1. "Rariorum aliquot Stirpium per Hispanias observatarum Historia," Antwerp, 1576, octavo, with above 220 wooden cuts, admirably executed. In several parts of this work, he considers the fructification as of primary importance for determining the genera of plants, a doctrine which had but recently been first advanced by Conrad Gesner, and Cæsalpinus.

2. "Rariorum aliquot Stirpium per Pannoniam, Austriam, et vicinas quasdam Provincias observatarum Historia," Antwerp, 1583, octavo, with above 350 wooden cuts, somewhat less elegant, as Haller observes, than those of the former work, but sufficiently good and original, as is the letter-press of both. The former is a treasure of the vegetable productions of the south of Europe, as the latter is of Alpine ones. Both are commodious and highly agreeable pocket-companions for the travelling botanist.

3. The foregoing were re-published, with the title of "Rariorum Plantarum Historia," in folio, at Antwerp, in 1601, with some additions of garden plants, an ample treatise on *fungi*, with cuts, some of Clusius's correspondence, and Pona's account of mount Baldus. This is the edition in common use, and most generally quoted.

4. "Exoticorum Libri decem," Antwerp, 1605, folio, with numerous cuts of animals, exotic fruits, and gums. The observations of Garcias ab Orta, Acosta, Monardez, and Bellon, form the basis of this work, to which Clusius has added many illustrations. An appendix of his own on rare plants is subjoined, in which is the first figure of the horse-chesnut in flower.

5. "Curæ Posteriores," Antwerp, 1611, folio. This posthumous work is generally bound with the last. It consists of a few excellent figures and descriptions of rare plants. The funeral oration of Clusius, with various poetical tributes to his memory, are commonly annexed to this volume, and among them a short account of his life from "Boissard's Portraits of Illustrious Men."

To this list may be added various translations and editions of other writers on Botany, or Materia Medica. A manuscript of Clusius on *fungi* is said to exist in the library at Leyden. Boissard. Haller's Bibl. Botan. Clusius's works. S.

CLUSIUS, or *Clusio*, in *Ancient Geography*, now *La Chiése*, a river of Italy, in Cisalpine Gaul; which bounded the country of the people denominated "Cenomani," according to Pliny.

CLUSTER, in *Agriculture*, a bunch or number of things of the same kind growing or joined together.

CLUSTER-*Sowing*, that method of sowing grain, in which a number of corns are placed in the ground together, or in clusters. See SOWING *of grain*.

CLUSTERS, a word provincially used, to imply the bunches or clumps in turnip crops, &c.

CLUSTER *of Stars*, in *Astronomy*. See NEBULA and STAR.

CLUSTER-*polype*. See POLYPE.

CLUTIA, in *Botany*. See CLUYTIA.

CLUTIA *androgyna*; Linn. Mant. See ANDRACHNE *fruticosa*.

CLUVERIUS, or CLUVIER, PHILIP, in *Biography*, a celebrated geographer, born at Dantzic in 1580. The earlier parts of his education he received under the eye of his father, who sent him to Leyden to finish his studies. Here he was intended to pursue the civil law, but showing a decided disposition for geographical studies, he was advised by Joseph Scaliger to devote himself chiefly to the advancement of that branch of knowledge. With this view he resolved to examine for himself the Low Countries; but in his way to Brabant, he was robbed, and obliged to return to Leyden. His father abandoned him to want, because he refused to pursue the course which he had marked out for him in the law; the young man, therefore, had recourse to the military life, and served in Bohemia two years. He was afterwards imprisoned, on account of a publication relating to state affairs. Upon recovering his liberty he resumed his geographical pursuits, and travelled into England, France, Germany, and Italy, for the purpose of making accurate observations of the countries which he meant to describe. He was every where received by literary and learned men, with all the respect due to his talents. He

spoke

fpoke with fluency ten languages, *viz.* the Greek, Latin, German, French, English, Dutch, Italian, Hungarian, Polish, and Bohemian. On his return to Leyden he taught with reputation, and died at the early age of 43 years. His principal works are, 1. "De Tribus Rheni Alveis;" 2. "Germania Antiqua;" 3. "Italia Antiqua, Sicilia, Sardinia, et Corsica;" 4. "Introductio in Universam Geographiam." Moreri.

CLUVESYECK, in *Geography*, a town of Germany, in the duchy of Holstein; 5 miles E.N.E. of Rendsburg.

CLUVIA, in *Ancient Geography*, a place of Italy, in the country of the Samnites, garrisoned by the Romans.

CLUYTIA, in *Botany*, (named by Boerhaave, in memory of Angerius Clutius, or, in his native language, Antgers Cluyt, professor of botany at Leyden. The name of the genus has usually been spelt Clutia; but professor Martyn has judiciously altered it to Cluytia, to make it more distinct, in pronunciation, from Clusia.) Linn. Gen. 1140. Schreb. 1526. Gært. 623. Juss. 387. Vent. 3. 489. (Clutelle; Encyc.) Class and order, *dioecia gynandria*. Nat. Ord. *Tricoccæ*, Linn. *Euphorbiæ*, Juss. *Tithymaloideæ*, Vent.

Gen. Ch. *Male. Cal.* Perianth five-cleft or five-leaved; leaves concave, spreading. *Cor.* Petals five, spreading very much, about the length of the calyx and alternating with its divisions; claws flat; scales (called by Linnæus exterior nectaries) five, small, trifid, spreading, opposite to the divisions of the calyx, placed in a circle within the petals, and about the length of the claws; glands (called by Linnæus interior nectaries) five, small, mellifluous at the tip, placed between the scales, opposite to the petals. *Stam.* five, situated on the upper part of the style, remote from the corolla, spreading horizontally; filaments short; anthers roundish, versatile. *Pist.* Germ none; style cylindrical, truncated, very long, bearing the stamens. *Female. Cal.* and *Cor.* as in the male, permanent; scales or exterior nectaries five, didymous, of the same size and situation as in the male; interior nectaries none. *Pist.* Germ roundish; styles three, bifid, reflexed, the length of the corolla; stigmas obtuse. *Peric.* Capsule globular, six-furrowed, scabrous, three-celled. *Seeds*, one in each cell, roundish, even-surfaced, with an appendage at the tip.

Eff. Ch. Calyx five-leaved or five-cleft. Corolla five-petalled. Styles, in the female flowers, three. Capsule three-celled. Seeds solitary.

Sp. 1. C. *daphnoides*. Lam 1. (Chamœlea; Burm. Afr. 120. tab. 44. fig. 2.) "Leaves nearly linear, narrowed towards the base, obtuse at the tip; younger ones tomentous on both sides; flowers solitary, erect." A shrub about two feet high, much branched; branches cylindrical, stiff; smaller ones leafy, cottony near the summit, tubercled below. *Leaves* almost sessile, near together, without any regular order, thickish, resembling those of Daphne Cneorum, but smaller and less smooth. *Flowers* axillary, peduncled, generally solitary; males smaller than the females and less erect. A native of Africa, communicated by Sonnerat. 2. C. *alaternoides*. Linn. Sp. Pl. 1. Mart. 1. Lam. 2. (Tithymalus; Pluk. Alm. 369. tab. 290. Chamœlia; Burm. Afr. 116. tab. 43. fig. 1. Alaternoides; Comm. Hort. 2. p. 3. tab. 2.) "Leaves nearly sessile, linear-lanceolate; flowers solitary, erect." Linn. "Leaves linear-lanceolate, mucronate, quite smooth, cartilaginous and scabrous at the margin." Lam. A shrub, about two feet high; Lam. (Six or eight; Miller.) *Stems* leafy, almost their whole length; branches numerous, on their upper part, commonly simple, angular. *Leaves* scattered. *Flowers* greenish-white, small, axillary, solitary, peduncled; males smaller, a little pendulous. A native of Africa. 3. C *polygonoides*. Linn. Sp. Pl. 2. Mart. 2. Lam. 3. (Chamœlea; Burm. Afr. 118. tab. 43. fig. 3.) "Leaves lanceolate; flowers axillary, very numerous." *Leaves* alternate, gradually narrowed to the summit, acute, smooth, quite entire. *Flowers* small, usually two together, pendulous. A native of the Cape of Good Hope. 4. C. *pulchella*, Linn. Sp. Pl. 3. Mart. 3. Lam. 4. Gært. tab. 107. Lam. tab. 835. (Frutex Æthiopicus; Comm. Hort. 1. p. 177. tab. 91.) "Leaves egg-shaped, quite entire; flowers lateral." A shrub, three or four feet high. *Stem* upright, branched at its summit, forming a handsome head; branches smooth, with a greenish bark. *Leaves* an inch broad, alternate, petioled, soft, finely dotted underneath. *Flowers* greenish-white, axillary, commonly several together; male ones smaller, on peduncles only three lines long; female, on peduncles longer than the petioles. Lam. *Capsule* pedicelled or sessile, globular, scabrous, with elevated points, three-furrowed, tricoccous; cocci of the substance of paper, gibbous on one side, angular on the other, semi-bivalved, the back of the valves separating spontaneously from the partitions; partitions membranous, permanent on the axis of the fruit, dark chestnut-coloured, shining, slightly serrated on the edges. *Receptacle* central; filiform, covered by the partitions which form six membranous roundish wings about the axis. *Seeds* dark chestnut-coloured, egg-shaped, smooth, shining, with a two-lobed white umbicular gland immediately below the tip on the inside. A native of Africa. 5. C. *lanceolata*, Mart. 10. Vahl. Symb. 2. 101. Forskal. Ægypt. 170. "Leaves elliptic-lanceolate; flowers lateral, tomentous." Nearly allied to the preceding, but differs in having the branches purple, and ash-coloured, villous at the top. *Leaves* broad-lanceolate, two inches long or more, without dots underneath, few above, and visible only with a magnifier. *Male-flowers* numerous, aggregate, axillary, on very short peduncles; female ones commonly solitary, peduncled; calyxes villous-tomentous. *Capsules* not dotted. A native of Ægypt. 6. C. *hirta*, Linn. jun. Supp. 432. Mart. 4. Lam. 9. Vahl. Symb. 2. 101. "Leaves wedge-shaped, smooth; flowers lateral, glomerate, hirsute." A shrub. *Branches* cylindrical, smooth, tubercled with the remains of fallen leaves, usually scattered, but sometimes three together. *Leaves* petioled, reticularly veined. *Flowers* nearly sessile; calyx rough with short hairs; petals oblong, minute, smooth; style trifid, involved in ash-coloured hairs. Found by Thunberg at the Cape of Good Hope. 7. C. *tomentosa*, Linn. Mant. 299. Mart. 5. Lam. 5. "Leaves elliptical, tomentous on both sides." A shrub, three feet high, much branched, upright, tubercled with the remains of fallen leaves. *Branches* cylindrical, pubescent. *Leaves* the size of those of thyme, sessile, rather acute. *Flowers* white, sessile, lateral solitary, longer than the leaves; calyx five-toothed, cottony on the outside; petals oval, the length of the calyx; stigma bearded. A native of sandy shores at the Cape of Good Hope. 8. C. *retusa*, Linn. Sp. Pl. 4. Mart. 6. "Leaves oval, retuse: flowers racemed, axillary." *Leaves* on short petioles, alternate, the size of those of beech, reflexed at the edge, with prominent transverse nerves underneath. *Flowers* very small; racemes axillary, quite simple near the ends of the branches; partial peduncles three or four, alternate, filiform; calyx-leaves acute; petals three-toothed; nectaries none, except a ring surrounding the receptacle; in the middle a column with five horizontal filaments, and versatile anthers. A native of the East Indies. 9. C. *squamata*, Lam. 6. (Scherunam-cottam. Rheed. Mal. 2. p. 23. tab. 16. Good. Rai. hist. 1623. Corni five forbi species; Bont. Jav. 103.) "Leaves elliptical, smooth above, pubescent and nerved underneath; flowers axillary, sessile,

sessile, squamose at the base." A shrub, ten or fifteen feet high; upper branches slender, almost filiform, leafy, pubescent towards the summit. *Leaves* alternate, on short petioles, entire; furnished underneath with lateral, oblique, parallel nerves, which are crossed by other smaller ones. *Flowers* axillary, not racemed, but sessile, and often clustered two or three together, supported by a small somewhat spungy knot, which is formed by the scales. *Capsules* egg-shaped, smooth, with three or four cells. A native of the East Indies, found by Sonnerat and Commerson. La Marck doubts whether it be not the retusa of Linnæus; but the descriptions are so inconsistent, that we have thought it best to keep them distinct, though the synonyms, quoted by Linnæus, probably belong to La Marck's plant. 10. C. *eluteria*, Linn. Sp. Pl. [illegible] Mart. 7. Lam. 8. Woodv. Med. Bot. Supp. Pl. 211. [illegible] Clif. 486. Croton; Brown, Jam. 347. n. [illegible] Pluk. a.m. tab. 220. fig. 5.) Seba Thes. 1. tab. 35. fig. 3. "Leaves cordate-lanceolate." A small tree, several feet high, with numerous branches; bark of the branches brown and smooth; that of the trunk externally more white and rough. *Leaves* alternate, on long petioles, obtuse, bright green above, paler underneath. *Flowers* both of the male and female plants in spikes, whitish, with all the characters of the other species; but it is necessary to observe that Dr. Woodville does not notice the number of stamens, which according to Linnæus are ten, and render the real genus of the plant uncertain. There is much confusion with respect to it and croton cascarilla of Linnæus; the latter of which, a native of the Spanish main, has been supposed by many to afford the medicinal bark, called cascarilla. But Dr. Woodville positively asserts, that this drug is the produce only of cluytia eluteria, and is brought to Europe solely from the Bahama islands. This description and figure are taken from a specimen in the herbarium of Sir Joseph Banks. In the same plate he has figured a branch sent from Jamaica by Dr. Wright, under the name of croton elutheria, which, in his account of medicinal plants of Jamaica, he says, is the same as the cascarilla, or elutheria; but it appears from Dr. Wright's specimens in the herbarium of the president of the Royal Society, that his plant is dioicous and truly a cluytia, differing from that of the Bahama islands in having broader and more obtuse leaves. According to Lewis, the cortex cascarillæ is imported into Europe from the Bahama islands, particularly from that which is called elutheria, in curled pieces, or rolled up into short quills about an inch in width; exhibiting, when broken, a smooth, close, blackish-brown surface. Freed from its outer whitish coat, which is insipid and inodorous, it has a light agreeable smell, and a moderately bitter taste, accompanied with a considerable aromatic warmth. Its virtues are partially extracted by water, and totally by rectified spirit. Distilled with water it yields a greenish essential oil, of a very pungent taste, and of a fragrant penetrating smell, more grateful than that of cascarilla itself. See CASCARILLA. 11. C. *stipularis*, Linn. Mant. 127. Mart. 8. Lam. 7. "Leaves oval, tomentous underneath." *Branches* zigzag, tomentous. *Leaves* rather large, quite entire, on short petioles; stipules egg-shaped, acute, the length of the petioles. *Flowers* dark purple, axillary, sessile, not longer than the stipules; calyx one-leafed, campanulate at the base, with five acute divisions, permanent; petals roundish, very short, alternately with the divisions of the calyx; style columnar, trifid, stamens five, fertile and horizontal. A native of the East Indies. 12. C. *acuminata*, Linn. Supp. 432. Mart. 9. Lam. 10. "Herbaceous; leaves egg-shaped, smooth, obtuse, with a point; flowers axillary, solitary." A native of the Cape of Good Hope. It resembles andrachne telephoides.

Propagation and Culture. C. alaternoides and C. pulchella, are easily propagated by cuttings during any of the summer months. The pots should be plunged into a very moderate hot-bed, till the cuttings have taken root. The plants should afterwards be put separately into small pots, and kept in the open air, in a sheltered situation, till October or later, if the weather prove mild. In winter they require only the shelter of the green-house, without artificial heat; but should occasionally be allowed free air, they will otherwise grow mouldy and perish. C. eluteria may also be propagated by cuttings during the summer, which should be kept in a dry place for a few days before they are planted. It will live through the winter in an airy glass-case, but must be sparingly watered. In summer it requires only to be screened from heavy rain.

CLWYDD, *Vale of*, in *Geography*, a singularly beautiful and fertile vale in North Wales, which extends northward from the termination of the Berwin hills, near Llangollen, by Ruthyn and Denbigh, to the sea beyond St. Asaph. The breadth of this vale is about three miles, and the length near thirty, and through almost the whole of it the two little rivers of the Clwydd and the Elwy run parallel to each other. It is separated by a ridge of mountains from the dreary wastes which encompass it; there is neither mountain nor rock to be seen in any part of it, after you turn your back upon Rudland; the hills on one side of it rise very gradually by gentle ascents: most of them are cultivated quite to their summits, others half-way up; and when the tops are not enclosed, they are a fine grassy down, and shaded and enlivened with wood. This vale abounds with rich enclosures, farm-houses, gentlemen's seats, pleasant villages; and its three towns, Ruthyn, Denbigh, and St. Asaph, stand in fine situations, about the distance of six miles from one another.

CLYDE, a large river in Scotland, inferior only to the Tay. The parent stream originates from Clydeslaw, in the parish of Crawford, one of those stupendous hills that separate the district of Annandale from Lanarkshire, near the sources of the Annan and the Tweed. After passing through, and thus dividing the county of Lanark, almost 55 miles, the Clyde enters the Frith of Clyde opposite to the district of Carval and the island of Bute, in Argyleshire. It is navigable for small craft only as far as Glasgow, and 6 miles below that city at Dalmure-burnfoot, the great canal from the Forth joins the Clyde. See CANAL. Part of Lanarkshire receives the name of Clydesdale, or Stathclyde, from this river, which it renders more fertile than any other portion of Scotland, and extremely romantic, through its numerous cascades. Twenty miles from Clydeslaw, the valley contracts, the banks become steep, and the gradual declinations on each side of the rivers are adorned with many handsome seats, the residences of gentlemen who have highly cultivated their lands, and planted the best descriptions of fruit-trees, which yield abundantly; and their rich meadows are covered with excellent flocks. Bonniton fall, or *linn*, derived from the Gaelic word "leum," *leap*, or *fall*, is so termed from an elegant mansion named Bonniton-house, situated near it; a short and romantic walk on a projecting rock, exhibits the fall of the river over a precipice 12 feet in height, into a hollow den, as Mr. Lockhart expresses it in the statistical account of Scotland, producing a pleasing contrast of foam and mist, with the placid surface above, where the Clyde emerges from beautiful groupes of forest-trees. After this descent, the stream rushes with angry impetuosity over a bed of rocks, bounded on either side with crags resembling ancient walls, from which wild birds fly in rapid succession; half a mile below, is the Corralinn, (derived from an estate and castle on one of the banks). The scenery of this neighbourhood is extremely grand, but the cascade, as viewed from seats placed in various parts of the walks, grouped with tremendous rocks, the castle, a corn-mill on a rock below, and rendered more sublime by the roar of the water rushing into an abyss, is truly astonishing." Sir James Carmichael, of Bonniton, erected a pavilion on the summit of a bank, in 1708, which affords a full view of the linn, and a mirror placed in the uppermost room, exhibits the cataract by reflection, as if it were on the point of overwhelming the spectator. The descent of the Clyde is said to be 84 feet, but there are three inconsiderable breaks in the fall. The mist from this prodigious body of water ascends to a very great height, and a perpetual rainbow glides, during the shining of the sun, from place to place, as the air acts on particles of the fluid. A third linn has obtained the name of Dundaff, or Black-cattle leap, probably from its vicinity to some fortress now forgot, which seems to be corroborated by the tradition, that denominates a rock the patriot Wallace's *chair*, or place of concealment from the English. Trouts frequently leap up this fall, which is about three feet high. New Lanark, a village, and four cotton-mills, are situated near Dundaff linn. Stonybyres linn, receives its name from Stonebyres, an estate in the possession of Daniel Vere, esq. This cataract, which is 80 feet in height, and 2 miles below Corra linn, terminates the progress of the salmon towards the source of the Clyde, but their attempts to ascend it during the spawning season, are incessant; nor is the horse-muscle, or pearl-oyster, though plentiful below the linn, ever found above it. The banks and precipices termed "Cartlane-craigs," are said to be nearly 400 feet higher than its level; and at the bottom flows the Mouss, a remarkable stream, which penetrates the hill of Cartlane, and the solid rock, in preference to a more convenient course on its very borders. The Clyde, having passed Lanark, proceeds to Hamilton and Glasgow, receiving several tributary streams, particularly the Avon, and the north and south Calders; besides which, the Leven enters it at Dumbarton, and the Carl near Renfrew; by these means the Clyde expands to the breadth of 2 miles opposite Newport, Glasgow, but the Channel alone is navigable by vessels of considerable burthen; below Greenock it enters the Frith of Clyde. Mr. Lightfoot, who explored the borders of this beautiful river, discovered some uncommon plants, which he has described in his "Flora Scotica," but the only mineral found in the neighbourhood, is spatum ponderosum, veins of which intersect the rocks. There are several small bridges on the Clyde, and one of magnificent design at Glasgow.

There is a light-house for the benefit of this navigation, on Little Cambray island, opposite to the south end of the Isle of Bute. The tide flows in this river to some distance above Paisley. The Ayr rail-way communicates with this river near the town of Ayr. An act passed 46 Geo. III. for making and maintaining water-works for supplying the town of Glasgow with water from this river. In 1806, 46 Geo. III. an act passed for the Glasgow and Saltcoats canal, to connect with this river at Ardrossan harbour. Mr. Thomas Telford, the engineer, is employed on both these works.

Clyde and Forth *Canal*. See *Forth* and *Clyde* in our article Canal.

CLYDON, from κλυζω, *I cause to fluctuate*; in *Medical Writers*, is used for the fluctuation of food taken into the stomach, arising from the laxity or weakness of its fibres, and of the abdominal muscles.

CLYMANT, a term used by some heralds to express a goat standing on his hind legs.

CLYMENE, in *Fabulous History*, the name of several females, the principal of whom were the following; viz. a daughter of Oceanus and Tethys, and mother, by Iapetus, of Atlas, Prometheus, &c.:—a nereid, and mother, by Jupiter, of Mnemosyne:—daughter of Oceanus, and mother, by Apollo, of Phaeton, &c.:—the mother of Homer, &c.

CLYMENEIDES, an appellation of the sisters of Phaeton, derived from the name of their mother.

CLYMENUM, in *Botany*, hispanicum, siliqua articulata, et siliqua plana, Tourn. See Lathyrus *articulatus*, and Lathyrus *clymenum*.

Clymenum *bithynicum, siliqua singulari*, Boerh. See Vicia *bithynica*.

Clymenus, in *Mythology*, a surname of Pluto.

CLY-MORE, a great two-handed sword, formerly used by the Highlanders. It was double-edged, and about two inches broad, or about one fifth of an inch broader than the ancient Roman gladius. The length of the blade of the cly-more was about 3 feet 7 inches; and that of the handle about 14 inches. It had a plain transverse guard of about a foot; and the weight of it was about six pounds and a half. These swords are supposed by some to have been the original weapons of the English, from the circumstance of the figure of a soldier's being found with one of them among the ruins of London, after the great fire in 1665. Such a sword must have been a very bad and inconvenient weapon, calculated only for giving a falling stroke, and that, too, at some distance, and must have been useless against a large shield; and such a sword as the Roman gladius, which was two-edged and sharp-pointed, peculiarly fitted for stabbing, and not above fifteen inches long in the blade.

CLYNDEE *Collieries*, in Langevelach parish, near Swansea in Glamorganshire, in South Wales, are works, belonging to Lockwood and Co., and famous for the under ground canal, which conducts to them, being a branch from the Swansea canal, in Morristown, about 3 miles above Swansea. This canal proceeds about 1000 yards in a north-west direction into the hill, along a tunnel 8½ feet high and 5 feet wide, for 4-ton boats; from over this canal-tunnel, a branch of under-ground rail-road, of half a mile long, proceeds along the Clyndee vein of coals, with numerous shorter branches of rail-road, to the present workings of coals. The communication between the canal and rail-road is made, by means of a perpendicular pit or shaft about 20 fathoms deep, through which the coals are let down in baskets of about 7 cwt. each, to be tipped or emptied into the boats below. The mode in which the descent of these baskets is regulated, is curious and singular: the rope, which connects the descending full basket and the ascending empty basket, winds over a horizontal roller, which connects by means of a toothed wheel with the upright shaft of a regulator, consisting of boards or arms which lave in the water of a round cistern or well, about 8 feet diameter, provided and constantly supplied with water to the requisite height, by means of pipes and cocks which bring in or let out water, whenever the coal-baskets are intended to descend slower or faster. This simple and effectual mode of regulating, or rather of destroying, power in machinery, was contrived by Mr. William Robert, a carpenter in the employ of Lockwood and Co. and was erected in the year 1793; notwithstanding

ſtanding which, Mr. Anthony George Echardt, in a patent dated 31ſt of January 1795, included this as his invention, and propoſes to apply it for regulating mills, to be worked by men, walking on the outſide or top, nearly of large cylindrical wheels.

CLYOQUOT, in *Geography*, a ſound or bay on the N.W. coaſt of America, weſterly from Berkley's ſound.

CLYPEA, or CLUPEA, a town of Africa, in the preſent kingdom of Tunis, the *Aſpis* of the Grecians, is built upon a ſmall promontory, the Taphitis of Strabo, which being in the figure of a ſhield or hemiſphere gave occaſion to the name. It is five leagues S.E. from the promontory of Mercury or Cape Bon. It is called by Livy, Mela, and Pliny, *Clupea*; by Polybius, Appian, and Agathemerus, *Aſpis*; but by Solinus and the Itinerary, *Clypea*. According to Silius Italicus and Solinus, it was built by the Sicilians; and they add, that its founders called it Aſpis. Strabo repreſents Clupea and Aſpis as one city; but Ptolemy erroneouſly diſtinguiſhes them, and places the cape of Mercurii promontorium between them. This was the firſt place which the Romans took in Africa, in the firſt Punic war. It was formerly an epiſcopal ſee. Nothing now remains of this ancient city, for the caſtle is a modern ſtructure: and what they now call *Clybea* is a collection of miſerable huts or cottages, about the diſtance of a mile from the ſpot where the old city ſtood.

CLYPEARIA, in *Botany*, alba; Rumph. Burm. See ADENANTHERA *falcata*.

CLYPEOLA, (diminutive of Clypeus, a ſhield, ſo called from the ſhape of the ſilicle.) Linn. gen. 807. Schreb. 1082. Willd. 1231. Gært. 819. Juſſ. 240. Vent. 3. 107. (Jonthlaſpi; Tourn. 99.) Claſs and order, *tetradynamia ſiliculoſa*. Nat. Ord. *Siliquoſæ*, Linn.

Gen. Ch. *Cal.* Perianth four-leaved; leaves ovate-oblong, permanent; Linn. (caducous; Lam.) *Cor.* Petals four, oblong, entire. *Stam.* Filaments ſix, ſhorter than the corolla; anthers ſimple. *Piſt.* Germ roundiſh, compreſſed; ſtyle ſimple, ſtigma obtuſe. *Peric.* orbicular, flat, compreſſed, very ſlightly emarginate, erect, deciduous, two-valved. *Seeds* orbicular, ſolitary.

Eſſ. Ch. Silicle emarginate, orbicular, compreſſed, flat, deciduous.

Sp. 1. C. *jonthlaſpi*, Linn. Sp. Pl. 1. Mart. 1. Lam. 1. Willd. 1. Gært. tab. 141. Lam. Ill. tab. 560. fig. 1. (Thlaſp. clypeatum, ſerpylli folio; Bauh. Pin. 107.—Jonthlaſpi: Col. Ecphr. 1. p. 281. tab. 284. Tourn. 210.) Annual treacle muſtard, or buckler muſtard. "Annual; ſilicles orbicular, one-celled, one-ſeeded." *Stems* about five or ſix inches high, ſlender, weak, almoſt ſimple, cloathed with ſhort whitiſh hairs. *Leaves* linear-ſpatula-ſhaped, ſmall, alternate, ſeſſile, glaucous, with minute ſtars of hairs on the ſurface. *Flowers* yellow, ſmall, the ſize of the calyx; in a ſmall terminal ſpike. *Silicle* pubeſcent, ſurrounded by a paler and finely ciliated edge, not opening ſpontaneouſly, but eaſily diviſible into two very thin membranous valves. *Receptacle* none, except a capillary umbilical cord, ſpringing from the margin of one valve, and extending to the centre of the cell. *Seed* elliptic, compreſſed, ſmooth, of a tawny colour. Gært. A native of the ſouth of France, Spain, and Italy. Villars doubts whether it be different from alyſſum minimum of Linnæus. Its filaments have a tooth above the baſe, as in moſt of the alyſſums. Willdenow has made this appendage, the leading eſſential character of that genus, but has, notwithſtanding, admitted maritimum and ſome other ſpecies, which he himſelf acknowledges to have perfectly ſimple filaments. 2. C. *tomentoſa*, Linn. Mant. 92. Mart. 2. (Alyſſum orientale. Ard. Spec. 2. p. 32. tab. 15. fig. 1. Lam. 9. Willd. 11.) Hoary treacle muſtard. "Perennial; ſiliques orbicular, two-celled; one ſeed in each cell." *Root* woody, branched ſtems ſhrubby, diffuſe; leaves hirſutely hoary; lower ones three inches long, half an inch broad, ovate-oblong, ſinuated; ſtem ones alternate, ſeſſile, linear-lanceolate, entire, or finely toothed. *Flowers* yellow, longer than the calyx, terminal and axillary, at firſt in a kind of umbel, but afterwards panicled. *Silicles* inverſely heart-ſhaped, alternate, peduncled. Firſt obſerved in the Levant by Tournefort; cultivated at Venice in 1755 by Arduini, from ſeeds ſent by Leonard Seller. 3. C. *maritima*, Linn. Sp. 2. Mart. 3. (Alyſſum maritimum; Lam. 8. Willd. 2. A. halimifolium; Hort. Kew. 2. 381; Bot. Mag. 101. Thlaſpi; alyſſon dictum maritimum; Bauh. Pin. 107.) Sea treacle muſtard or clowns muſtard. "Perennial; ſilicles two-celled, egg-ſhaped; one ſeed in each cell." *Stems* ſhrubby, much branched, diffuſe, evergreen. *Leaves* linear-lanceolate, quite entire. *Flowers* white, darker in the middle, reſembling thoſe of water-creſſes, with an agreeable honey-like ſmell, calyx deciduous; petals inverſely egg-ſhaped; filaments dark purple, toothleſs; anthers yellow. A native of the coaſt of the Mediterranean. In England, where it is uſually ſown in the rich borders of the garden, it grows ſo luxuriantly, that the ſtems, becoming juicy and tender, are generally deſtroyed by our froſts. It thus becomes an annual from peculiarity of circumſtance. Tournefort, Arduini, La Marck, Gærtner, Juſſieu, Ventenat, and Willdenow, all agree in referring the laſt two ſpecies to alyſſum, on account of their two-celled ſilicle, which Gærtner makes an eſſential character of alyſſum; a circumſtance which we cannot but think fully ſufficient to conſtitute a generic diſtinction; but as they have not been taken up in our firſt volume, we found it neceſſary to introduce them here.

CLYPEOLA *alliacea*, Arduin. Lam. See PELTARIA *alliacea*.

CLYPEOLA *alyſſoides*, Crantz. See ALYSSUM *calycinum*.

CLYPEOLA *annua ſiliculis bilocularibus diſpermis*, Sauv. See ALYSSUM *campeſtre*.

CLYPEOLA *didyma*, Crantz. See BISCUTELLA *lævigata*.

CLYPEOLA *montana*, Crantz. See ALYSSUM *montanum*.

CLYPEOLA *ſiliculis bilocularibus tetraſpermis*, Hort. Clif. See ALYSSUM *calycinum*.

CLYPEUS, or CLYPEUM, *Buckler*; a piece of defenſive armour, which the ancients uſed to carry upon the arm, to ſecure them from the blows of their enemies.

The figure of it was either round, oval, or ſexangular: in the middle was a boſs of iron, or of ſome other metal, with a ſharp point. See SHIELD.

CLYSMA, in *Ancient Geography*, a town and fortreſs of Egypt, ſituated at the bottom of the gulph of Heroopolis, according to Ptolemy, who, as well as the table of Peutinger, diſtinguiſhes this town from Arſinoe. Euſebius ſays expreſsly, that at Clyſma the Iſraelites paſſed the Red Sea. F. Calmet ſays, that this place, in modern times, is called *Colſum*.

CLYSSUS, a term uſed by the old writers in *Chemiſtry* and *Alchemy*, is defined, by Macquer, to be the vapours that ariſe from the detonation of nitre with any inflammable ſubſtance, &c. The clyſſus of nitre is the vapours from nitre and charcoal; the clyſſus of ſulphur, thoſe from ſulphur and nitre, &c. The term is now obſolete.

CLYSTER, or GLYSTER, in *Medicine*, Enema. A clyſter is a liquid medicine applied by injection up the rectum, and is a very ancient, and, in many caſes, a very important form of medicine, though leſs frequently employed in this than

than in many other countries, where medicine is practifed as a fcience.

Clyfters are applied either by a large fyringe which holds from one to two or more pints of liquid; or, in private practice, generally by means of a fmall ivory pipe faftened to, and opening into the middle of, a hog's bladder. To ufe it, firft ftop, with a fmall cork, the end of the pipe which opens into the bladder, then pour into the bladder the liquid intended to be thrown up, and tie it tight that none may fpill out. Then lay the patient on his belly, and introduce the pipe (previoufly oiled) for an inch or two into the rectum, draw out the cork, which may be eafily done through the folds of the bladder, and, by preffing gradually on the bladder, all the liquid will readily pafs up into the rectum. A perfon may readily perform this office for himfelf when ufed to it. The direction in which the pipe is to be introduced is parallel to the facrum, being that of the courfe of the lower part of the rectum to the anus.

Clyfters are ufed for feveral purpofes. Moft commonly they are purgative, and moft of the liquid cathartics taken by the mouth are alfo ferviceable as clyfters, obferving that confiderably larger dofes may be fafely ufed by injection. A pint of decoction of chamomile flowers with Glauber's falt, or thin gruel and falt, electuary of fenna and milk, or caftor oil made into an emulfion with egg, are very ufeful mild cathartics, which may be employed in this way, and many others might be enumerated. It is of advantage to employ fome emollient fubftance, combined with the purgative, to defend the inteftine in fome meafure againft the acrimony of the medicine. Thus, if the electuary of fenna is ufed, it may be conveniently rubbed up with a little oil, and the whole will then mix uniformly with milk or any other liquid.

When clyfters are employed as purgatives, it muft be remembered that they cannot pafs higher up than the valve of the colon, and confequently that they can only act directly upon the large inteftines. Therefore, they can feldom entirely fupply the place of purgatives by the mouth, which pafs through and excite the whole inteftinal canal; but they prove moft ufeful auxiliaries, particularly in thofe cafes of inteftinal diforder that are attended with much vomiting and irritability, where, befides emptying the lower bowels, they act as topical fomentations, and very often induce eafe and fleep when other methods fail. In fuch cafes, therefore, they fhould be in pretty large quantity, not very ftimulating, and as warm as the patient can bear them.

Glyfters are alfo of fingular fervice in checking that extreme and painful irritation of the rectum, that attends long continued diarrhœa and dyfentery. In thefe diforders the great fuffering of the patient is the inceffant tenefmus, and difcharge of bloody mucus from the inteftine, with extreme pain and irritation. This is often wonderfully relieved by a glyfter made of thin ftarch, or linfeed tea, or any other mild mucilage, mixed with a few drops of laudanum. The quantity of liquid injected in this cafe fhould be but fmall, that it may not ftimulate the inteftine merely by its bulk, but the dofe of any opiate, given by glyfter, may in general be three or four times the quantity which, under fimilar circumftances of age, conftitution, &c., would be given by the mouth.

We may mention a few other fpecific purpofes for which glyfters have been employed with advantage.

As vermifuges they have a peculiar and local ufe, where the worms are lodged in the lower inteftines, particularly as very highly ftimulating medicines are often required to diflodge thefe troublefome animals, which, if given by the mouth, might produce a good deal of inconvenience and irritation.

Tobacco infufion is given by way of glyfter in ftrangulated hernia, to bring on that extreme ftate of faintnefs and relaxation which is moft favourable to the reduction of the hernia.

In uterine or inteftinal hæmorrhage, reftringent clyfters, and particularly iced water, are fometimes of powerful ufe in checking thefe alarming accidents.

Afafœtida infufion, and other antifpafmodics, were formerly often injected in hyfteria, and other complaints for which this clafs of remedies is employed, but this is little ufed at prefent.

Turpentine mixed with a watery liquid, by the intermede of egg, is often given by clyfter, and in this way it powerfully acts both on the bowels and kidnies, giving that peculiar fmell to the urine which attends the internal ufe of this remedy.

Laftly, nutritive fubftances are fometimes given in this way, when, from conftriction or wounds in the œfophagus, nothing can be taken into the ftomach. This is, doubtlefs, a very imperfect method of fupplying the wants of nature, as comparatively only a fmall quantity of the abforbents open into the lower inteftines, but cafes have occurred in which life has been fupported by this means for many days. The fubftances to be injected in thefe cafes, are any of the animal or vegetable liquids and infufions which are known to afford the moft nutriment, fuch as ftrong broths, milk, jellies, and the like.

CLYSTRUS, in *Ancient Geography*, a town of Afia, fituated near the fea, in a diftrict of mountainous Cilicia, according to Ptolemy.

CLYTÆ, a people of Macedonia, who furnifhed excellent nitre. Pliny.

CLYTEMNESTRA, in *Fabulous Hiftory*, the daughter of Jupiter, or of Tyndarus, king of Sparta, by Leda, and wife of Agamemnon. While this prince was at the fiege of Troy, fhe had an intrigue with Ægifthus, whom fhe engaged to murder Agamemnon on his return. His fon Oreftes, however, avenged the death of his father, by killing Ægifthus, together with his mother Clytemneftra. See AGAMEMNON and ORESTES.

CLYTHENESS, in *Geography*, a cape of Scotland, in the German Ocean, on the fouth-eaft coaft of the county of Caithnefs. N. lat. 58° 14'. E. long. 0° 10'.

CLYTIA, or CLYTIE, in *Fabulous Hiftory*, daughter of Oceanus and Tethys, was beloved by Apollo; but afterwards deferted by him, in confequence of an amour with Leucothoe, her fifter. Clytia difcovered the fecret to her rival's father; and on this account Apollo treated her with contempt and abandoned her; fo that fhe languifhed, and, by continually gazing on the fun, was changed into a funflower, which ftill turns towards the fun, in token of her love.

CLYTIUS, one of the giants flain in the war againft Jupiter, by Hecate; or, according to Apollodorus, by Vulcan.

CLYTORIS, a beautiful virgin of Theffaly, deflowered by Jupiter, who, for this purpofe, affumed the form of an ant.

CLYTUS, one of the Centaurs.

CNACADION, in *Ancient Geography*, the name given by Paufanias to one of the three mountains, between which was fituated the town of Las. This mountain was in Laconia.

CNACALON, or CNACALUS, a mountain of the Peloponnefus, in Arcadia. Diana had a temple on this mountain, and was worfhipped in it under the appellation of "Cnacalefia." Paufanias.

[illegible]USON, a town of the Peloponnefus, in Arcadia, [illegible] according to Paufanias (l. viii. c. 27.), was one of the colonies founded under the aufpices of Epaminondas.

C[illegible]CLEUS, fuppofed to be the *Cnacion* of Plutarch, a river of the Peloponnefus, in Laconia.

CNEMIS, a town of Greece, upon the fea-coaft in the Locride, according to Pliny. It is called *Cnemides* by Mela, Ptolemy, and Strabo; the latter of whom fays, that it was a fortified place, and fituated oppofite to the promontory C[illegible], in the ifle of Eubœa.—Alfo, a mountain of the Lo[illegible], oppofite to the fame ifland, from which the Locrii Epicnemides, who inhabited its vicinity, derived their appellations.

CNEMODACTYLÆUS, in *Anatomy*, a mufcle, otherwife called EXTENSOR *tertii internodii digitorum*.

CNEORUM, in *Botany*, (Κνεωρον; Hippoc. Theophraft. Cneorum; Plin. Derivation unknown.) Linn. Gen. 48. Schreb. 65. Willd. 81. Juff. 369. Vent 3. 443. (Chamælea; Tourn. 421. Gært. 441. Cameleé; Encyc.) Clafs and order, *triandria monogynia*. Nat. Ord. *Tricoccæ*, Linn. *Terebintaceæ*, Juff. Vent.

Gen. Ch. *Cal.* very fmall, three-toothed, permanent. *Cor.* Petals three, oblong, erect, three times the fize of the calyx, equal, deciduous. *Stam.* Filaments three, awl-fhaped, fhorter than the corolla; anthers fmall. *Pift.* Germ. fuperior, obtufe, triangular; ftyle erect, the length of the ftamens; ftigma trifid, fpreading. *Peric.* Berry dry, hard, globularly three-lobed, tricoccous; cocci two-celled, two-feeded, (three-berried drupe; Gært.) *Seeds* folitary, con[illegible].

Eff. Ch. Calyx three-toothed. Petals three, equal. Berry dry, tricoccous.

Sp. C. *tricoccum*, Linn. Sp. Pl. Mart. Lam. Willd. Gært. tab. 70. Lam. Ill. tab. 27. (Chamælea tricoccos; Bauh. Pin. 462. Cam. Epit. 973.) Widow wail, or fpurge olive. A fmall ever-green fhrub, about two feet and a half high; branches compact, well garnifhed with leaves, cylindrical, fmooth, greenifh. *Leaves* alternate, feffile, elongated, entire, narrowed at the bafe, a little enlarged towards the fummit, fmooth, rather thick, with a ftrong vein or rib along the middle. *Flowers* pale yellow, fmall, axillary, on fhort peduncles, often folitary, fometimes two or three together. Lam. *Fruit* tricoccous, or confifting of three fmall-berried drupes, gibbous on one fide, angular on the other, joined at a common axis, dark brown when ripe; flefh thin, green; fhell bony, thick, nearly globular, wrinkled, marked on the inner fide with a furrow and umbilical hole, two-celled, without valves; one of the cells placed behind the other, both of them at the feat of the radicle, divided by a very flender partition, fo that the upper part of the fhell appears four-celled. *Receptacle common* filiform, terminated by the ftyle; *proper* confifting of fmall umbilical cords reaching from the axis of the fruit to the feeds. *Seeds* one in each cell, very fmall, egg-fhaped, doubled together like a worm, white, with a brown caruncle at the infertion of the umbilicus. Gært. A native of the fouth of Europe in dry, rocky foils. CNEORUM. See CONVOLVULUS, and DAPHNE.

Propagation and Culture. This ornamental little fhrub is hardy enough to bear the cold of our winters, provided it be not rendered too luxuriant by being planted in a very rich foil. Its feeds fhould be fown in autumn, foon after they are ripe, in a bed of common earth, and covered half an inch deep. In the autumn following the plants may be removed where they are to remain. They flower in March, and produce a frefh fucceffion through the whole of the fummer. The leaves and fruit are acrid, cauftic, and violently purgative.

CNEPH, in *Mythology*, denoting *good*, by way of eminence, an appellation under which the ancient Egyptians, particularly in the vicinity of Thebes, honoured the beneficence of the Creator, as they adored his power under the name of *Phtha*, and his wifdom under that of *Neith*. "The priefts of Egypt," fays Eufebius, (Evang. Præp. l. 3.) "call Cneph the architect of the univerfe." Strabo mentions his temple, built in the ifle of Elephantis. The fymbol of this god, or attribute of the divinity, was a ferpent, called by the Phœnicians the "Good Genius." To this purpofe Eufebius obferves, that "the ferpent in the middle of a circle, which it touches in the two oppofite points of its circumference, indicates the Good Genius." For this object they chofe a particular fort of ferpent, of which Herodotus (l. ii.) gives the following defcription. "There are found, in the environs of Thebes, facred ferpents which are not venomous. They have two horns on the top of the head. When they die, they are buried in the temple of Jupiter. The name of Cneph, or Good Genius, was beftowed on them, as well as on the divinity they reprefented; and the veneration of the people extended no farther than to the image. The temple of Cneph may be regarded as the moft ancient in the country; and its exiftence has been alleged, in connection with thofe of Phtha and Neith, as an evidence that among the Egyptians the worfhip of the Creator, which was one of the dogmas of their religion, preceded every other. Cneph was fometimes reprefented in the fhape of a man of a dark-blue complexion, holding a girdle and a fceptre, with a royal plume on his head, and thrufting forth an egg out of his mouth, whence another God proceeded whom they named Phtha, denominated by the Greeks Vulcan. Thefe hieroglyphics have been thus explained; the intelligent being denoted by them is hidden and invifible, the giver of life, and the univerfal fovereign; and his being moved in an intellectual fpiritual manner, is fignified by the feathers on his head, and the egg, proceeding from his mouth, is interpreted to be the world.

CNESTIS, in *Botany*, (Κνηστις, Gr. from Κναω, or Κνεω, fcalpo; fo called on account of the prickly capfules which wound the fkin when rubbed againft them.) Willd. 911. Juff. 374. Vent. 3. 452. (Gratelier; Lam. Encyc.) Clafs and order, *decandria pentagynia*. Nat. Ord. *Terebintaceæ*, Juff. Vent.

Gen. Ch. *Cal.* deeply five-cleft; fegments oval or oblong, villous on the outfide, coloured within, caducous. *Cor.* Petals five, inferted into the receptacle, fometimes fhorter, fometimes longer than the calyx, alternating with its divifions. *Stam.* Filaments ten, attached to the receptacle, a little longer than the petals; anthers round, didymous. *Pift.* Germs five, fuperior, egg-fhaped, very villous; ftyle fhort; ftigma truncated, obfcurely two-lobed. *Peric.* Capfules five, diftinct, one or more frequently abortive, narrowed towards the bafe, villous, one-valved, opening longitudinally on one fide like thofe of fterculia or apocynum, a little curved. *Seeds* one in each capfule.

Eff. Ch. Calyx five-cleft. Petals five. Capfules five, one feeded.

Sp. 1. C. *glabra*, Lam. Encyc. 1. Ill. Pl. 387. Willd. 1. "Leaflets egg-fhaped, petioled, fmooth on both fides; racemes fafcicled, fhort, flender." A tree. *Leaves* fcattered; fituated near the ends of the branches, pinnated with an odd one. Common petioles from five to feven inches long, cylindrical, fmooth; leaflets from nine to fifteen, two inches long or more, entire, coriaceous, on very fhort petioles;

Flowers red or purple, small; racemes numerous, scarcely two inches long, cottony, lateral and terminal, corollas open, scarcely longer than the calyx. *Capsules* club-shaped, curved, six or seven lines long, russet, covered with an abundant prickly pubescence, which wounds the skin. A native of the isles of France and Bourbon. 2. C. *polyphylla.* Lam. 2. Willd. 2. "Leaflets ovate-oblong, somewhat villous, on very short petioles; racemes tomentous; capsules very obtuse." A tree, with the habit of the preceding. *Branches* somewhat cottony towards the summit. *Leaflets* about seventeen, sometimes slightly acuminate, nearly smooth above, nerved, and a little villous underneath. *Flowers* rather larger than those of the preceding species; racemes three inches long or more, a little fascicled, cottony, axillary, and terminal; petals narrowish, longer than the calyx. *Capsules* resembling those of the preceding, but quite obtuse. A native of Madagascar. 3. C. *corniculata*, Lam. 3. Mart. 3. (Spondioides pruriens; Smeathman, Herb.) "Leaflets oblong-acuminate; middle nerve villous; capsules oblong, acute, horn-shaped, tomentous, prurient." *Branches* woody, cylindrical, brown, slightly pubescent near the summit. *Leaves* more distant than in the preceding; leaflets about nine, an inch and a half long, entire. *Capsules* four or five, near an inch and a half long. Discovered by Smeathman, at Sierra-Leona. 4. C. *trifolia*, Lam. 4. Willd. 4. (Spondioides villosa; Smeathman, Herb.) "Leaves ternate; leaflets egg-shaped, acuminate, even-surfaced above, panicle terminal." *Branches* woody, cylindrical, cottony. *Leaves* alternate, sometimes almost opposite; petioles three inches long, cylindrical, cottony, leaflets entire, nerved and reticularly veined underneath, slightly tomentous; stipules small, setaceous or filiform. *Flowers* in a loose terminal panicle; peduncles cottony; bractes small, filiform. *Capsules* club-shaped, half an inch long, rather acute at their summit, curved, cottony. Found in Africa by Smeathman.

CNICUS, *erisithales, ferox, spinosissimus, centauroides, uniflorus, cernuus.* Linn. See CARDUUS, n. 70. 86, 87. 92, 93. 95. —— *acarn.* Linn. See CARTHAMUS *canescens.* —— *oleraceus, pygmæus*, Linn. See SERRATULA.

CNICUS *aculeatus purpureus humilior*, Tourn. See ATRACTYLIS *humilis.*

CNICUS *sylvestris spinosior*, Bauh. Pin. See CARLINA *vulgaris.*

CNICUS *cæruleus asperior*, Bauh. Pin. See CARTHAMUS *cæruleus.*

CNICUS —— *humius montis lupi*, Herm. See CARTHAMUS *carduncellus.*

CNICUS *creticus, atractylidis folio et facie*, Tourn. See CARTHAMUS *creticus.*

CNICUS *dentatus*, Forsk. See CARTHAMUS *dentatus.*

CNICUS *hispanicus arborescens, fœtidissimus*, Tourn. See CARTHAMUS *arborescens.*

CNICUS *sativus, sive officinarum*, Bauh. Pin. —— *vulgaris*, Clus. See CARTHAMUS *tinctorius.*

CNICUS *caule diffuso, foliis dentato-sinuatus*, Hort. Cliff. See CENTAUREA *benedicta.*

CNIDINIUM, in *Ancient Geography*, a strong place of Asia Minor, in Ionia, placed by Diodorus Siculus in the vicinity of the town of Ephesus.

CNIDUS, a town of Asia Minor, in Caria, in the province called Doris, at the extremity of a promontory, anciently denominated Triopium, now Cape Crio, having on the north the Ceramic, or Ceraunian bay, and on the south the Rhodian sea. This ancient city was much celebrated. Venus, its tutelary deity, was worshipped in this place; and hence she has been called the Cnidian Venus. Her statue, which was reckoned one of the most beautiful productions of Praxiteles, was placed here in a temple, which was open on all sides, so that the statue might be every where seen; and in whatever point of view it was examined, it excited equal admiration. No drapery veiled its charms; and its beauty was so singular and extraordinary, that it inflamed with a violent passion another Pygmalion, who, in the dark, endeavoured to animate a cold and insensible representation of a most fascinating woman, and there left traces of a mad profanation. (Pliny, H. N. l. xxxvi. c. 5.) Nicomedes, king of Bithynia, offered to pay the debts of this city, which were immense, in order to obtain this master-piece of art; but the Cnidians could not be prevailed upon to part with it. Pliny, who relates the fact, praises them for their refusal to surrender an object which immortalized their city, as well as their passion for the fine arts. In this place were other statues, which, destitute of the perfection and seducing graces of the Venus of Praxiteles, contributed no less to the public glory and prosperity, by the crowd of strangers who came hither to admire them. Heaps of ruins at this day occupy the place of one of the most splendid cities of ancient Greece; and the curious are prohibited from digging among them, in order to discover fragments of its ancient splendour. Independently of a taste for the arts, the Cnidians had also a genius for great enterprises. They had resolved to cut through the base of the large promontory which formed their domain, and to convert their peninsula into an island. Thus, their small craft would have avoided the long circuit of Cape Triopium, as well as the dangers of the tempestuous sea which breaks upon it; and their country, more insulated, would have been less exposed to attacks and surprises from the enemy. But an oracle suspended labours which were likely to conduce to the safety and prosperity of the state. It was found that the meaning of the two hexameter verses, pronounced by the Pythian at Delphi, signified that the inhabitants of Cnidus were to leave their isthmus such as it was; because, if Jupiter had willed it to be an island, he would have saved them the trouble of making it so; an absurd answer, calculated only to divert from the execution of grand projects, and worthy of personages who, on mysterious tripods, and in an obscure language, boasted of being the interpreters of the gods. The shores of Cnidus furnish now, as in former times, a great abundance of fishes, justifying the appellation of "Piscosam Cnidon," given it by Ovid. The wines of Cnidus were anciently very famous. Theophrastus (l. vii. c. 4.) speaks of Cnidian onions as of a particular species; they were very mild, and did not occasion tears.

CNIZOMENÆ, a people of Asia, placed by Diodorus Siculus in the vicinity of the Arabian gulf.

CNOPITZ, in *Geography*, a river of Carinthia, which runs into the Drave, about 6 miles S. W. of Saxenburg.

CNOSSUS, in *Ancient Geography*, a town situated on the northern coast of the island of Crete, towards the east, and at a small distance from the sea. According to Strabo (l. x.) it was formerly called Cœratus, or Ceretos, from the name of the river which watered it. This was famous for the residence and court of Minos, and as the abode of the most wealthy, as well as the most powerful and warlike, people of the whole island. Strabo says, that in extent it was 30 stadia. A small village, Cnossou, would serve to point out the scite of the ancient town, if it were not discoverable in the rubbish which covers it, and a great part of which has supplied materials for the building of modern Candia. The port of Cnossus was denominated Heraclæum.

CNOTHONDORF, in *Geography*, a town of Hungary, 18 miles W. of Tokay.

CNUPHIS, or CHNUMIS, in *Ancient Geography*, a city of Egypt, S. of Thebes, and on the fame fide of the river, fo called from a god of that name, worfhipped by the inhabitants. See CNEPH.

CO, a town of Egypt, and the capital of the Cynopolite nome.

COA, in *Botany*, *fcandens*, *fructu trigemino*, Plum. See HIPPOCRATEA *volubilis*.

COA, in *Ancient Geography*, a town of Arabia Felix, near the fea, and almoft oppofite to the ifland of Diofcorides, according to Ptolemy. It is mentioned in the books of Chronicles and Kings, on occafion of the horfes with which Solomon was fupplied by it.—Alfo, a river of Afia, which had its fource, according to Ptolemy, in Mount Imaus, and joining the river Suafte, difcharged itfelf into the Indus.

COA, in *Geography*, a river of Portugal, which runs into the Duero: 12 miles S. of St. Joanno de Pefqueira.

COACERVATUM VACUUM. See VACUUM.

COACH, a vehicle for commodious travelling, fufpended on leathers, and moved on wheels.

In England, and throughout Europe, the coaches are drawn by horfes, except in Spain, where they ufe mules. In a part of the Eaft, efpecially the dominions of the great Mogul, their coaches are drawn by oxen. In Denmark they fometimes yoke rein-deer in their coaches; though this is rather for curiofity than ufe.

The coachman is ordinarily placed on a feat raifed before the body of the coach. But the Spanifh policy has difplaced him in that country by a royal ordonnance; on occafion of the duke d'Olivares, who found that a very important fecret, whereon he had conferred in his coach, had been overheard, and revealed by his coachman; fince that time the place of the Spanifh coachman is the fame with that of the French ftage-coachman, and our poftillion, *viz.* on the firft horfe on the left.

If we derive the origin of the modern word *coach*, or *coche*, from *caroche*, or *caroffe*, and thefe from *caroccio*, we find that this term was known in the 14th century, and was probably invented not merely to defignate a military machine fo called, but was adopted from one already in ufe, fignifying a larger kind of car or waggon. Muratori, in his "Differtation on the Military Syftem of the rude ages in Italy," (vol. i. p. 360.) obferves, that the inventor of the caroche, introduced after the year 1000, was Eribert, archbifhop of Milan, in the 11th century, who directed that a ftandard of the following kind fhould precede his men as they marched to battle. A tall beam, like the maft of a fhip, fixed in a ftrong waggon, is raifed on high, bearing on the top a golden ball, with two very white ftreamers depending from it. In the middle, the holy crofs, painted with the image of our Saviour, with its arms widely fpread, overlooked the furrounding troops, fo that, whatever fhould be the event of the combat, they might be comforted with this fign. This is the undoubted origin of the military caroche, in imitation of which other more powerful cities afterwards formed them with a little variation, in order to ferve the purpofes of war. The caroche was ufed not only by the Milanefe, but alfo by the Bolognefe, Paduans, Veronefe, Brefcians, Cremonefe, Placentines, Parmefans, &c.; and it appears, that in the 13th century the ufe of the caroche was regarded as fingularly honourable, and of great avail in conquering the enemy. To lofe it was accounted an irreparable difgrace, as it was the higheft glory to take that of the adverfary. From Italy the ufe of thefe caroches paffed into Germany, Flanders, Hungary, and other countries, as Du Cange has remarked; but in the 14th century, when another mode of fighting was introduced, and they were found to be rather an incumbrance than an advantage, they ceafed to be employed. But to return from this digreffion to the hiftory of coaches, more properly fo called.

Some have thought, from the etymology of the word *coach*, to determine the country in which it was invented. But it would be much more eafy to afcertain the origin of the term, if we did but know by whom clofe-carriages were invented. Menage makes it Latin, and by a far-fetched derivation, traces it from "vehiculum." Junius derives it from οχεω, to carry. Wachter feeks its origin in the German word "kutten," to cover; and Lye in the Belgic "koetfen," to lie along, as it properly fignifies a couch or chair. The Italian derivation has been already mentioned. Others endeavour to prove, that the word *coach* is of Hungarian extraction, and that it had its rife from a village in the province of Weifelburg, which is at prefent called "kitfee," but was formerly known by the name of "kotfee," or "cotzi," and that this travelling machine was even there firft invented. However this be, it is certain that in the 16th century, or even at an earlier period, a kind of covered carriages was known, under the name of Hungarian carriages.

Beckmann, in his "Hiftory of Inventions" (vol. i. p. 111, &c.) has taken confiderable pains to prove, that covered carriages, under different forms and denominations, were ufed among the principal nations of antiquity. Accordingly, he fays, that the *arcera*, mentioned in the 12 tables, was a covered carriage, ufed by fick and infirm perfons. This was employed at an earlier period than the foft *lectica*, and difufed after this was introduced. A later invention was the *carpentum* (which fee); and at a ftill later period were introduced the *carrucæ*, concerning which fo little is known, that antiquaries are not certain, whether they had only one wheel, like our wheel-barrows, or, as is more probable, four wheels. (See CARRUCA.) In procefs of time covered carriages became more generally appendages of Roman pomp and luxury; but at length the fpirit of the feudal fyftem for fome time banifhed the ufe of them. The feudal lords, conceiving it to be of the greateft importance that their military vaffals fhould ferve them on horfe-back, were averfe from indulging them with elegant carriages, the prevalence of which would render them indolent, and unfit them for military fervice. Accordingly perfons of every rank, males and females, clergy and laity, rode upon horfes or mules, and fometimes upon fhe-affes. The minifter rode to court, the magiftrates of the imperial cities to council, even in the beginning of the 16th century, and great lords made their public entry on the moft folemn occafions on horfe-back. In the accounts of the papal ceremonies that occur, we find no mention of a ftate-coach, or body-coachman, but merely of ftate-horfes, or ftate-mules.

It was neceffary that a horfe for his holinefs fhould be of a grey colour, not mettlefome, but a quiet tractable nag; that a ftool with three fteps fhould be brought in order to affift him in mounting; and the emperor and kings, if prefent, held his ftirrup, and led his horfe, &c. Bifhops alfo made their public entrance on horfes or affes richly decorated. At the coronation of the emperor, the electors and principal officers of the empire were ordered to make their entrance on horfes, and to perform their fervice on horfeback. Moreover, it was formerly neceffary, that thofe who received an inveftiture fhould make their appearance on horfeback: the vaffal was obliged to ride with two attendants to his lord's court, where, having difmounted from his horfe, he received his fief. Covered carriages, however, were known in the principal ftates of Europe, in the 15th and 16th centuries; but they were at firft ufed by women of rank, and the men thought it difgraceful to ride in them. At this period, when

when the electors and princes did not chuse to be present at the meetings of the states, they excused themselves by informing the emperor that their health would not permit them to ride on horseback; and it was considered as unbecoming for them to ride like women. In the year 1544, when count Wolf of Barby was summoned by John Frederic, elector of Saxony, to go to Spires, to attend the convention of the states assembled there, he requested leave, on account of his ill state of health, to make use of a close carriage with four horses. The use of covered carriages was for a long time forbidden even to women. In the year 1545, the wife of a certain duke obtained from him, with great difficulty, permission to use a covered carriage in a journey to the baths, with this express stipulation, that her attendants should not have the same indulgence. It is nevertheless certain, that the emperors, kings, and princes, about the end of the 15th century, began to employ covered carriages on journies, and afterwards on public solemnities. Indeed, in the account of Don Ambrose Travasari's embassy, in 1433, we are informed that he made his entry into Mantua in a coach, *(un nobil cocchio tirato du spiritosi destrieri.)* In 1474, the emperor, Frederic III, visited Frankfort in a close carriage; and in the following year he came into the same city in a very magnificent covered carriage. In the description of the splendid tournament held by Joachim, elector of Brandenburg, at Ruppin in 1509, the electress appeared in a carriage all over gilt, accompanied by twelve other coaches, ornamented with crimson, and another of the duchess of Mecklenburg, which was hung with red satin. At the coronation of the emperor Maximilian, in 1562, the elector of Cologne had twelve carriages; and in 1594, when the margrave John Sigismund did homage at Warsaw, on account of Prussia, he had in his train thirty-six coaches with six horses each. Count Kevenhiller (cited by Beckmann,) describing the marriage of the emperor Ferdinand II. with a princess of Bavaria, says, "the bride rode with her sisters in a splendid carriage studded with gold; her maids of honour in carriages hung with black satin; and the rest of the ladies in neat leather carriages." The same author mentions the entrance of cardinal Deitrichstein into Vienna in 1611, and tells us that forty carriages went out to meet him. At the election of the emperor Matthias, the ambassador of Brandenburg had three coaches, which were constructed in a coarse manner, of four boards clumsily put together. When the consort of that emperor made her public entrance, on her marriage in 1611, she rode in a carriage covered with perfumed leather. Mary, infanta of Spain, consort of the preceding emperor, Ferdinand III., rode, in Carinthia, in 1631, in a glass carriage, in which no more than two persons could sit. The wedding-carriage of the first wife of the emperor Leopold, who was also a Spanish princess, cost, together with the harness, 38,000 florins. The coaches used by that emperor are thus described; "in the imperial coaches no great magnificence was to be seen; they were covered over with red cloth and black nails. The harness was black, and in the whole work there was no gold. The pannels were of glass, and on this account they were called the imperial glass coaches. On festivals the harness was ornamented with red silk fringes. The imperial coaches were distinguished only by their having leather traces; but the ladies in the imperial suite were obliged to be contented with carriages, the traces of which were made of ropes." At the magnificent court of duke Ernest Augustus, at Hanover, there were in the year 1681, fifty gilt coaches with six horses each. The first time that ambassadors appeared in coaches, in a public solemnity, was at the imperial commission held at Erfurth, in 1613, respecting the affair of Juliers.

In the history of France we find many proofs, that at Paris, in the 14th, 15th, and even the 16th centuries, the French monarchs rode commonly on horses, the servants of the court on mules, and the princesses, together with the principal ladies, sometimes on asses. In 1534, queen Eleonora and the princesses rode on white horses, during a sacred festival; and that private persons, *e. g.* physicians, used no carriages in the 15th century, has been inferred from the principal entrance to their public school, which was built in 1472, and which was so narrow, that a carriage could not pass through it, though it was one of the widest existing at that period. In Paris also, at all the palaces and public buildings, they had steps for mounting on horseback, such as those which the parliament caused to be erected in 1599. However, carriages appear to have been used at an early period in France. An ordinance of Philip the Fair, issued in 1294, for suppressing luxury, and in which the wives of the citizens are forbidden to use carriages (cars), is still preserved. Coaches or chariots are said to have been in use at the duke of Burgundy's court so early as 1445. (See Palaye's "Memoires sur l'Ancienne Chevalerie.") Under Francis I., or rather about 1550, somewhat later, there were at Paris, for the first time, only three coaches; one of which belonged to the queen, another to Diana de Poictiers, the mistress of two kings, Francis I. and Henry II., by the latter of whom she was created duchess of Valentinois, and the third to René de Laval, lord of Bois-Dauphin, who, being a corpulent unwieldy nobleman, was not able to ride on horseback. Others say, that the three first coaches belonged to Catherine de Medicis, Diana duchess of Angoulême, the natural daughter of Henry II., who died in 1619, and Christopher de Thou, first president of the parliament, the latter of whom was troubled with the gout; but his wife came to Paris on horseback. The other ministers of state soon followed his example. Henry IV. was assassinated in a coach, but he usually rode through the streets of Paris on horseback, and had only one coach for himself and his queen. We find, however, two coaches at the public solemnity on the arrival of the Spanish ambassador, Don Peter de Toledo, under the reign of this king. The coaches used at this time were not suspended by straps; they had a canopy supported by ornamented pillars; and the whole body was surrounded by curtains of stuff or leather, which might be drawn up. If Henry's coach had been furnished with glass, it is probable that he would not have been murdered. Bassompiere, in the reign of Louis XIII., is said to have been the first who projected a small coach with glasses: and the coach in which Louis XIV. made his public entrance about the middle of the 17th century, appears to have been a suspended carriage. The inventor of this very material improvement, or that of suspending the body of the carriage from elastic springs, cannot be ascertained. This is the only information relating to it that occurs, unless we allow that the first word of the following expression, "branlant et moult riche," which is applied to the carriage presented to the queen of France, in 1457, by the ambassador of Ladislaus V., king of Hungary and Bohemia, indicates that the carriage was suspended.

Twiss, in his "Travels through Spain and Portugal," says, that coaches were seen for the first time in Spain in the year 1546. To this purpose it is observed by Don Lorenzo Vander Hamin and Leon, in the first book of Don John of Austria's life, that Charles Pubest, a servant of Charles V. king and emperor, came in a coach or chariot, a thing rarely seen in these kingdoms. Whole cities ran out to stare at it, for at that time they only made use of carts drawn by oxen, and in them were seen the most considerable persons even of the court. Within a few years, about three score and ten, it was found necessary to prohibit coaches by royal proclamation. In Madrid, it is said, there are from four to five thousand gentlemen's carriages.

Towards the end of the thirteenth century, when Charles of Anjou made his entrance into Naples, the queen of Naples rode in a carriage, called by historians "caretta," the outside and inside of which were covered with sky-blue velvet, interspersed with golden lilies. From Naples the luxury of carriages spread over all Italy.

England lays claim to a very early use of coaches; but whatever may be the denomination under which they are mentioned, it is most probable that the ancient vehicles of this kind were merely cars, or a superior sort of waggons. From the life of St. Erkenwald, in sir William Dugdale's history of St. Paul, he appears to have used somewhat approaching to their construction, or a sort of chaise with wheels, in which he preached when he was old and infirm. This must have been as early, at least, as the year 675. Brooke, in his "Catalogue and Succession of Dukes, Earls, &c." says, that William de Ferrars, earl of Derby, died of a bruise occasioned by a fall from his coach in 1253. Mr. Dallaway, in his "Inquiry into the Origin of Heraldry," cites a manuscript register of the abbey of Gloucester, preserved in the archives of Queen's college, Oxford, which states the manner of conveying the body of Edward II., from Berkeley castle; "Iste tum abbas suo curru, honorificé ornato cum armis ejusdem ecclesiæ depictis, &c.;" and from which citation he infers that arms were painted at this early period on carriages and domestic furniture. From Stowe's survey of London, we learn, that the oldest carriages used by the ladies in England were known under the now obsolete name of "whirlicotes." When Richard II., towards the close of the 14th century, was obliged to fly from his rebellious subjects, he, and all his followers, were on horseback; but his mother, who was sick and weak, rode in a carriage. But this became afterwards unfashionable; for that monarch's queen, Anne, the daughter of the king of Bohemia, shewed the English ladies how gracefully and conveniently she could ride on a side-saddle; and, therefore, whirlicotes and chariots were disused, except at coronations and other public solemnities. In 1471, after the battle of Tewkesbury, which decided the fate of king Henry VI. and that of the house of Lancaster, when others fled in different directions, the queen was found in her chariot, almost dead with sorrow. (Hall's Chronicle.) In 1487, on occasion of a grand celebration of the feast of St. George, at Windsor, in the third year of king Henry VII., the queen and the king's mother rode in a chaise, covered with a rich cloth of gold, drawn by six coursers, harnessed with the same cloth of gold; and 21 ladies, habited in crimson velvet, rode on white palfreys. (Ashmole's Order of the Garter.) In the Northumberland household-book, the duke's chapel-stuff is ordered to be sent before by my lord's chariot; which use of it, about the year 1512, indicates that it bore little resemblance to the modern carriage of that name. In the procession of the funeral of Thomas Howard, duke of Norfolk, 1524, the body laid in a chariot was drawn by horses richly caparisoned; and before it, in its way to Thetford, where he was buried, went three coaches of friars. Holinshed says that queen Elizabeth used a chariot at a very early period (1558) of her reign. From these and many similar instances that might be cited, we may easily conjecture what kind of vehicle was the ancient coach. In every period of English history chairs and horse-litters, or hanging-waggons, occur, and they appear to have been the most easy and commodious machines for conveyance with which our ancestors were acquainted. Stowe, in his "Summarie of the English Chronicles," cited by Strutt, in his "Manners and Customs of the English," vol. ii., states, that, in 1555, Walter Ripon made a coach for the earl of Rutland, which was the first that was ever used in England; and, in 1564, the same Walter made the first hollow turning-coach, with pillars and arches, for her majesty; and again, in 1584, he made a chariot-throne, with four pillars behind, to bear a canopy with a crown imperial on the top, and before, two lower pillars, on which stood a lion and a dragon, the supporters of the arms of England. From Stowe's large chronicle we learn, that in the year 1564, Guylliam Boonen, a Dutchman, became the queen's coachman, and that he was the first that brought the use of coaches into England. Soon after, within the period of 20 years, they became common among the nobility and other persons of rank. About this time it is said long waggons, conveying passengers and commodities, were introduced. Anderson, in his "History of Commerce," says that coaches were first known in England about the year 1580, and that they were introduced from Germany by Fitz-Allen, earl of Arundel. He adds, from Stowe, that they were in general use by the nobility and gentry about the year 1605. But Mr. Strutt informs us, that it was a long time after the invention of coaches before a coach-box was added to the body; "for the coachman joineth a horse fixed to match a saddle-horse to the coach-tree; then he sitteth upon the saddle; and when there are four horses he drove those which went before him, guiding them with a rein." In the year 1598, when the English ambassador went to Scotland, he had a coach with him. The duke of Buckingham, the unworthy favourite of two kings, was the first person who rode with a coach and six horses, in 1619; in ridicule of which novel pomp, the earl of Northumberland put eight horses to his carriage.

Towards the end of the 16th century, John of Finland, on his return from England, among other articles of luxury, brought with him to Sweden the first coach. Before that period, the greatest lords in Sweden, when they travelled by land, carried their wives with them on horseback, and the princesses travelled in the same manner.

In Dâ Roches's "History of Denmark," there are two passages, in which coaches are mentioned as existing in that country in the time of Christian II. about the year 1515; but, perhaps, they merely mean the covered carts which are still used in Westphalia and its neighbourhood.

It appears that in the capital of Russia there were elegant coaches as early as the beginning of the 17th century. At Amsterdam coaches with wheels were prohibited in the year 1663, in order to save the expensive pavement of the streets, for coaches there, even in summer, are placed upon sledges as those at Petersburg are in winter. Many attempts have been made to suppress the use of coaches. The feudal nobility and vassals on the continent were forbidden the use of coaches, under pain of incurring the punishment of felony. In 1588, duke Julius of Brunswick published an order, prohibiting his vassals to ride in carriages; and in 1608, Philip II., duke of Pomerania-Stetten, reminded his vassals, that they ought not to make so much use of carriages as of horses. These prohibitions, however, have been of no avail; and coaches became common all over Germany.

Louis XIV. of France, made several sumptuary laws for restraining the excessive richness of coaches, prohibiting the use of gold, silver, &c. therein, but they have had the fate to be neglected.

Coaches may be divided into two kinds; those that have iron bows, or necks, and those that have not; both the one and the other have two principal parts, the body, and the train,

train, or carriage. The *body* is that part where the paffengers are difpofed; and the *carriage* is that which fuftains the body, and to which the wheels are faftened, that give motion to the whole machine.

There have been various contrivances among coach-makers to enable coaches, and other four-wheeled carriages, to turn fhorter than the common coaches, without the fore wheels touching the perch. The moft common and effective among thefe, is a contrivance called the *crane-neck*, a reprefentation of which is given in *Plate* XIII. *fig.* 1. of *Mechanics*. In the place of the common fingle perch or pole, which connects the two axletrees together, two iron perches, A, A, are fubftituted; they are firmly attached to a ftout piece of wood, B, by bolts and fcrews; this piece, which carries the two fprings, D, D, at its ends, has another, E, halved into it at right angles, that fupports, at its end, a third beam, F, parallel to the firft, the ufe of which is to hold iron braces, *b*, *b*, for the fprings, and to ftrengthen the perches A, A, which are connected to it by fcrew-bolts at the place where they crofs each other. The perch-bolt, *a*, round which the fore-axle moves as a centre, when the coach is in the act of turning, paffes through the interfection of the pieces B and E, and alfo through the axletree G. H is an iron circle concentric with the perch-bolt, firmly fixed to the axletree, on which the ends of the pieces B and E reft, fo as to guard againft the perch-bolt being broken or bent by any fudden jerk when the carriage is turning. The remainder of the carriage is made in the common way, and the improvement confifts in bending the two perches, A, A, upwards, fo that the fore wheels can turn under them, and might be made to turn quite round, if neceffary.

Fig. 2, reprefents a contrivance of Mr. Jacob, of Greek-ftreet, Soho-fquare, for the fame purpofe. A is the perch, as in a common coach, B the piece carrying the fprings, and F the piece fupporting their braces, bolted acrofs the perch at right angles; *a* is the perch-bolt, which does not pafs through the axletree itfelf, but through a piece of wood, G, projecting perpendicularly from the middle of the axletree, about half the diameter of the fore-wheels, and is firmly fixed to it by bolts and ftraps of iron; the axletree, H, is ftraight on the upper fide, and has a ftraight edge of iron fcrewed on the top of it, on which the end of the perch, A, is fupported; the under fide of the perch is alfo faced with iron, where it lies upon the axletree. It is evident, from the drawing, that by removing the perch-bolt to a diftance from the axletree, by means of the piece G, the axletree may be turned round much nearer into a line with the perch, without either of the wheels touching it, than it could do, if the perch-bolt went through the middle of it, as in the common way. By this contrivance, though it does not poffefs all the advantages of the crane neck, coaches may be made to turn much fhorter than the common ones, without any increafe of expence in their conftruction.

Coaches are diftinguifhed, with regard to their ftructure, into *coaches*, properly fo called, *chariots*, *calafhes*, and *berlins*. With regard to the circumftances of their ufe, &c. we diftinguifh *ftage-coaches*, *hackney-coaches*, &c.

Chariot, or *Half*-Coach, is a kind of coach that has only a feat behind, with a ftool, at moft, before. When thefe are very gay, richly garnifhed, and have five glaffes, they are called Calashes.

By 43 Geo. III. c 161. repealing former acts, the following duties are impofed on carriages, to take place from April 5, 1804, and they are levied under the provifions of the 43 Geo. III. c. 99, and by 45 Geo. III c. 15, &c. *viz.* for one carriage with four wheels, the annual fum of 11*l.*; for two fuch carriages, 24*l.* 4*s.*; for three, 39*l.* 12*s.*; for four, 55*l.*; for five, 71*l.* 10*s.*; for fix, 89*l.* 2*s.*; for feven, 107*l.* 16*s.*; for eight, 127*l.* 3*s.*; for nine 148*l.* 10*s.*; and an additional 16*l.* 10*s.* for every other carriage: and for every additional body, fucceffively ufed on the fame carriage or number of wheels, the further fum of 15*s.* 6*d.*:—For every carriage with lefs than four wheels (tax-carts excepted) drawn by one horfe, 5*l.* 15*s.* 6*d.*; and drawn by two or more horfes, 8*l.* 1*s.* 8¼*d.*; and for every additional body, fucceffively ufed on the fame carriage or number of wheels, the further fum of 2*l.* 15*s.*:—For every carriage, kept for the purpofe of being let to hire, for any period not exceeding 28 days, fo that the ftamp-office duty, payable by law on horfes let to hire, fhall be duly paid and fatisfied on every fuch letting by a licenfed perfon, if fuch carriage have four wheels, as above; if it have lefs than four wheels, the refpective fums above mentioned in the cafe of the fame carriages:—all which duties fhall be refpectively paid by the perfon keeping the fame:—For every carriage kept for the purpofe of being let to hire, for any period of time lefs than one year, and in fuch manner, that the faid ftamp-office duty fhall not be payable to fuch letting by any fuch licenfed perfon, if the carriage fhall have four wheels, the annual fum above ftated; and if fuch carriage have lefs than four wheels, the refpective fums above mentioned. Poft chaifes are chargeable with eight guineas each. By 43 Geo. III. c. 161, the following new duties are to be paid by coach-makers, and on carriages built for fale, in lieu of the duties thereby repealed; and alfo the new duties on perfons vending fuch carriages by auction or commiffion: *viz.* by every perfon who fhall carry on the trade of a coach-maker, &c. the annual duty of 5*s.*; by every fuch coach-maker for every carriage with four wheels, made for fale, 1*l.*, and for every fuch carriage with two wheels, 10*s.*:—By every perfon who fhall fell any carriage chargeable with duty by this act, by way of auction or commiffion, the annual duty of 5*s.*; by every fuch perfon for every fuch carriage with four wheels, which he fhall fell by auction or on commiffion, 1*l*, and for every fuch carriage with two wheels, fo fold, 10*s.* Perfons who have kept any carriages in the year ending on the days appointed for the commencement of the duties in 1804, are to return lifts to the affeffors; and perfons beginning or ceafing to keep carriages, or to carry on the trade of coach-makers, are to give notice of the fame. Coach-makers are required to keep accounts of carriages built or fold by auction or on commiffion. The affeffors, &c. to whom fuch accounts are delivered, fhall certify the fame to commiffioners.

The number of coaches made in England in the year 1793, is faid to have amounted to 40,000, more than half of which were exported. By the yearly accounts of the net produce of the permanent taxes, it appears that the duty on four-wheeled carriages (exclufive of hackney coaches) amounted in the year 1803 to 184,389*l.* 5*s.* 7½*d.* and in 1804, to 172,013*l.* 5*s.* 5½*d.*; and the duty on two wheeled carriages, to 90,090*l.* 2*s.* 7¾*d.* and 119,866*l.* 11*s.* 5¼*d.* refpectively: and the amount of the duties on both forts of carriages was 260,589*l.* 13*s.* 9½*d.* in 1805, 260,088*l.* 4*s.* 7½*d.* in 1806, and 302,349*l.* 3*s.* 2*d.* in 1807 refpectively. The duties upon hackney coaches and chairs amounted in 1806 to 24,325*l.* 2*s.* and in 1807 to 25,857*l.*

Coaches, *Hackney*, thofe expofed to hire in the ftreets of London, and fome other great cities, at rates fixed by authority.

Thefe firft began to ply in the ftreets of London, or rather waited at inns, in 1625, and were only twenty in number; but they were fo much increafed in 1635, that king Charles iffued an order of council for reftraining them. In 1637, 1637, he allowed fifty hackney-coachmen, each of whom might keep twelve horses. In 1652 their number was limited to two hundred, and in 1654 extended to three hundred, for which 600 horses were employed. In 1661 four hundred were licensed at 5*l.* annually for each. In 1694 seven hundred were allowed, and taxed by the 5 and 6 W. and M. at 4*l.* per annum each.

By 9 Anne, cap. 23, the king may appoint commissioners, not exceeding five in number, for regulating hackney-coaches within the bills of mortality; and by this statute eight hundred hackney-coaches were allowed in London and Westminster; but by 11 Geo. III. cap. 24, the number was increased to one thousand; and by 42 Geo. III. c. 78. one hundred more was added, which are to be licensed by the commissioners, and pay a duty of 5*s.* per week (9 Anne. c. 23.) and an additional duty of 5*s.* per week (24 Geo. III. sess. 2. c. 27.) for each licence to the crown, to be paid monthly: and if any person drive or let to hire a hackney-coach without licence, he shall forfeit 5*l.* The commissioners may appoint inspectors to see that licensed persons provide safe and clean coaches and sufficient horses, and suspend the licence of any person whose coach or horses shall be found defective (39 and 40 Geo. III. §. 4.); nor shall any horse be used with any hackney-coach under the height of 14 hands (9 Anne. c. 23.). By the same statute every coach is to have a distinct mark or number on both sides, which is not to be altered under penalty of 5*l.* No unlicensed coaches shall ply at funerals for hire, or without having a number fixed on the fore-standard, shewing it to be licensed, on pain of 5*l.* 1 Geo. c. 57. 24. Geo. III. sess. 2. c. 27. By 1 Geo. c. 57. refusing any person to take the number of the coach, or giving a wrong number, incurs the forfeiture of a sum not exceeding 40*s.* By 11 Geo. III. c. 28. every hackney-coach is to be provided with checque-strings, and plying without them incurs a penalty of 5*s.*; and by 1 Geo. c. 57. drivers of hackney-coaches are to give way to persons of quality and gentlemen's coaches, under penalty of 10*s.*

By 39 and 40 G. III. c. 47. the fares on hackney coaches allowed by 26 G. III. c. 72. are repealed, and the following fares are to be taken in lieu thereof: namely, between six in the morning and twelve at night for every distance not exceeding one mile 1*s.* and for every further distance not exceeding half a mile 6*d.* and increasing 6*d.* for every half mile such coach shall go farther. s. 1.

And as to time, for every coach kept in waiting between six in the morning and twelve at night, for not exceeding 40 minutes 1*s.* and for any further time not exceeding 20 minutes 6*d.* and so on during the whole time such coach shall be engaged, computing at the rate of 6*d.* for every 20 minutes.

And for every coach hired where there is a regular continuation of carriage-way pavement, or at any stand beyond such continuation, and taken to, and discharged at any place from which the same cannot be driven to the nearest continuation of such carriage-way pavement, or such stand, before sun-set, (estimating the rate of driving at five miles an hour,) then one half part of the fare hereby allowed for such distance as such coach can be so driven towards such nearest pavement before sun-set, so as no fraction of any sum less than 6*d.* shall be payable by reason of such half rate; and the full rate hereby allowed shall be paid for such distance as shall remain for such coach to be driven at the rate aforesaid to such pavement after sun-set, or where such coach shall have been hired at any standing beyond such pavement, then to such standing or to the nearest pavement, at the option of the person discharging such coach.

And every coach hired for a day not exceeding 12 hours, and to end before 12 o'clock at night, and the distance not to exceed 20 miles, shall be paid 18*s.* for such day's work, and for any further time or distance or if after 12 at night, such further rate for such time or distance as is allowed for any further time or distance of the like nature by this act: And also if any such coach shall be taken to and discharged at any place exceeding one mile from where there is a regular carriage-way pavement, so as that such coach cannot be driven to such pavement within such 12 hours, or before 12 at night; or where the distance where such coach shall be discharged, added to the distance such coach shall have been driven, shall in the whole exceed 20 miles, then such further additional rate as is herein allowed for any further time or distance of the like nature.

And for every such coach which shall be hired or kept in waiting after twelve at night or before six in the morning, or shall be discharged at any such time and place that it cannot be driven to some regular carriage-way pavement before twelve at night, an additional fare for such time or distance as aforesaid, over and above the rate before mentioned, of 6*d.* upon every 1*s.* but so that such additional rate shall not be taken for any such coach hired between ten and twelve o'clock at night, unless the rate, according to the time for which such coach shall be kept, or the distance such coach shall be taken, shall according to the rates aforesaid amount to 2*s.* or upwards, although such coach shall not be discharged till after twelve at night.

And when the average price of oats computed according to 31 G. III. c. 30. shall exceed 25*s.* per quarter, the commissioners for licensing hackney coaches may allow additional fares to be taken, *viz.* 6*d.* on every 2*s.* fare: 1*s.* on every 4*s.* fare, and so 6*d.* additional on every additional 2*s.* provided the coach goes or is kept to the full amount of the fare; and such additional rates may be continued till 30 days after oats are reduced to one guinea per quarter. s. 2, 3.

Every licensed coachman, plying for hire, within the cities of London and Westminster, or the suburbs thereof, or elsewhere within the bills of mortality, shall be obliged and compellable, on every day of the week, at seasonable times, to go any where within the distance of ten miles from either of the said cities. 7 G. III. c. 44. s. 12. 12 G. III. c. 49, s. 1.

No person who shall regularly use such hackney coach as a stage coach to and from any of the towns or places in the neighbourhood of London or Westminster, shall be obliged to carry any fare out of the ordinary course of his stage work or duty; provided that he do, by painting in legible characters, on the door of such coach, or on a board to be affixed on such door, plainly denote and distinguish the same to be a stage coach to and from any such town or place. 12 G. III. c. 49. s. 2.

If any hackney coachman shall refuse to go at, or exact more for his hire, than according to the above act, or bye-laws; he shall forfeit a sum not exceeding 3*l.* nor under 10*s.* 1 G. st. 2. c. 57. s. 2.

And every hackney coachman where coaches are standing, shall be compellable to go with any person when desired, and on refusal, (unless he prove being hired) shall be liable to the like penalties as persons refusing to carry for hire, by any law now in being. 39 and 40. G. III. c. 48. s. 5.

Hackney coachmen exacting more than their fare, shall be liable to the penalties, and their fares shall be recoverable, as under former acts. s. 11.

And if any person who shall drive a coach, or carry a chair for hire, acting under a person licensed, shall be guilty of misbehaviour, by demanding more than his fare, or giving abusive

abusive language, or other rude behaviour; he shall, on conviction on oath, forfeit not exceeding 20 s. to the poor; and if he shall not be able, or refuse to pay, he shall be committed to Bridewell or some other house of correction, to be kept to hard labour for seven days, and receive the public correction of the house before he be discharged. 9 An. c. 23. s. 44.

And on misbehaviour of a coachman or chairman by abusive language, or otherwise, the commissioners may revoke his licence, or inflicton him a penalty, not exceeding 3 l. to the poor; and on non-payment, he shall be committed to Bridewell or some other house of correction, to be kept to hard labour for 30 days. 9 An. c. 23. s. 49. 7 Geo. III. c. 44. s. 16.

If any person shall refuse to pay, or shall deface any coach or chair, any justice may grant his warrant to bring him before him; and on proof upon oath may award satisfaction to the party, and on refusal to pay, may bind him over to the next sessions, who may determine the same. 9 An. c. 23. s. 22.

And if any hackney coachman or his renter, shall be in arrear for any rent made payable by his licence for any longer time than is expressed therein, the said commissioners may revoke such licence, and levy the money upon the goods of either the owner or renter, in like manner and form as by any law now in being with respect to the owner. 26 G. III. c. 72. s. 3.

The rents and penalties to be levied by distress, by warrant of three commissioners; which distress shall be sold in ten days, returning the overplus, charges of the distress and of the warrant being first deducted (if on seven days' notice they pay not the fine without such warrant); and in default of distress, to be imprisoned till paid; and if any rent shall be unpaid for 14 days, the commissioners may withdraw the licence. 9 An. c. 23. s. 12.

And moreover, the breach of the bye-laws, and of these rules and orders, may be punished by any justice of the peace, mayor, bailiff, or other magistrate, where the offence shall be committed, in like manner as by the commissioners. 9 An. c. 23. s. 17. 1 G. st. 2. c. 57. s. 7. 4 G. III. c. 36. 7 G. III. c. 44. s. 19. 10 G. III. c. 44. s. 7.

And every licensed person who shall neglect or refuse (being duly summoned for that purpose) to appear by himself or his renter, shall forfeit 10 s. to be recovered as the other penalties; and if such licensed person shall neglect or refuse to appear, together with his renter, upon the third summons, the complaint may be heard and determined in his absence. 10 G. III. c. 44. s. 6.

And if any owner of a licensed hackney coach, shall refuse or neglect to appear with his driver before the commissioners upon the third summons left at his usual place of abode, the said commissioners may revoke such licence, and licence another person in his room. 24 G. III. sess. 2. c. 27. s. 37.

And all penalties levied by any justice, mayor, bailiff, or other magistrate, shall by them be transmitted to the receiver general of the duties on hackney coaches and chairs, and they shall also transmit a certificate thereof to the commissioners, within ten days after levying such penalty, on pain of 10 l. half to the king and half to him that shall sue. 10 G. 3. c. 44. s. 8.

Hackney coaches were first established at Edinburgh in 1673; and carriages of this kind have been introduced within some years, in several principal cities and towns of England. At Paris, and in some other places in the continent, they are known, by the name of "fiacres." This appellation is said by Beckmann to have originated in France, about the year 1650, when one Nicholas Sauvage first thought of keeping horses and carriages for hire; and as he lived in a house called the "hôtel S. Fiacre," the coaches, coachmen, and proprietor were called "fiacres." A particular kind of hackney carriage is peculiar to the Parisians; it is denominated "brouette," or "roulette," and sometimes by way of derision, "vinaigrette;" and was invented by a person of the name of Dupin; the body is almost like that of our sedans, but rolls upon two wheels, and is dragged forwards by men. Carriages of this kind came into common use in 1671, but they were employed only by the common people. The number of all the coaches at Paris is computed (says Beckmann) at about 15,000; and the author of the "Tableau de Paris," reckons the number of the hackney coaches to amount to 1800, and asserts that more than 100 foot passengers lose their lives by them every year. Fiacres were introduced at Warsaw, for the first time, in 1778. In Copenhagen there are 100 hackney coaches. In Madrid there are from 4 to 5,000 gentlemen's carriages; in Vienna 3000, and 200 hackney coaches.

COACHES, *Stage*, are those appointed for the conveyance of travellers from one city or town to another; and these, as well as other coaches, chaises, &c. with four wheels, pay an annual tax of 8 l. 8 s.

Persons keeping stage-coaches for the purpose of conveying passengers by hire, shall take out a licence at 5 s. annually, and renew it on pain of forfeiting 10 l. 25 Geo. III. c. 51. By 30 Geo. III. c. 36. it is enacted, that the drivers of stage-coaches, drawn by three or more horses, are not to admit more than one outside passenger on the box, and four on the roof, under a penalty of 5 s. for every person above the limited number, to be paid to the toll-taker at every turnpike gate through which such carriage shall pass; the proprietor's name shall be put on the carriage; and if the coachman shall suffer any person to drive the same, without the consent of the inside passengers, or quit the box without reasonable occasion, or for a longer time than such occasion may require; or shall, by furiously driving, negligence, or misconduct, overturn the carriage, or endanger the persons or property of the passengers, or of the owner of such carriage, he shall for every such offence forfeit not exceeding 5 l. nor less than 40 s.; and if the guard fire without cause, he shall forfeit for every such offence 20 s. If the driver cannot be found, the proprietor of such carriage shall be liable to the penalty laid upon the driver. The penalties are to be applied, half to the informer, and half to the surveyor of the highways in the place where the offence is committed, for the repair of the highways. See POST-*horses*.

COACH, in *Sea Language*, denotes a chamber or apartment near the stern, in a ship of war.

COADJUTOR, *Fellow-helper*, is properly used for a prelate joined to another, to assist him in the discharge of the functions of his prelature; and even, in virtue thereof, to succeed him.

The coadjutor has the same privileges with the bishop himself. Coadjutors were formerly appointed by kings, for archbishops and bishops grown old, or absent, and not able to superintend their dioceses. But the right of appointing coadjutors, in Romish countries, is now reserved to the pope alone.

Coadjutors are also called bishops *in partibus infidelium*; because it is necessary the coadjutor of a bishop should be a bishop himself; without which he cannot discharge the office.

The use of coadjutors in the church, is borrowed from the Roman empire. Symmachus speaks of assistants, or coadjutors, given to magistrates, and calls them *adjutores publici officii.* See SUFFRAGAN.

The popes formerly made a shameful abuse of the coadjutories;

jutories;

jutories; some they granted to children, and young people, with this clause, *donec ingressus fuerit; till they were capable of entering upon the administration of the office.* Others they granted to persons not in orders, with this clause, *donec accesserit;* and others to persons at a great distance, with this clause, *cum regressus;* but the council of Trent tied down the pope's hands, by adding abundance of restrictions on the article of coadjutors.

In nunneries they have coädjutrixes, who are religious, nominated to succeed the abbess, under pretence of aiding her in the discharge of her office.

COADUNATÆ, in *Botany*, the 12th of the natural orders of Linnæus in the Philosophia Botanica, and the 52d of the Posthumous Prælections. In the former it contains the following genera; annona, liriodendrum, magnolia, uvaria, michelia, and thea. In the latter xylopia is added, and thea removed to columniferæ. Linnæus has left no explanation of this order.

COAGMENTATION, is used, among chemists, for the act of melting down a matter, by casting in certain powders, and afterwards reducing the whole into a concrete or solid.

COAGUILLA, or NEW ESTREMADURA, in *Geography*, a province of New Leon, part of the Spanish dominions in North America; the bounds of which are extended by Alcedo to the river Medina, and the extent of which is computed at 200 leagues from N. to S. and 160 from N.W. to N.E. The capital is Monclova, in lat. 27° 30′. This province is a desert waste, scarcely peopled, except by some Missions; and its mineral treasures, if any exist, have not been explored.

COAGULATION, in *Chemistry.* A liquid is said to coagulate when it becomes solid, or nearly so, without assuming a regular crystallized form, and without the loss of the more fluid part by evaporation, or by any other method. The solidification of the white of egg by heat, and the spontaneous stiffening of blood when drawn from the living vein, are familiar examples of coagulation. We are perfectly ignorant both of the cause of coagulation in these cases, and of the nature of the change that takes place in them.

In many cases a thickening, which is also termed coagulation, is produced in liquid solutions, by certain additions, which exercise a well-defined chemical action. In this case coagulation is synonymous with incipient and copious precipitation, where the relative bulk of fluid is small; as, for example, where milk is coagulated by rennet, which produces a separation between the curd and whey; but before the separation is complete the whole mass stiffens, or coagulates. This term is also applied to a sudden and copious production of crystals, so minute or irregular, as hardly to assume to the naked eye the crystalline form, as when strong sulphuric acid is poured into a concentrated alkaline solution, which immediately converts the whole into a confused mass of sulphat of potash.

COAGULUM, the *coagulum* of the Latins, the πιτυα, and the ταμισος of the Greeks, are the same with what in English we call rennet. See RENNET.

COAITA, in *Zoology*. See SIMIA *paniscus*.

COAK. See COKE.

COAKS, in *Ship-Building*, denote oblong ridges left on the surface of different pieces of made-masts, by cutting away the wood round them, the intermediate part being called the plain.

COAKING, is the uniting of two or more pieces together in the middle, by small tubular pieces, formed from the solid of one piece, and sunk exactly the same in the other, the butts of which prevent the pieces from drawing asunder length-ways. There are different methods of coaking, such as the following:—*Coak and plain*, when a coak is formed, and a plain surface follows between that and the next:—*Running coaks*, which are coaks continued through the whole length along the middle, but answering the above purpose, as the butts of each coak come one-third of their breadth within and without each other alternately:—*Chain-coaks*, which are formed one at the end of the other, on the opposite sides of the middle line. See TABLING.

COAKING, or *Bushing*, in *Block-making*, denotes letting through the middle of a sheave a cylindrical piece of metal, with a hole through its centre, to admit the pin or axis on which the sheave turns; on each side of the sheave a plate is let in, having three or four corresponding holes in each, for rivets to go through, to secure and strengthen the whole. The entrance of the holes in the plates is enlarged, that the heads of the rivets and points, when clenched, may have a smooth surface. When there is only one plate, the rivets have broad heads; the holes in the sheave are made accordingly, and the points are clenched on the plate. The cylinder and one plate are cast in one piece.

COAKING, *plank*, is letting in narrow pieces of lignum-vitæ, transversely to each other, one on each side of the sheave; which has likewise a small circular brass plate let in on each side, and riveted through, as others.

COAL, in *Mineralogy*. The word coal has been derived by some writers from the Hebrew, and by others from the Greek or Latin, but whatever may be its origin, it is deserving of remark that the same sound for the same object is used in the Anglo-Saxon, the Teutonic, the Dutch, the Danish, and the Islandic languages. Coals are found in several parts of the continent of Europe, but the principal mines are in this country. They have been discovered and wrought in Newfoundland, Cape Breton, Canada, and in some of the provinces of New England. China abounds in them, and they are well known in Tartary, and in the island of Madagascar.

History of Coal as an Article of Commerce.

Coals are first mentioned as fuel for artificers by Theophrastus, who describes them as earthy substances that burn like wood-coals, and are used by the smiths. The ancient Britons had a primitive name for this fossil, and Pennant says, "that a flint axe, the instrument of the aborigines of our island, was discovered in a certain vein of coal in Monmouthshire, and in such a situation as to render it very accessible to the inexperienced natives, who in early times were incapable of pursuing the seams to any great depths."

Although coals are so abundant in many of the above named places, yet as there are no beds found in the whole extent of Italy, the great line of this fuel seems to sweep round the globe, from the north-east to the south-west, visiting Brabant and France, and avoiding Italy. The strongest argument adduced by those who contend that the Romans, while in possession of this island, were ignorant of the use of coal, is, that there is no name for it in the Latin language, the word *carbo* being always used for charcoal. Cæsar takes no notice of coal in his description of this island; yet there is good evidence to believe that the Romans brought it into use. In the West Riding of Yorkshire are many beds of cinders, heaped up in the fields, in one of which a number of Roman coins were found some years ago.

From Horsely it appears, that there was a colliery at Benwell, about four miles west of Newcastle-upon-Tyne, supposed to have been actually worked by the Romans, and it is evident from Whitaker, that coals were used as fuel in this country by the Saxons. No mention is made of this fossil during the Danish usurpation, nor for many years after the Norman conquest.

The firſt charter for the licence of digging coals, was granted by king Henry III., in the year 1239; it was there denominated ſea-coal; and, in 1281, Newcaſtle was famous for its great trade in this article, but in 1306, the uſe of ſea-coal was prohibited in London, from its ſuppoſed tendency to corrupt the air. Shortly after this, it was the common fuel at the king's palace in London, and, in 1325, a trade was opened between France and England, in which corn was imported, and coals exported. In 1379, a duty of ſixpence per ton was impoſed upon ſhips coming from Newcaſtle with coals. At this period, the inhabitants of the county of Durham had obtained no privilege to load or unload coals on the ſouth ſide of the Tyne; but, in 1384, Richard II., on account of his devotion to Cuthbert, the tutelary ſaint of Durham, granted them licence to export the produce of their mines, without paying any duties to the corporation of Newcaſtle. In the year 1421, it was enacted, that the keels or lighters carrying coals to the ſhips ſhould meaſure exactly twenty chaldrons, to prevent frauds in the duties payable to the king.

Æneas Sylvius, afterwards pope Pius II., viſited this iſland, about the middle of the 15th century, and he remarked, that the poor of Scotland received for alms pieces of ſtone, which they burnt in place of wood, of which at that time the country was deſtitute. About the beginning of the 16th century, the beſt coals were ſold in London at the rate of 4*s.* 1*d.* per chaldron, and at Newcaſtle for about 2*s.* 6*d.*; and in 1563, an act was paſſed in Scotland to prevent the exportation of coals, which had occaſioned a great dearth of fuel in that country. Queen Elizabeth, in the year 1582, obtained a leaſe of a great part of the mines of Durham, for ninety-three years, at the annual rent of 90*l.*, which occaſioned an advance in the price of coals; it was afterwards aſſigned to Thomas Sutton, the founder of the Charter-Houſe in London, who aſſigned it to the corporation of Newcaſtle, for the ſum of 12,000*l.*; and the price of coals was immediately advanced to ſeven ſhillings and eight ſhillings per chaldron. Notwithſtanding the ſeveral advances upon this article, when queen Elizabeth demanded the arrears of two-pence per chaldron, which had been granted to Henry V., but the payment of which had been neglected by the corporation, they petitioned for a remiſſion of the debt on account of their inability; this was granted, and alſo a charter to incorporate a new company, called hoſtmen or coal-engroſſers, for ſelling all coals to the ſhipping; in conſequence of which the corporation impoſed one ſhilling per chaldron additional upon this article. At this period the lord mayor of London complained to the lord-treaſurer, Burleigh, that the free-hoſts in Newcaſtle, to whom the grand-leaſe had been aſſigned, for the uſe of the town, had transferred their right to a few perſons, who engroſſed all the other collieries, and he requeſted that the collieries might be free, and that the price of coals ſhould not exceed ſeven ſhillings per chaldron.

It appears, by an order of the hoſtman's company, dated A.D. 1600, that tram-waggons and waggon-ways had not then been invented, but that the coals were at that time brought down from the pits in wains, holding eight bolls each (all of them meaſured and marked), to the ſtaiths by the ſide of the river. About this period, an engine for drawing the water out of the coal mines was invented in Scotland, by a predeceſſor of the firſt earl of Balcarras, who obtained from James VI. a patent for 21 years. This improvement was not, till ſome time after, adopted in the neighbourhood of Newcaſtle.

In a petition of grievances, preſented by the houſe of commons to king James, in 1610, a complaint occurs of a late impoſition of one ſhilling per chaldron on ſea-coals, riſing in Blyth and Sunderland, not by virtue of any contract or grant, as on the coals of Newcaſtle, but under the mere pretext, aſſumed by the contractors, of his majeſty's royal prerogative. This petition diſplayed ſo ſtrongly the rapacity of that body of men, and the diſtreſs occaſioned by it to the inhabitants of London, that the prayer of the petition was immediately complied with. It was during the ſame reign, that an information was exhibited in the ſtar-chamber, by the attorney-general, againſt the mayor and burgeſſes of Newcaſtle, by the name of hoſtmen, for that they, having the preemption of coals for the inheritors in Northumberland, and the county of Durham, by their charter of the 42d of Elizabeth, forced ſhips to take bad coals, amongſt which was a quantity of ſlate; in conſequence of this they were all fined, ſome of them in penalties of one hundred pounds each, and committed to the Fleet priſon; and the decree was ordered to be read in the open market in Newcaſtle, two ſeveral market days.

In 1615, there were employed in the coal trade of Newcaſtle 400 ſail of ſhips, one-half of which ſupplied London, the remainder the other part of the kingdom; the French too are repreſented as trading to Newcaſtle at this time for coal, in fleets of 50 ſail at once, ſerving the ports of Picardy, Normandy, Bretagne, and as far as Rochelle and Bourdeaux, while the ſhips of Bremen, Embden, Holland, and Zealand, were ſupplying the inhabitants of Flanders.

In 1622, an order was iſſued by the hoſtmen, againſt the ſecret and diſorderly loading of coals, but not until they had received ſeveral precepts from the king and privy-council, concerning this abuſe. They were ſummoned to anſwer again, by proceſs from the exchequer chamber, againſt the governor, ſtewards, and ſome others of the company, for the above default; and as we are not informed of the reſult of this proceeding, we may conclude it did not terminate in their favour. Soon after this, David Ramſay, a great projector, obtained an excluſive charter to raiſe water from low mines and coal pits, by a method entirely original. In the year 1630, the king let to farm an impoſt on coals of 5*s.* per chaldron, for thoſe tranſported out of England, Wales, and Berwick-upon-Tweed, to any part beyond the ſeas, except Guernſey, Jerſey, and the Iſle of Man; of 1*s.* 8*d.* over and above the 5*s.* on thoſe to be exported, as above, by any Engliſhman; and alſo of 3*s.* 4*d.* for every chaldron to be exported except for Ireland and Scotland. In 1631, an information was again made in the ſtar-chamber, by Heath, attorney-general, againſt the hoſtmen of Newcaſtle, for mixing 40,000 chaldron of coals with ſlates, &c.; from whence it ſeems, that the former fines and impriſonment had no effect, but that they had ſtill proceeded to cheat the metropolis and the country at large, even after thoſe ſevere meaſures of government. A. D. 1634, the king, ſolely by his own authority, impoſed a duty of four ſhillings per chaldron on all ſea-coal, ſtone-coal, or pit-coal, exported from England to foreign parts.

In 1637, one ſhilling per chaldron appears to have been paid, on the foreign vent of coals, to the mayor of Newcaſtle and corporation. Government being applied to for redreſs, letters were ſent to the biſhop of Durham, requiring him to write to the ſaid mayor, and order an immediate reſtoration of the above exaction; the biſhop's letter is dated 10th of January, 1638. In 1643, when the Scots beſieged Newcaſtle, all the coal-mines were, it is ſaid, ordered to be ſet on fire, which was prevented by general Leſlie, who took the veſſels by ſurprize. In 1648, coals were ſo exceſſively dear in London, that many of the poor are ſaid to have died for want of fuel. In November 1653, articles were again exhibited

hibited againſt the town of Newcaſtle, concerning the coal-trade; and the cauſe, as uſual, was given againſt them. About this time the port of Sunderland appears to be riſing into importance. In 1667, coals are ſaid to have been ſold in London for above 20*s.* a chaldron; about 320 keels were at that time employed upon the river Tyne, in the coal trade, each of which carried annually 800 chaldrons on board the ſhips. To adjuſt the difference of meaſures it muſt be noted, that 16 chaldrons of Newcaſtle, are equal to 31 of London pool meaſure, according to Mr. Eddington. In 1658, the cuſtoms upon all coals exported, were let to Mr. Martin Nowel at 22,000 pounds per annum, of which ſum 19,783*l.* 14*s.* 8*d.* were for the coals of England, and 2,216*l.* 5*s.* 4*d.* for thoſe of Scotland. Commiſſioners were now appointed by the lord protector, under the great ſeal of England, for the meaſuring of keels, which was performed in a new and better manner than had been before known. In December 1667, the parliament made an order, that the price of coals, till the 25th of March following, ſhould not exceed 30*s.* per chaldron; and by an act made that year, after the great fire in London, a duty of one ſhilling per chaldron was granted to the lord mayor of that city, to enable him to rebuild the churches, and other public edifices. This, however, being inſufficient, it was made three ſhillings, to continue twenty years. In 1677, Charles II. granted to the duke of Richmond one ſhilling per chaldron on coals brought to London, which was continued in the family till the year 1800, when it was purchaſed by government, for the annual ſum of 1,900*l.* payable to the duke and his ſucceſſors. This duty at preſent produces to government 2,500*l.* annually. At the end of the ſeventeenth century, 1400 ſhips are ſaid to have been employed in exporting yearly from Newcaſtle, two hundred thouſand chaldrons of coal, Newcaſtle meaſure, which was about two thirds of the whole trade. The over-ſea trade in this article, at the ſame time, employed nine hundred thouſand tons of ſhipping. In 1710, a duty was laid upon coals for building 50 churches; a curious and particular account of the monies collected by duties on coal, for the building of St. Paul's church, in London, from October 1, 1668, to May 5, 1716, is preſerved in the Antiquarian Repoſitory, vol. ii. page 40. In the year 1741, a drawback was granted on the duty on coals, uſed in fire-engines for working the tin and copper mines in Cornwall. Mention occurs in 1758, of a machine invented by Michael Meninzies, eſq. by which coals were drawn up, not by the ſtrength of horſes or of men, but by the deſcent of a bucket full of water, of a weight ſuperior to that of the coals drawn up, lifting a corve of ſix hundred pounds weight, out of a pit about fifty fathoms deep, in two minutes. A machine, nearly ſimilar, was afterwards erected at Worſley, by James Brindley, on the duke of Bridgewater's canal, and is mentioned in our article Canal. See alſo *bucket* Engine. In the year 1764, there were exported from the river Tyne, for London, and coaſtwiſe, twenty thouſand chaldrons of coals, and forty thouſand chaldrons of London meaſure for foreign parts, more than had been exported in any one year. From the years 1770 to 1776, were ſhipped to London, and other parts of Great Britain, 351,000 chaldrons of coals, of which 260,000 were ſent to London: to the Britiſh colonies and plantations, 2,000 chaldrons; and exported to foreign parts, 3,700; in all, averaging 380,000 chaldrons, Newcaſtle meaſure, per annum. The weight of theſe, at 53 cwt. per chaldron, is one million, ſeven thouſand tons; the duty paid to the crown at the ports of diſcharge, on 351,000 chaldrons, at 5*s.* per chaldron, is 167,000 pounds.

In 1776, from a note communicated by the ſurveyor of the cuſtoms of Newcaſtle, we find, that 14,000 chaldrons were exported in that year from Blyth; 18,000 chaldrons from Hartley Haven; 350,803 chaldrons from Newcaſtle, coaſtwiſe.

The trade, thus rapidly encreaſing, acquired its preſent importance. The following account of coals exported from the river Tyne, in the years 1802, 1803, 1804, and 1805, will give an idea of the amazing extent to which it is now carried.

	Coaſtwiſe.	Over-ſea.	Plantations.
In the year 1802	494,488	41,157	2844
1803	505,137	42,838	1,516
1804	579,929	48,737	3852
1805	552,827	47,213	2360

We do not here include the quantity exported from the harbours adjoining near to Newcaſtle, *viz.* Sunderland, which exports, annually, about three hundred thouſand chaldrons; and Blyth and Hartley, which alſo export conſiderable quantities; neither do we notice the proportion conſumed in the town and neighbourhood of Newcaſtle.

It is calculated, that the ſum expended in materials for boring and ſinking for coal, ſuch as wood, iron, ropes, &c. independently of the money paid for the excluſive privilege of working, amounts, in ſome collieries, to upwards of 30,000 pounds per annum. By a calculation lately made, it is ſuppoſed that 64,724 people are employed by the coal trade on the rivers Tyne and Wear. See theſe under our article Canal. The following is a calculation of the capital employed in the ſame trade.

In the collieries -	1,030,000
In ſhipping - -	1,400,000
Capital employed by the London coal-merchants -	700,000
Total	3,130,000

From this detail, the coal-trade muſt appear of the utmoſt importance, not only in a local, but in a national point of view, as a nurſery of excellent ſeamen for the Britiſh navy; and as the means of employment for many thouſands of induſtrious working people. Beſides the important advantages already enumerated, others deſerve to be noticed. Coal is in many reſpects, and in a very high degree, uſeful to the landed intereſt, not only by greatly enhancing the real value of thoſe lands in which it is found, and thoſe through which it muſt paſs, from the works to the place where it is ſhipped, but from the general improvements which it has occaſioned, in conſequence of the wealth it has brought into the country.

An act of parliament paſſed in 1803, as hereinafter mentioned, for preventing the mixing of coals of different ſorts together, by the dealers, before delivery in London and its environs; and for that purpoſe, it required the name of the coals contained in each ſhip's cargo to be certified to the buyers. It were much to be wiſhed, that ſome better criteria could have been adopted for aſcertaining the different ſorts of coals (the worſt of which often are, or rather ſhould be, ſelling in London at two thirds of the price of the beſt ſorts, or leſs,) than merely the names of the ſeveral pits' mouths out of which they were drawn; when it is well known, that all the deeper pits are ſunk through ſeveral veins of different qualities, and ſometimes have one of theſe veins in work, and ſometimes another, or perhaps ſeveral of them at the ſame time; whence the facility ariſes, of ſending better or worſe coals to market under the ſame name, according as the relative prices of good and bad coals may induce: could not the names of the different veins which have diſtinct qualities, have been certified, along with the coals dug therefrom, inſtead of the arbitrary,

trary, and perhaps worse than useless name of the pit, containing several veins exactly the same with, and actually opening into the works of the neighbouring pits? The following is an alphabetical list of the names of the different cargoes of coals published in the newspapers, as sold at the coal-exchange, London, during a considerable period, with the name of the river, canal, or port from which they were put on ship-board, after being conveyed thither by rail-ways, &c. (see our article CANAL) and a series of numbers, expressing the number of times that each name appeared among the coal-exchange sales of the day, during the period alluded to.

Adair's Main	*Tyne*	126
Allan's Main	*Wear*	1
Baker's Main	*Tyne*	16
Bedford Main	*Wear*	45
Bedworth	*Grand Junction.*	
Benton	*Tyne*	301
Benwell	*Tyne*	4
Biddick Main	*Wear*	17
Bigg's Main	*Tyne*	419
Birtley Moor	*Wear*	3
Blyth	*Blyth*	199
Boundry Main	*Wear*	14
Bourn Moor Main	*Wear*	343
Brandling Main	*Tyne*	141
Byker	*Tyne*	73
Cowper Main	*Blyth*	122
St. David's	-	17
Eden Main	*Wear*	138
Eighton Main	*Tyne*	51
Elmore Main	*Tyne*	3
Flatworth	*Tyne*	6
Flocton	-	2
Gate's Head Park	*Tyne*	2
Greenwich	-	42
Harecastle	*Grand Junction.*	
Harraton	*Wear*	3
Hartley	*Seaton Burn*	232
Heaton Main	*Tyne*	359
Hebburn Main	*Tyne*	377
Hollywell Main	*Tyne*	178
Howard's Main	-	2
Hutton Seam	*Wear*	2
Kenton, East and West	*Tyne*	103
Lambton Main	*Wear*	6
Lawson's Main	-	5
Marley Hill	*Tyne*	3
Montague Main	*Tyne*	266
Murton Main	-	12
Newbottle	*Wear*	90
Newton	-	4
Percy Main	*Tyne*	1
Pontop, Simpson's	*Tyne*	48
——— Windsor's	*Tyne*	154
Primrose Main	*Wear*	32
Rectory Main	*Tyne* or *Wear*	87
Russel's Main	*Tyne* or *Wear*	153
Scotch Coal	-	3
Sheriff Hill	*Tyne*	105
South Moor	*Tyne*	122
Stanley	-	8
Tanfield Moor	*Tyne*	115
——— Pitt's	*Tyne*	154
Team	*Tyne*	94
Tyne Main	*Tyne*	25
Usworth	*Tyne*	4
Wallbottle Moor	*Tyne*	101
Walker	*Tyne*	292
Wall's End	*Tyne*	468
Warwick Main	*Wear*	55
Wednesbury	*Grand Junction.*	
Wentworth	*Wear*	28
Westfield	-	7
Wharton	*Wear*	1
Whitfield	*Tyne*	15
Willington	*Tyne*	337
Wooler	-	12
Wylam Moor	*Tyne*	152

The number of the different sorts of coals as above, which were in one day on sale in the market, on four particular occasions, within the above period, amounted to 24; on three market days, there were 23 different sorts sold; on three days, 22 sorts; on two days, 21 sorts; on eight days, 20 sorts; on seven days, 19 sorts; on 10 days, 18 sorts; on 18 days, 17 sorts; and on 235 market days, cargoes of from 10 to 15 different sorts of coals, were reported as sold in the London market.

From the above table, the proportionate frequency of demand and facility of supply in London, for different sorts of coals, appears to have stood as follows, *viz.* Wall's end, Bigg's main, Hebburn main, Heaton main, Bourn moor main, Willington, Benton, Walker, Montague main, Hartley, Blyth, Hollywell main, Pontop (Windsor's), Tanfield moor (Pitt's), Russel's main, Wylam moor, &c. The order of the different sorts of coals, as to price per chaldron, on ship-board in the pool, have, on several occasions, stood as follows, beginning with the highest, *viz.* Wall's end, Percy main, Bigg's main, Heaton main, Hebburn main, Kenton, Walker, Willington, Benton, Montague main, Adair's main, Eighton main, Cowper main, Tanfield moor, Pontop, Brandling, Blyth, Bourn main, Team, Hartley. Newbottle, Russel's main, Bedford main, Hollywell main, Wallbottle, &c. These prices are of course subject to vary considerably, according as the vessels arrive in considerable numbers or not, with the sorts which happen to be at that time in demand. We have been at considerable pains in collecting the above particulars, in order to throw all the light in our power upon a branch of commerce, of the first importance in a national point of view, but particularly so to the metropolis, whose prosperity and comforts so much depend upon it. In Eddington's "Essay on the Coal Trade, 1803," many highly useful particulars on this subject will be found.

By 30 C. II. st. 1. c. 8. and 6 and 7. W. c. 10. and 11 G. II. c. 15. a penalty of 10*l.* is enacted, for defacing marks on keels, boats, waggons, &c. used for the carriage of coals in the ports of Newcastle, Sunderland, &c.; and by 15 G. III. c. 27. extended to the other parts of this kingdom. By 31 G. III. c. 36, regulations are enacted to the same purpose; and any person convicted of removing, defacing, or destroying such marks, is subject to the forfeiture of a sum not less than 40*s*, and not exceeding 5*l.* By 12 Ann. st. 2. c. 17. every coal-bushel shall be round, with an even bottom, be 19½ inches from outside to outside, and contain one Winchester bushel; and all sea-coal and culm, chargeable with any duties by the Winchester measure, shall be charged, sold, measured, and paid by the chaldron, containing 36 such bushels heaped up. By 17 G. II. c. 35, three justices may set the retail price of coals, after landing in any place to which the 16 and 17 G. II. respecting the price of coals brought into the river Thames, doth not extend, as they shall judge reasonable. Concerning the weights, measures, and prices of coals, especially in and about London; and also concerning the duties upon them, there are various regulations enacted by about 40 different acts of parliament, which

which we shall not recite. The stat. 43 G. III. c. 134, which is an "act for establishing a free market in the city of London, for the sale of coals, and for preventing frauds and impositions in the vent or delivery of all coals brought into the port of London, within certain places therein mentioned," situate within the distance of 25 miles from the Royal Exchange, in the city of London, empowers the corporation of London to purchase the coal-exchange in the said city, and regulates the mode of indemnity to those whose buildings may be requisite for the purposes of the said act. For preventing the sale of one sort of coals for another, the vender and dealer shall forfeit, for every such offence, 20*l.* per chaldron so sold; and such vender or dealer shall not be subject to any penalty inflicted by the 3 Geo. II. c. 26, on every person who shall knowingly sell one sort of coals for, and as a sort of coals which they really are not; provided always, that no ship-owner, master, or other person, having the care or command of any vessel within the said port of London, shall be subject to such penalty in respect of any number of chaldrons exceeding 25 chaldrons, for the same cargo of coals. This act directs, that no coal-meters or coal-heavers shall be unnecessarily detained on board a ship, and settles how the wages of coal-heavers shall be paid; it also requires, that ship-meters shall give certificates of the coals delivered in each lighter; and that no fractional part of five chaldrons shall be delivered into any room of a barge, under a penalty of forfeiture in the first case, of a sum not exceeding 10*l.*, and in the latter not exceeding 20*l.* This statute further enjoins and prescribes the mode of remeasuring coals by the vat; and also enacts, that in case the coals so remeasured shall not amount to the quantity mentioned in the certificate of such ship-meter as required by this act, the coal-meter, who measured them from the vessel into the craft, shall, for every bushel found deficient, if the deficiency be not equal to three bushels in five chaldrons, forfeit 5*s.* per bushel, and if such deficiency shall equal or exceed three bushels in five chaldrons, then such meter shall forfeit 5*l.* per bushel; and also the expences of placing the vat for the remeasurement. Carmen are required to carry a bushel measure in their carts, of the form, size, and dimensions directed by the 12 Ann. c. 17; and the carmen, not having such measure, shall, for every offence, forfeit not exceeding 10*l.* nor less than 40*s.*; and the vender or dealer in such coals, shall forfeit not exceeding 20*l.* nor less than 5*l.* Carmen are also to deliver a printed ticket in a prescribed form, previous to the delivery of any coals; and in default of such delivery, for every such offence forfeit not exceeding 10*l.* nor less than 40*s.* Meters are forbidden to give certificates without actually measuring the coals comprised in them, under forfeiture of a sum not exceeding 20*l.* if it shall appear upon the remeasurement of such coals, or any part thereof, that any sack shall not contain three bushels; then the vender of, or dealer in such coals, shall for every sack of coals deficient, on the remeasurement, forfeit not exceeding 40*s.* for every sack so found deficient. Every sack used for the delivery of coals within the limits determined by this act, shall measure in the inside, at least four feet two inches in length, by two feet one inch in breadth, under a forfeiture of a sum not exceeding 40*s.*; and no sack shall, after the passing of this act, be marked at the Guildhall of London, or at the exchequer at Westminster, that shall measure less than above. The penalty on carmen for driving away coals without measuring, when required, for every such offence, is a forfeiture of a sum not exceeding 10*l.*; and the vender or dealer shall incur the same forfeiture, and such coals shall be forfeited for the benefit of the poor.

From this account of coal, as an article of commerce, and the laws relating to it, we now proceed to its natural history. There are three genera or families of coal; *viz.* brown coal, black coal, and uninflammable coal.

I. Family.—*Brown Coal.*

Sp. 1. *Common brown Coal, Bovey Coal, Surturbrand,* or *bituminized Wood.* Its colour is light brownish black; it occurs in mass; its longitudinal fracture is fibrous lamellar, passing into slaty or woody, and is slightly glimmering; its cross fracture is more or less conchoidal, with a shining resinous lustre; it acquires a polish by friction, and is moderately hard. Sp. gr. 1.4, when pure, but when mixed with pyrites, it is often considerably heavier.

It burns with a weak flame, like half-charred wood, giving out an unpleasant bituminous odour; when ignited in an open fire, it leaves a small quantity of white ashes. According to Mr. Hatchett (Phil. Transf. for 1804), 100 parts yield by distillation

30.	Acidulous water.
10.5	Thick, brown, oily bitumen.
45.	Charcoal.
14.5	Hydrogen, carbunetted hydrogen, and carbonic acid.
100	

It is found in England at Bovey, near Exeter, and in smaller quantities in the island of Purbeck, some parts of Hampshire, Sussex, &c. lodged in pipe-clay. It is also found in the territory of Hesse and other parts of Germany, in Denmark, Iceland, Greenland, Italy, Faro islands, &c.

Sp. 2. *Moor Coal.* Its colour is dark blackish brown; it occurs in mass, forming thick beds, which are full of rifts and cracks. Internally, it exhibits a bright resinous lustre; its longitudinal fracture is imperfectly slaty, its cross fracture is even, approaching to flat conchoidal. It breaks into rhomboidal fragments. It is very tender, easily frangible, and of low specific gravity.

It is found in Bohemia, Transylvania, in Denmark, the Faro islands, &c.

II. Family.—*Black Coal.*

Sp. 1. *Slate Coal.* Its colour is pure black, or greyish-black, and is often iridescently tarnished. It occurs in mass, and commonly possesses a high resinous lustre. Its longitudinal fracture is slaty; the cross fracture is small-grained, uneven, passing into flat conchoidal. It breaks into angular fragments. It is soft and easily frangible. Sp. gr. 1.25 to 1.4. It contains from 57 to 64 per cent. of charcoal, from 33 to 43 per cent. of bitumen, and from 3 to 6 per cent. of earth and oxyd of iron. The bitumen is partly in the state of asphaltum, and partly in that of maltha; in proportion to the prevalence of the former, is the caking quality of the coal.

Almost all the common coals, as pit coal, sea-coal, caking-coal, bituminous coal, run-coal, rock coal, &c. belong to this species.

Sp. 2. *Pitch Coal,* or *Jet.* Its colour is velvet black. It occurs in mass, in plates, and sometimes in the shape of branches and trunks, with the true ligneous texture. It has a brilliant resinous lustre, and a conchoidal fracture. It is soft and brittle. Sp. gr. 1.3. It burns with a greenish flame and a strong bituminous odour. It occurs in Spain, the south of France, and in the Prussian amber mines, where it is called black-amber. In France, this substance is manufactured into buttons, beads, and other trinkets.

Sp. 3. *Cannel,* or *Candle-Coal, Splent Coal,* or *Parrot-Coal of Scotland.* Its colour is dark greyish black It occurs in mass, and has a glistening resinous lustre. Its frac-

ture

ture is conchoidal. It is much lefs frangible than common coal. Sp. gr. 1.23. It is very inflammable, and crackles and flies while burning. It flames much and burns quickly, does not cake, and leaves from 3 to 4 per cent. of afhes. The fplent-coal of Scotland is a coarfe flaty variety of the above, containing pyrites, and leaving, after combuftion, about 20 per cent of afhes.

Cannel coal occurs occafionally in the Newcaftle pits, in Ayrfhire in Scotland, and elfewhere, but the largeft beds of it, and of the pureft kind, are near Wigan in Lancafhire. It is an excellent fuel; it will take a good polifh, and may, with care, be turned in a lathe, into fnuff-boxes and other trinkets, which are often paffed off for true jet.

III. Family.—*Uninflammable Coal.*

Sp. 1. *Mineral Charcoal.* Its colour is greyifh black. It occurs in plates and irregular pieces. It has a glimmering, filky luftre, and a fibrous fracture. It foils the fingers, is foft and friable. It is fomewhat heavier than common charcoal, and burns to afhes without flaming. It generally occurs mixed with flate-coal.

Sp. 2. *Kilkenny Coal, Welfh Culm*, or *Stone-Coal.* Its colour is dark iron black, verging on fteel-grey. It occurs in mafs, has a bright metallic luftre. Its longitudinal fracture is flaty; its crofs fracture is fmall and imperfectly conchoidal. Sp. gr. 1.5. to 1.8.

When laid on burning coals, it becomes red hot, emits a very light lambent flame, like charcoal, and is at length flowly confumed without caking, leaving behind a portion of red afhes.

The true Kilkenny coal is harder than Welfh culm, and of a brighter luftre; it often contains pyrites, and therefore gives a fulphureous odour when burning. This fpecies of coal is found alfo in Hungary, Italy, and France.

Thefe are the moft confiderable varieties of coal commonly known; but we muft not imagine that each of them is to be met with in a pure ftate, in thofe places where they are found; on the contrary, the different qualities and proportions of their ingredients make a vaft number of other varieties, fit for different purpofes, according to the quality and quantity of thofe they contain. The various kinds of coals are often found mixed with each other under ground, and fome of the finer forts run, like veins, between thofe of a coarfer. Mr. Magellan obferved in the fine coals employed in a curious manufactory at Birmingham, that they produced a much clearer flame than he had ever feen produced from common coal, but, on inquiry, he found that thefe were picked out from the common coals of the country through which they ran in veins, and were eafily diftinguifhed by the manufacturers, though they did not afford fufficient indications of a fpecific difference. The purpofe to which they were applied, was the moulding of rods of tranfparent and coloured glafs, into fhapes proper for common buttons, which the workmen performed with aftonifhing expedition.

On fubjecting pit-coal of any kind to diftillation in clofe veffels, it firft yields watery liquor, then an ætherial or volatile oil, afterwards volatile alkali, and, laftly, a thick and greafy oil. But it is remarkable, that by rectifying this laft oil, a tranfparent, thin, and light oil, of a ftraw colour, is produced, which, being expofed to the air, becomes black, like animal oils. From this and other obfervations, the general opinion is, that all coals, bitumens, and other oily fubftances found in the mineral kingdom, derive their origin from vegetables buried in the earth, during the fucceffive proceffes of ftratification; fince it is well known, that only organized bodies have the power of producing oily and fat fubftances.

Before a coal-pit is funk, it is neceffary to explore the ground by boring, but if there are already pits in the neighbourhood, fections are obtained from them, which prevent the neceffity of doing fo.

Boring is accomplifhed in the following manner: The rods are made of iron, from three to four feet long, and one inch and a half fquare, with a folid or male fcrew at one end, and a hollow one at the other, by which they are faftened together, and as the hole formed by them increafes in depth, other rods are added. The chifel is about eight inches long, and two and a half broad at the extremity, which is fcrewed on to the end of the lower rod, and a lever or handle is put through an eye at the top of the upper rod.

The mode of operation is, to lift up the rods a little, and then let them fall, turning them at the fame time gently round; by a continuance of this motion, a hole is fretted, and worn by degrees through the hardeft ftrata or rocks. The borers can fix on handles for two, three, or four perfons to work as they find it neceffary. After they get down to a certain depth, the rods are wrought by a bracke; a box of wood is firft inferted into the ground, to keep the rods in a vertical or ftraight direction, and a triangle is erected over the fpot where the boring is to be made (which is about three inches in diameter), for the fake of drawing up the rods; they have one key, or temporary handle, for unfcrewing, and another for fecuring the rods from falling back again; they ufe a clofe wimble to bring up fludge and foft matter. When the chifel is blunted, or has cut down four or fix inches, the rods are lifted up, either all together, if there be convenience, or by pieces, when a key is ufed to keep the rods from dropping down the hole; the chifel is fcrewed off, and the wimple or fcoop fcrewed on. This being put down, brings up afterwards the duft or pulverized matter of the ftratum through which the chifel has cut, and fhews as well what kind of matter they are boring in, as the exact depth thereof.

A confiderable improvement in this effential operation was made a few years ago, by Mr. James Ryan, a gentleman of Ireland, for which he took out patents in 1805; a copy of that for England may be feen in the 2d feries of the "Repertory," vol. vi. p. 324; this confifts in ufing a cylindrical cutter, fomething like the furgeon's trepan-inftrument, by which a core, or folid and unbroken piece of each ftratum, is cut, and by other tools brought vertically to the furface, in the exact pofition as to the cardinal points, in which it ftood in the ftrata, and thus the quantity and direction of the dip, as well as the exact nature of the ftrata or meafures, are correctly afcertained, the former being moft effential circumftances towards determining the proper place to fink an engine-fhaft, for draining the bed of coals intended to be worked. The borers and apparatus of Mr. Ryan are calculated to form a hole of any fize, from eight inches to near as many feet in diameter; fome of two feet diameter have, we are told, been actually funk thereby, to a confiderable depth, and anfwer the purpofes of pump and air-fhafts, and that one, nearly eight feet in diameter, is now finking thereby in Ireland! In April, 1807, Mr. Ryan prefented a complete fet of his apparatus to the Board of Agriculture in London, and bored a hole of fome depth therewith near Kenfington, under the infpection of fome of its members, the cores or borings therefrom, being exhibited to the Board, and lodged with the apparatus in their repofitory, they voted a pecuniary reward to Mr. Ryan. From the apparent importance

portance of this diſcovery to mining, but to coal-finding in particular, we were induced to wiſh, to give an accurate deſcription and drawings in this place of Mr. Ryan's apparatus and proceſs, but found the time too ſhort, after the Board of Agriculture became poſſeſſed of the ſame, to do it here; under the article MINING, we ſhall endeavour to give them in the further ſtate of perfection, in which practice will doubtleſs then preſent the ſame.

Boring is of the utmoſt uſe and importance in collieries, for by boring previouſly to the ſinking of a pit, the owners procure moſt eſſential data on which to proceed, being informed before hand of the nature of the earth, minerals, and waters through which they have to paſs, and knowing, to an inch or ſo, how deep the coal lies, as well as the quality and thickneſs of the ſtratum bored. The boring notes of collieries are the grand arcana of the coal-mining trade, which the owners ſometimes diſlike to diſcover to the prying eyes of the philoſopher. They have, however, been occaſionally exhibited, which gives us an opportunity of laying before our readers an account of what relates to the boring of two of the principal collieries in the neighbourhood of Newcaſtle.

Section of the Strata South of the Main Dike in MONTAGUE MAIN Colliery, $3\frac{1}{2}$ Miles above Newcaſtle.—The Numbers in the firſt column on the left-hand form an Index, from which it will be immediately perceived, where the ſame ſtrata occur; the ſecond column contains the number of the ſtrata, the third the names of each, and the fourth, or numeral columns, expreſs the thickneſs of each ſtratum in Fathoms, Yards, Feet, and Inches.

			Thickneſs of each Stratum.			
		Particulars of the Strata.	Fa.	Yds.	Ft.	In.
0	1	Soil - -	0	0	1	0
0	2	Clay - -	2	0	2	0
1	3	White poſt - -	0	0	2	6
0	4	Coal - -	0	0	0	4
2	5	Black metal ſtone - -	0	1	0	2
3	6	Grey poſt - -	1	1	2	0
4	7	Blue metal ſtone - -	2	1	1	0
3	8	Grey poſt - -	2	0	0	0
1	9	Strong white poſt -	2	1	0	0
3	10	Grey poſt - -	0	1	1	0
5	11	White poſt with black metal partings	5	0	0	0
3	12	Grey poſt - -	0	0	1	4
6	13	Brown poſt with coal pipes -	0	1	1	8
1	14	White poſt - -	2	1	0	0
7	15	Ditto mixed with whin - -	0	1	0	0
0	16	Coal - -	0	0	0	6
2	17	Black metal ſtone -	4	1	0	0
8	18	Grey metal ſtone -	4	2	0	0
9	19	Brown poſt with ſkanny partings	0	1	1	0
0	20	Coal - -	0	0	0	9
8	21	Grey metal ſtone -	1	1	2	10
10	22	Coal } BENWELL MAIN - -	0	0	1	9
11	23	Band } BENWELL MAIN -	0	0	0	6
10	24	Coal } BENWELL MAIN - -	0	1	0	0
8	25	Grey metal ſtone -	0	1	1	0
1	26	Strong white poſt -	2	1	1	0
12	27	Whin - -	0	0	2	0
1	28	White poſt - -	1	0	2	0
0	29	Coal - -	0	0	1	8
2	30	Black metal ſtone -	1	1	0	0
1	31	White poſt - -	3	0	0	0
2	32	Black metal ſtone -	4	1	0	0
8	33	Grey ditto - -	5	0	2	4
13	34	Ditto poſt with whin girdles -	2	1	0	0
1	35	Strong white poſt -	6	0	[illegible]	0
8	36	Grey metal ſtone -	3	0	2	0
0	37	Coal - -	0	0	0	8
14	38	Poſt girdle - -	0	0	2	0
8	39	Grey metal ſtone -	1	0	1	0
15	40	COAL, BEAUMOMT SEAM -	0	1	0	4
16	41	Strong white thill -	0	1	0	7
1	42	Ditto do. poſt -	2	0	0	4
1	43	Coal - -	0	0	1	6
17	44	Black thill - -	0	0	2	4
8	45	Grey metal ſtone - -	0	0	1	2
3	46	Ditto poſt - - -	0	0	2	0
8	47	Ditto metal ſtone -	0	0	2	10
1	48	Strong white poſt -	0	1	0	4
0	49	Coal - -	0	0	1	3
2	50	Black metal ſtone -	1	0	2	4
1	51	White poſt -	0	0	1	8
18	52	Blue metal ſtone with poſt girdles	1	0	0	0
19	53	White poſt with whin gridies	2	0	1	9
2	54	Black metal ſtone -	0	0	1	5
3	55	Grey poſt - -	0	0	1	2
4	56	Blue metal ſtone -	0	1	0	0
1	57	Strong white poſt -	0	0	1	3
4	58	Blue metal ſtone -	1	0	2	1
0	59	Coal - -	0	0	0	8
17	60	Black thill - -	0	1	0	4
18	61	Blue metal ſtone with poſt girdles	1	0	1	0
3	62	Grey poſt - -	0	1	0	0
1	63	Strong white poſt -	3	1	2	6
2	64	Black metal ſtone -	0	0	0	1
20	65	COAL, LOW MAIN -	0	0	2	11
8	66	Grey metal ſtone -	4	1	0	0
1	67	White poſt - -	2	1	0	0
21	68	Grey metal ſtone with poſt girdles	1	0	0	0
19	69	White poſt with whin girdles	3	0	1	6
21	70	Grey metal ſtone with poſt do.	0	1	1	0
22	71	COAL, LOW LOW MAIN -	0	0	2	10
8	72	Grey metal ſtone - -	0	1	2	0
1	73	White poſt - -	0	0	2	0
8	74	Grey metal ſtone - -	0	0	1	8
2	75	Black metal do. - -	0	0	0	10
8	76	Grey do. do. -	1	0	2	6
3	77	Ditto poſt - -	1	0	0	6
19	78	Strong white poſt with whin girdles	3	1	1	8
8	79	Grey metal ſtone -	3	0	2	6
3	80	Ditto poſt - -	0	0	2	0
1	81	White poſt - -	0	1	2	0
8	82	Grey metal ſtone - -	0	0	1	0
0	83	Coal - -	0	0	0	6
8	84	Grey metal ſtone - -	0	0	1	0
21	85	Ditto with poſt girdles -	3	0	2	2
0	86	Coal - -	0	0	0	5
8	87	Grey metal ſtone - -	0	0	0	4
3	88	Ditto poſt - -	1	0	1	6
7	89	White do. mixed with whin -	2	1	0	4
8	90	Grey metal ſtone - -	0	0	1	0
0	91	Coal - -	0	0	0	3
2	92	Grey metal ſtone with poſt girdles	1	0	0	6
19	93	Strong white poſt with whin do.	0	1	2	5
			122	1	2	3

Section

Section of the Strata of the Low Main Coal at Saint ANTHONY's Colliery, three Miles below Newcaſtle.

		Particulars of the Strata.	Thickneſs of each Stratum. Fa.	Yds.	Ft.	In.
0	1	Soil - -	0	0	2	0
0	2	Clay - -	4	1	1	0
1	3	Brown poſt - -	12	0	0	0
0	4	Coal - -	0	0	0	6
2	5	Blue metal ſtone - -	2	1	2	0
3	6	White girdles - -	2	0	1	0
0	7	Coal - -	0	0	0	8
4	8	White and grey poſt -	6	0	0	0
5	9	Soft blue metal ſtone -	5	0	0	0
0	10	Coal - -	0	0	0	6
6	11	White poſt girdles - -	3	0	1	0
7	12	Whin - -	1	1	1	6
8	13	Strong white poſt -	3	0	1	0
0	14	Coal - -	0	0	1	0
9	15	Soft blue thill - -	1	1	2	0
10	16	Soft girdles mixed with whin -	3	1	2	0
0	17	Coal - -	0	0	0	6
11	18	Blue and black ſtone -	3	1	1	0
0	19	Coal - -	0	0	0	8
8	20	Strong white poſt -	1	1	0	0
12	21	Grey metal ſtone - -	1	1	1	0
0	22	Coal - -	0	0	0	8
13	23	Grey poſt mixed with whin -	4	0	1	0
14	24	Ditto girdles - -	3	0	1	0
15	25	Blue and black ſtone -	2	0	2	0
0	26	Coal - -	0	0	1	0
12	27	Grey metal ſtone - -	2	0	0	0
8	28	Strong white poſt - -	6	0	0	0
16	29	Black metal ſtone with hard girdles	3	0	0	0
17	30	COAL, HIGH MAIN -	1	0	0	0
			76	0	0	0
18	31	Grey metal - -	4	1	0	0
6	32	Poſt girdles - -	0	0	2	0
5	33	Blue metal - -	0	1	1	0
14	34	Girdles - -	0	0	1	2
2	35	Blue metal ſtone - -	5	0	0	0
8	36	Poſt - -	0	0	1	0
2	37	Blue metal ſtone - -	3	0	0	0
19	38	Whin and blue metal - -	0	0	1	6
8	39	Strong white poſt - -	3	1	0	0
1	40	Brown poſt with water -	0	0	0	7
20	41	Blue metal ſtone with grey girdles	2	0	2	0
0	42	Coal - -	0	1	1	0
2	43	Blue metal ſtone - -	3	0	0	3
8	44	White poſt - -	0	1	1	0
0	45	Coal - -	0	0	0	6
21	46	Strong grey metal with poſt girdles	2	0	0	6
8	47	Ditto white poſt - -	1	0	1	0
7	48	Whin - -	0	0	1	0
2	49	Blue metal ſtone - -	1	0	2	7
21	50	Grey ditto with poſt girdles -	2	1	1	5
22	51	Blue do. whin do. -	1	1	1	3
0	52	Coal - -	0	0	1	6
23	53	Blue grey metal - -	0	1	0	8
8	54	White poſt - -	2	0	0	7
24	55	Ditto mixed with whin -	2	0	0	0
8	56	White poſt - -	1	0	2	0
25	57	Dark blue metal and coal -	0	0	2	2
26	58	Grey metal ſtone and girdles -	2	0	2	0
24	59	White poſt mixed with whin. -	3	0	0	7
7	60	Whin - -	0	0	1	0
24	61	White poſt mixed with whin -	1	0	0	6
12	62	Dark grey metal ſtone -	0	1	0	3
0	63	Coal - -	0	1	0	6
27	64	Grey metal with whin girdles -	1	1	1	10
21	65	Ditto with girdles -	1	1	0	0
0	67	Coal - -	0	1	0	2
23	68	Blue and grey metal -	0	1	1	0
8	66	White poſt -	0	1	0	0
0	69	Coal - -	0	0	0	9
23	70	Blue and grey metal -	2	0	0	0
24	71	White poſt mixed with whin -	0	1	1	6
18	72	Grey metal - -	1	0	0	6
21	73	Ditto with girdles - -	1	0	0	9
28	74	COAL, LOW MAIN - -	1	0	0	6
			135	0	1	6

From the foregoing ſections will be ſeen, the various ſorts of ſubſtances through which the miner, near Newcaſtle, has to paſs, before he comes to the object of his purſuit: theſe ſubſtances we may divide into ſix different claſſes, of each of which we will give an account in their order.

1ſt. Whin-ſtone; the ſtrata thus named are the hardeſt of all others, ſo that angular pieces of it will cut glaſs. It exhibits, by fracture, the appearance of large grains of ſand, half vitrified. It can ſcarcely be wrought, or broken in pieces by common tools, without the aſſiſtance of gunpowder; it decays a little by being expoſed to the atmoſphere, leaving a brown powder; in the fire it cracks, and turns reddiſh-brown. Each ſtratum is commonly homogeneous in ſubſtance and colour; the moſt common of which are black or dark blue, yet there are others of it aſh-coloured and light brown.

2d. Poſt-ſtone, is a free ſtone of the hardeſt kind, of a very fine texture, and when broken, appears compoſed of the fineſt ſand. It is commonly found in a homogeneous maſs, though variegated in colour, and is not ſubject to injury from expoſure to weather: there are four varieties of this ſtone; 1ſt. The white-poſt, which, in appearance, is like Portland-ſtone, but conſiderably harder. This is ſometimes found having brown, red, or black ſpots. 2d. Grey-poſt, which has the appearance of a mixture of fine black and white ſand; it is often variegated with brown and black ſtreaks, the laſt mentioned look like ſmall clouds compoſed of particles of coal. 3d. Brown or yellow poſt is often met with of different degrees of colour, moſt frequently that of light ochre or yellow ſand. It is as hard as the others, and ſometimes has black and white ſtreaks. 4th. Red-poſt is generally of a dull red colour. It is often ſtreaked with white or black, but is rarely met with. All theſe lie in ſtrata of different thickneſſes, but commonly thicker than any other ſtrata. They are ſeparated from each other by ſmall partings of coal, of ſand, or of ſoft matters of different colours, which are very diſtinguiſhable.

3d. Sand-ſtone; this is a free ſtone of a coarſer texture than the above; it is eaſily pervious to water, and when broken, is of a coarſe ſandy texture. It is friable, and readily moulders to ſand when expoſed to the air and rain. It has frequently white ſhining ſpangles, or plates of mica, in it, and pebbles, or other ſmall nodulous ſtones incloſed in its maſs; of this there are two kinds, diſtinguiſhed by their colours grey and

and brown. It is found in considerable thickness with but few partings, which are sandy or soft. It is sometimes in layers as thin as the common grey slate.

4th. Metal-stone; this is a tolerably hard stratum, next in point of hardness to sand-stone, solid, compact, of considerable weight, of an argillaceous substance, interspersed with nodules or balls of iron ore, and yellow or white pyrites. The surfaces of its strata are hard, polished, and smooth. When broken, it has a dull dusky appearance, is of a fine texture, like hard, dried clay mixed with particles of coal. Though hard in the mines like the sand-stone, it moulders when exposed to the action of the air. Its colour varies from black to light brown or grey; it lies in strata of various thickness.

5th. Shiver; this stratum is more frequently met with in collieries than any other; it is known to the miners under the names of black shiver, black metal, or bleas; the black is the most common, it is softer than metal stone, and, in the mine, is rather a tough than a hard substance. It is easily separable by the multitude of its partings. It breaks into long small pieces when struck with force, which, on examination, present the figures of small irregular rhomboids, each of which has a polished glassy surface; when broken across the grain, it exhibits a dry laminated texture, like exceedingly fine clay. It is very friable, feels to the touch like an unctuous substance, and dissolves in air or water to a fine black clay; and, like the last mentioned, it sometimes contains nodules of iron stone, often even beds of iron-stone are found in it. The colour of the shiver is not confined to black; it discovers brown, dun, and grey colours, and a variety of shades according to the proportions of each. Its strata are parted from each other by lamina of spar-coal, or other matter; as may be seen by the foregoing section.

Many of these strata are considerably thick, being frequently found from 100 to 200 feet in depth, or upwards, of nearly the same kind of matter throughout, whilst others again are of the least imaginable thickness. They are all divided or parted from each other, either by an even, smooth, polished surface, or with a very thin lamina of soft, dusty matter between them, called the parting, by which means they are easily separated; yet though the surfaces are sometimes so closely joined together, that it is with difficulty they can be separated, which is called a bad parting, they are never known to be in the slightest degree intermingled.

There are besides this principal division or parting, secondary ones also laterally, but these are not so strong or visible, and are only met with, where the texture is not of a uniform hardness or colour through the whole body of the strata. In almost every stratum there are other divisions called backs, which cross the former longitudinally, and cut the whole stratum through its two surfaces; these are again crossed by others, called cutters, running either in an oblique or perpendicular direction, and which cut the stratum through its two surfaces, and, together with the other partings, divide it into various figures. The softer kind of strata has in general more backs and cutters than the harder ones, which sometimes have thin partitions of dusty or soft matter, but like the partings are sometimes without any. Whenever the strata lie regularly they are thus divided, and generally extend in this manner through a large extent of country, though it is often otherwise, for that regularity is frequently interrupted, and the strata disordered by various chasms, breaks, or fissures, which are called *dikes*, *hitches*, and *troubles*, according to their dimensions, and the matters with which they are filled; first,

Dikes, or *faults*, are fissures of the largest kind, which seem to be cracks, or breaks, of the solid strata, occasioned by one part of them being broken away and fallen from the other. They generally run in a straight line for a considerable length, and penetrate from the surface to the greatest depth ever yet tried, in a direction sometimes perpendicular, and sometimes oblique, to the horizon, in which case they are said to hade or underlay. The same kind of strata are found lying upon each other in the same order, but the whole of them are sometimes greatly elevated or depressed on the one side of the dike or on the other. These fissures are frequently two or three feet wide, and at other times many fathoms. If the fissure or dike be of any considerable width, it is generally filled with heterogeneous matter, different from that of the solid strata on each side of it; sometimes with clay, gravel, or sand, sometimes with a confused mass of different kinds of stone lying edge-ways, and at others with a solid body of free-stone or even whin-stone. When the fissure is of no great width, suppose two or three feet, it is then usually filled with a confused mixture of the different matters which compose the adjoining strata, consolidated into one mass. If the dike runs or stretches north and south, and the same kind of strata are found on the east side of the dike, in a situation with respect to the horizon, 10 or 20 fathoms lower on the other side, it is then said to be a dip dike, or down-cast dike, of 10 or 20 fathoms to the eastward; or counting from the east side, it is then said to be a rise dike or upcast, of so many fathoms westward. If the strata on one side are not much higher or lower with respect to the horizontal line, than those on the other, but only broken off, or removed to a certain distance, it is then said to be a dike of so many fathoms deep, and from the matter contained between the two sides, it is denominated a clay, a stone dike, &c. There are some, though they are not often met with in the coal countries, whose cavities are filled with spar, ores of iron, lead, or other metallic or mineral matters; and it is pretty well known, that all metallic veins are nothing else than what in the coal countries are called dikes. It generally happens, that to a considerable distance on each side of the dike, all the strata are in a kind of shattered condition, very tender, easily pervious to water, and debased greatly in their quality, and in their inclination to the horizon often altered.

2dly. A *hitch* is only a dike of smaller degree, by which the strata on one side are not elevated or separated from those on the other more than a fathom. These hitches are denominated in the same manner as dikes, according to the number of feet which they elevate or depress the strata.

3dly. *Troubles* or bends may be called dikes of the smallest degree, for they are not a real breach, but only a tendency towards it. The strata are generally altered by a trouble or bend from their regular direction to a different one. When the regular course of the strata is nearly level, a trouble will cause a considerable ascent or descent; where they have, in their regular situation, a certain degree of ascent and descent, a trouble either increases or alters it to a contrary direction; and a trouble has these effects upon the adjoining strata in common with dikes, that it greatly debases them from their original qualities; the partings are separated; the backs and cutters disjoined, and their regularity disordered; the original cubic and prismatic figures, of which the strata are composed, are broken, the dislocation filled with heterogeneous matter, and the whole strata are reduced to a softer and more friable state.

Notwith-

Notwithstanding that the dikes and hitches, or faults, as they are as generally called, are filled with extraneous matters, in a considerable degree of disorder, yet there generally is a *leading*, as the miners call it, or streak of imperfect and mixed coal, which leads or directs to the vein on the other side of the fault, whether the same be higher or lower, and by which they are in a considerable degree directed, in cutting the fault to recover their vein; in very considerable faults, like that on the north of Newcastle, which drops the strata 540 feet, it is not probable that any leading can be traced. In the coal-mines near Bath, there is a fault which has altered the level of the same vein of coals, much more than in the above case.

By the sinking of the shaft, which is a narrow, perpendicular passage, a communication is opened with the various strata above-mentioned, and the different veins of coal. The strata of this fossil are seldom or never found to lie in a true horizontal situation, but generally have an inclination or descent, called, as before noticed, the *dip*, to some particular part of the horizon. If this inclination be to the east, it is called the east dip and a west rise, and according to the point of the compass, to which the dip lies, is it denominated. This inclination, or dip of the strata, is found every where; in some places it varies very little from the level, in others very considerably, even so much as to be nearly in a perpendicular direction; but whatever degree of inclination the strata have to the horizon, if not interrupted by dikes, hitches, or troubles, they are always found to lie in the regular manner first mentioned. They generally continue upon one uniform dip, until they are broken or disordered by any of the above interruptions. Wallis, in his "History of Northumberland," tells us, that the strata in that part of the island generally rise to the north-west and dip to the south-east. Dr. Stukely, in his "Itin. Curios." 1725, says, that some of the coal-works in the same country dip full east; but it is plain, he adds, that south-east is the natural dip. As those at Whitehaven, inclining south-west, receive, he supposes, a counter-bias, as being on the west side of the island; he further observes, that the principal dip is to the south-east; yet in this country dips in various directions, as the fall of valles, or beds of rivers, as well as the causes above-mentioned, occasionally influence its primary bent. See *Geology*, *Plate* I. *fig.* 1. where *aa* is intended to represent the vegetable mould or alluvial matters deposited on the surface of the regular strata, represented by *b*, *c*, *d*, *e*, &c. on the left-hand side of the figure. AA, and BB, are intended to show the dikes, by which the same are disjointed, depressed, or elevated, as before described; and where CC shows a hitch or smaller dike; DD, EE, FF, and GG, are the representations of troubles or bends of the strata.

Such are the usual dispositions of the strata; two principal difficulties are met with in the descent, the first is in keeping out quick-sands where they occur, and the second to keep the shaft so dry as to allow the men to work. A quick-sand is kept out by a process called "tubbing," that is forming a circle in the inside of the pit where the sand bed is, with staves of oak, each piece being shod with a sharp piece of iron; these are driven through the stratum of sand, so closely joined that no water can penetrate, and are kept in their situation by internal hoops or kirbs at certain distances; the water is drawn out now generally by a steam-engine and pump. See STEAM ENGINE, PUMP, *Pressure* ENGINE, *Bucket* ENGINE.

Through a large district of South Wales, their highly valuable veins of coals, of which an account was lately presented by Mr. Edward Martin to the Royal Society (and published in the Philosophical Transactions for 1806, p. 342, &c.) are gained at comparatively trifling expences, compared with most of the Newcastle pits; the depth of the vallies and heights of the hills in that part of the country, allowing several successive and thick veins of coals to be worked by tunnels into the hill above the level of the rivers, or springs of water, in the vallies; and the coals, and the valuable iron ore which also abounds, are let down into the boats on the canal tunnels, or as loading for tram-waggons in the tunnels below; through which they are conveyed to open day, and thence to the iron-works or place of shipping: of several of these curious works in South Wales we have given concise accounts, under the names of the particular canals, railways, &c. in our article CANAL; and we shall take occasion, as the names of them occur in our work, to give several material additions and corrections which have come to our knowledge, principally through the kindness of Mr. Martin above mentioned, since that article was put to press, so as to render the same, we hope, quite complete.

In the environs of Glasgow there are considerable coal-mines of excellent quality, which are also worked at an easy expence; they are found under beds of quartzose freestone, which in some mines are more than 140 feet thick; it adheres to the freestone, without any intermedium. The coal appears at the depth of 30 feet from the surface, in scattered lines running in an irregular manner through the midst of the freestone; then follow beds of the same stone without the least vestige of coal, but as the beds descend, the coal reappears in small straggling and interrupted seams from three to four inches thick; these are again succeeded by an unmixed mass of freestone, which falls through a depth of more than 40 feet, and terminates in solid and continued beds of coal. It is much to be regretted that the operation of boring is held in so little estimation in Scotland, but the reason is very obvious; in England it is made a distinct trade, and is conducted by men of information, who have been regularly brought up to the business: in Scotland it is effected by any common workmen about the pits, possessing neither information nor experience, and their accounts are consequently so confused, imperfect, and equivocal, as to merit no confidence whatever.

The great and universally felt importance of its veins of coals to this country, makes us again regret our inability, at present, to lay before our readers, any more than a few of the principles, of the modern and yet unpublished discoveries of Mr. William Smith, on this and other subjects connected with the stratification of the British islands (see our articles *Structure of the* EARTH and STRATIFICATION.) It is confessedly of the first importance, either to the inhabitants of a district in general, or to the owners of the soil in particular, to be able to detect and work such veins of coal, as may exist under their soil; and hence we find on inquiry in the neighbourhood, that almost every common, moor, heath, or piece of bad land, in parts where coals are scarce, have at one time or other been reported by ignorant coal-finders to contain coal: how many times, for instance, have our grandmothers and nurses, repeating their stories, told us, that plenty of coals might be dug at Blackheath, near Woolwich, and on other commons near London, if government had not prohibited their being dug, for encouraging the nursery of seamen, &c. Our inquiries, and those of Mr. Smith, have brought to light hundreds of instances, where borings and sinkings for coals have been undertaken in such situations, and on such advice, in the southern and eastern parts of England, attended with heavy, and sometimes almost ruinous, expences to the parties, though a source of profit to the pretended coal finders, who, or some of their never-failing race of successors, equally sapient, have in many instances been able to return to the same spot or or neighbourhood, and perfuade a new proprietor to act again the fame farce, and fquander his money on an unattainable object; for fuch, we can without hefitation pronounce, the publication of Mr. Smith's map and fections of England will prove it to be. This gentleman, more than 15 years ago afcertained, by an actual examination of the country, that the ftratum on which London ftands, is the higheft but one (the Bagfhot-Heath Sand) in the Britifh feries of ftrata, and that whether we proceed from London directly for the Newcaftle coal mines, in a direction not greatly to the weft of a north point, or to thofe in Somerfetfhire, near Bath, lying in an cafterly direction, or rather fouth of it, from the metropolis; or whether we travel thence to the neareft coal mine, lying in any intermediate direction, as in the counties of Durham, Yorkfhire, Nottinghamfhire, Leicefterfhire, Warwickfhire, Gloucefterfhire, &c.; on a careful examination we fhall find, the very fame fucceffion of ftrata occurring upon the furface, and may eafily fatisfy ourfelves, by an examination of the quarries, pits, and even of the hollow roads and ditches, which are every where to be found, of the identity in the nature of the various ftratified matters, as fand, chalk, marle, clay, limeftone, &c.; and of the exact occurrence of each in the fame order, as we proceed outwards from the metropolis. A more particular examination will next fatisfy us, that thefe appearances are occafioned by the feveral ftrata which we have mentioned, fucceffively rifing towards the north weft, (and confequently dipping in the contrary direction) generally fpeaking, and ending one after another, with very curioufly indented or fingered edges, after which the fame ftratum never occurs again: the chalk ftrata, for inftance, will be quitted near Dunftable, in the road to Warwickfhire, and never be feen afterwards on the furface, or be found funk to in any pit or excavation during all the remainder of the journey, or even in purfuing one in the fame direction, to the utmoft limits of the Britifh iflands; and, though we fhall, in fuch an examination, meet with a number of different fands, clays, and other ftrata, which may feem at firft fight to be recurrences of the fame ftratum, after it has rifen to the furface and ended; yet, on examining two of fuch more minutely, we fhall find, either the ftrata lying in undifturbed contact with them above and below, to be different in the two cafes, or their vifible or chemical qualities to differ, their thickneffes to vary, or, that the fame particular fpecies of organic remains are not found imbedded, or their impreffions left in one of the ftrata, as are obfervable in the other: wherever, on the contrary, thefe circumftances concur, they may be faid to prove the identity of any ftratum, at however diftant points it may be compared; and for fhortening our inquiries for fuch purpofe, fcience happily prefents us with the profpect of fimilar advantages, to thofe poffeffed by the botanift of the prefent day; who, inftead of examining all the parts of a plant fuppofed to belong to particular genera or fpecies, proceeds at once to examine fome one or two of them, which the writings of former botanifts have fhown to be effential characters of that particular plant; and it is no unreafonable hope now to form, that the effential characters of each of the moft remarkable and ufeful ftrata in the Britifh feries, will ere long be generally known to mineralogifts, fince they have become fo to fome particular individuals. Each particular ftratum appears to us, to have formed part of one vaft plane, with a flight inclination towards the fouth-eaft, or nearly, and with great extenfion in the directions of N.E. and S.W. in thefe latitudes; prior to the truly enormous violence with which the earth has fince been diflocated and broken, during the formation of the dikes, faults, hitches, and troubles, which we have had occafion more particularly to mention in this article, and fome greater ones, which we fhall have future opportunities of mentioning, particularly that by which the whole of the land of England, fouth of the river Thames, has been difturbed and broken from its original pofition (dipping S.E.) into one, in which all the ftrata north of a line paffing not far from Haftings, Battle, Eaft Grinftead, Guildford, &c. have now a much greater dip, nearly at right angles thereto, or N.E.; while, on the other, or fouth fide, they have juft a contrary or S.W. dip; but with as many local deviations or partial dips in each cafe, as are ufually to be found, and which fometimes vary, perhaps in feveral directions, many times in travelling a mile, and yet on the whole, the ftrata keep rifing as above, the planes being the longeft in one particular direction.

The organic remains, or exuvia of different animals, and the remains of plants, are found lodged in our ftrata in the greateft abundance, and, to fuperficial obfervers, appear to have no method or arrangement therein; but, on a clofer examination, and taking care to notice the minuter differences in thefe organized remains, it will be found, that each particular kind, either alone, or mixed with one or more diftinct kinds, occupies a certain thicknefs of ftrata, fometimes but an inch, or lefs, and fometimes many feet, but extending to the greateft diftances in the plane of that ftratum, and that either above or below thofe limits, the remains will be found to be different, or none are found; hence the layers of fhells, plants, &c. become the moft ufeful, as well as certain, criteria of the identity of ftrata; thefe often changing, where the obvious qualities of the ftrata appear unchanged, by which means they divide thick ftrata into thinner ones, and furnifh us with fo many more afcertained or known points in the progreffion of ftrata; which, in the confined operation of finking a fhaft or well, is of the greateft importance, but particularly fo in boring, for afcertaining the ftrata. See Philofophical Magazine, vol. xxv. p. 45.

We have been led to enter thus far into Mr. Smith's theory of the ftratification, in order to explain in this place fome part of that which relates more particularly to the finding of coal; and as the mention of organic remains has, and muft often again occur, we beg here to call the attention of our readers to three diftinct eras obfervable, relating to foffil organized bodies; 1ft, that period in which the animals themfelves, or their exuvia, and vegetables, were quietly depofited and buried, in and among the fucceffive depofitions of ftrata, taking effect according to laws, apparently as uniform and extenfive as thofe of cryftallization; 2d, a period wherein the ftrata were ruptured, torn, and wafhed by mighty currents of water, and during which great quantities of the organized remains from within the ftrata were detached, broken, and worn, and at length left with the gravel and alluvial matters, which now cover almoft every part of the furface, although, in many places, fuch alluvium is no thicker than what is called the vegetable mould; 3d, a period extending from the laft to the prefent time, in which the waves of the fea on its coafts, the currents of inundated rivers, and the other operations of nature, have, though in a very limited degree, been continuing the fame procefs of wafhing out, breaking, expofing, and wearing the original organized matters of the ftrata, thofe which had in the fecond period been depofited with the gravel and alluvium; and expofing alfo, in many inftances, organized remains belonging to an earlier part of the prefent or third period; which is further diftinguifhed, by the growth of immenfe beds of vegetable, or peaty matters on the furface, which have inclofed the remains of recent animals, vegetables, &c. mixed with the occafional depofitions of muddy waters, to which fuch have, in low fituations, been repeatedly fubject.

When, therefore, we fpeak of organized remains, without further

further explanation, we wiſh to be underſtood as meaning thoſe of the ſtrata, of the firſt era, no otherwiſe altered than by the gravity or chemical action of the ſurrounding matters; when we wiſh to ſpeak of the organized remains peculiar to the ſtrata, but diſturbed during the ſecond era, we ſhall, as Mr. Smith does, call them *gravel foſſils;* and this, whether they bear marks of breaking and wear, or not, if they are found depoſited with gravel, or among angular or worn fragments of matter near the ſurface, the evident effects of colliſion and attrition; when we have to mention the organized foſſil matters of the third era, if they appear ſuch as have been depoſited by water among gravel, and the depoſitions of water, as above mentioned, or have been buried by the labour and works of men or animals, and undergone a mineralization, we ſhall call ſuch *recent foſſils*, while thoſe which owe their burial, and probably their change and preſervation, to vegetation, ſhall be called *peat foſſils;* theſe terms and diſtinctions appear to us eſſentially neceſſary for avoiding, in theſe inquiries, endleſs miſtakes and abſurdities, into which former writers on this ſubject have been led, for want of ſuch diſcriminations. When organized matters of the preſent race, are found on or near the ſurface of the earth unchanged, at leaſt not mineralized, they will ſtill be denominated recent ſhells, bones, teeth, horns, plants, &c. and will be ſufficiently diſtinguiſhed from our recent foſſils above.

A careful examination of the ſeveral ſtrata which intervene and end, between London and any of the neareſt points mentioned as coal-diſtricts, will ſhow theſe ſtrata to be very various in their qualities, and in their thickneſſes (altogether amounting to ſeveral hundred fathoms), with no one circumſtance ſo obſervable among them, as the total abſence of diſtinct vegetable impreſſions or remains (among their numerous animal remains,) except of wood, and which, it is obſervable, are generally, we believe we might have ſaid always, found in theſe upper ſtrata in the ſeries, in caſual, detached, and broken pieces of the trunk, almoſt like chips and billets, and generally with the appearance upon them of previous rottenneſs and wear, from toſſing or floating in water; not unfrequently alſo, this ſuppoſition is ſtrengthened by the worm-holes with which theſe detached pieces of wood abound, particularly in the Woburn Sand ſtratum, where mineralized remains of the worms or animals which perforated the wood, found below the fuller's-earth ſtratum, are ſtill ſeen occupying the holes in the ſilicious wood, of which we have ſpecimens now before us. The pieces of wood found in the ſeries above the coal, are in ſtates as various as the matters of the ſtrata incloſing them; in many inſtances they are ſilicious, pyritic, or ochreous, leſs frequently, perhaps, they occur in a ſoft rotten ſtate, ſometimes like charcoal, and at others bituminized almoſt to the conſiſtence of pitch; and theſe laſt ſpecimens they are, which, when accidentally accumulated, as at Bovey-Tracey, and many other places, on the out-crop of the Purbeck pipe clay ſtratum, have been improperly denominated coal ſtrata; and in Suſſex, and other parts, have miſled the coal-finders, or perhaps rather their credulous employers, above alluded to.

This abſence of vegetable impreſſions will be found to continue in our journey outwards from the metropolis, until a remarkable ſtratum is paſſed, called by the miners in Somerſetſhire the "red earth," being a very red ferruginous earth, or ſtone, ſomething like that on which the city of Coventry ſtands: from hence, examining weſtward or northward, we ſhall find a material change take place, in the animal remains becoming very ſcarce, and vegetable impreſſions beginning to appear and increaſe, among a certain ſeries of ſtrata, called, by the miners of ſeveral counties, the "coal meaſures," which are often remarkable for their quick and varied alternations, as the two ſections of coal ſtrata or meaſures, which we have given in this article, will exemplify. For many fathoms together, among ſome of the coal meaſures, particularly in the argillaceous or coal-ſhales, ſcarcely a lamina of the ſtrata, as thick as paper, can be ſplit off, without expoſing the impreſſion or bituminized remains of ſome plant, as mentioned hereafter, many of them highly beautiful: as thoſe appearances increaſe, veins of coals, or uniform ſtrata of theſe bituminized vegetables, without the intervention of ſhale, or earthy matters, occur; theſe are often extremely thin, and have intervening ſtrata, or coal meaſures, ſometimes of conſiderable thickneſs between them, ſo that in ſome of our Britiſh coal-pits, 30 or more diſtinct and ſeparate veins of coal are ſunk through, before the "main," or moſt deſirable ſeam of coals is reached; from which, if the pit was to be farther ſunk, or if we travel weſtward or northward to the ending of the ſeveral meaſures ſunk through, and over thoſe below, we ſhall at length find theſe coal-meaſures end, and what the miners call "dead earth," or ſtrata, as diſſimilar to coal-meaſures as thoſe at the top of the Britiſh ſeries, already mentioned, will be found to ſucceed through a certain ſeries of ſtrata, but then other coal-meaſures will be found to occur again, &c. Theſe different ſets of coal meaſures traverſing the country, as now ſeen on Mr. Smith's map, have often been noticed by practical men, and by ſome writers, under the title of "runs of coal;" and that on which Newcaſtle is ſituated, probably from its early and great importance in ſupplying the metropolis, has been called the "great run." The firſt workings of all our coal has evidently been upon their out-crop, or breaking-to day, either at the ending of the ſtrata, or where the former and convulſive heavings of the ſtrata have left their edges bare, or nearly ſo: but experience has progreſſively proved, as the improvements of pumps, and machinery permitted, that the coals were better in quality, and leſs troubled, the farther they were purſued into the deep, or in the direction of the "ten o'clock ſun," from their out-crop, moſt generally: and thus the Newcaſtle mines have been progreſſively creeping nearer to the ſea, and now extend to, or under it, and ſtill find their coals improve; of which the Wall's End coals, brought to the London market, are an inſtance: in like manner, the mines on the oppoſite coaſt, near Whitehaven, for working ſeams, which the local dip of that part occaſions to deſcend under the ſea, have their works now extended near a mile under the ocean, at about ſix hundred feet beneath its bottom. Accordingly it has occurred, that mines have been begun higher and higher up, on the ſeries of ſtrata, called coal-meaſures, and, conſequently, had their pits of greater depths, and now the attempt is making at Bath-Eaſton, in Somerſetſhire, of ſinking in matters above the red earth, in hopes of there reaching the Somerſetſhire coal-veins, hitherto not worked ſo far eaſtward, or into the deep, by ſome miles, although ſome of their mines, owing to the rapidity of the partial dips are, we believe, working at the greateſt depths of any in the kingdom. An application of the principles above explained will enable any ingenious perſon to judge, whether his diſtrict is likely to contain coals, at practicable mining depths; for it ſeems an uſeleſs inquiry, whether they exiſt or not beyond this; for inſtance, whether the vicinity of London, and the more ſouth-eaſterly parts of our iſland have the coal-veins of the middle counties dipping under them, it can be of ſmall uſe to inquire; from the immenſe number and thickneſs of the known ſtrata which intervene, and contain no coals, or other very valuable matters. The very open and porous ſtate of ſome of theſe ſtrata, the chalks (more than 50 fathoms thick) for inſtance, occaſion them to be ſo powerfully ſupplied with

 water

water, as to render the profpect of finking even one fhaft through them at London, utterly hopelefs. Mr. Dodd, whofe fcheme for a tunnel in chalk under the Thames, at Gravefend, we have noticed in our article CANAL, has fince complained to the public, that the boring of one fmall augre hole, before his fhaft was funk, let up fo much water into it, that he was unable to penetrate more than 122 feet deep; what then was he to have expected, had he ever come to open the length of 900 yards of an 18 feet tunnel in this fame chalk? We hope to be excufed for thefe digreffions, as they tend, we think, to illuftrate the queftion, of the practicability of finding coals, through a large and important part of our ifland; and we fhall now proceed to the methods ufed in finking for coals.

The firft operation after finking the engine pit of a coal mine is the working or driving in the coal, and finking the firft coal pit; the fituation of which fhould be a little higher up the plane of the ftrata, or to the rife of the engine pit, that the water which collects may not obftruct the working of the coals when the engine ftops: yet it fhould not exceed the diftance of 30 or 40 yards, becaufe when the firft mine is to be driven a long way, it becomes both difficult and expenfive. After the pit is thus funk to the coal, the miner is to begin his work; he firft digs or undermines with his pick-axe, a light inftrument for hewing coal, (nearly in the fhape of an inftrument of the fame name ufed by paviors and gardeners) at the bottom, and on one fide, into the feam or ftratum as far as he can; he then forces down great pieces of coal by a wedge and mallet, taking care to leave, at proper intervals, pillars for fupporting the roof.

Fig. 2. in *Plate* I. reprefents the plan of the workings of a coal mine, where A A reprefents the main paffage or gangway, in the direction of the dip, and in which tram-plates or rails are now often laid, for the paffage of the trams loaded with coal to the pit or winding fhaft; B B, C C, D D, and E E, reprefent other parallel and ftraight paffages, between the pillars of coal, *a*, *b*, *c*, *d*, &c. *e*, *f*, *g*, *h*, &c. which are left for fupporting the roof and ftrata above.

The coal is often wrought in this manner to the limits of the mine; when thefe pillars, or fo many of them as can be got, are taken out by a fecond working, and the roof and other folid ftrata are permitted to fall down and fill up the excavation, often to the great and permanent injury of the furface of the land, and fometimes to canals, and other works, as particularly mentioned under our article CANAL.

If the roof and pavement are both ftrong, as well as the coal, and the pit only 30 fathoms deep, then two-thirds or three-fourths may be taken away at the firft working, and one-third or one-fourth left in pillars; if tender, it will require a larger proportion to be left, probably one-third or nearly one-half.

There is an overman, whofe office it is to go through the pit to examine the places which the men have wrought, to meafure their work, and to fee that the pit is free from inflammable vapour. There is alfo a deputy overman to fuperintend the pillars of coal that are left, and to fet up props or build walls, when the roof is loofe and threatens to fall. The bufinefs of the perfon called an "onfetter" is to hang the corves (ufually bafkets made of hazel rods) upon the rope to be drawn up the fhaft. Collieries are liable to an accident of a very dangerous nature, called a "creep" or "fit," when the pillars of coal are left fo fmall as to fail or yield under the weight of the fuperior ftrata, or when the pavement of the coal is fo foft as to permit the pillars to fink into it, which fometimes happens, by the great weight that lies upon them; in either cafe the folid ftratum above the coal falls and crufhes the pillars to pieces, and clofes up a great extent of the working, or probably the whole colliery.

Mr. Ryan, we underftand, propofes to cure the defect of a foft pavement, in the principal paffages, which are required to ftand for a long time, by forming them in the coal, of the form fhown in *fig.* 3. *Plate* I., or nearly approaching to elliptical; the tram-plates or rails *a*, *a*, in their bottoms occupying nearly the whole width in that part, with the undifturbed coal nearly or quite meeting under them: in this cafe it will be neceffary to conftruct two parallel paffages at a proper diftance, one for the going of the trains to the pit, and the other for their return. Another fatal accident to which coal-miners are fubject, in the vicinity of old workings between water-tight ftrata, arifes from the water contained in thefe artificial cavities, or fometimes in natural cavities or fiffures filled with loofe and porous matters, burfting in and fuddenly filling their works: the only fecurity againft this, is to bore an augre hole before the working as it proceeds, to prove the regular continuance of the coal. The collieries about Radftock, on the Somerfetfhire coal canal, have been fubject to this accident, on imprudently cutting through their faults, or dikes, which, as well as feveral of their intervening ftrata, are of water-tight matters.

There are two other evils to which coal mines are fubject; hydrogen gas called by the workmen, "fire-damp" by the explofion of which many lives are loft; and carbonic acid gas commonly called "choak damp," which is not fo fatal as the former. Hydrogen gas is principally generated, by the contact of pyrites with water in fome of the old workings of the collieries which have been neglected and not fufficiently ventilated: it there accumulates until difcovered by the occafional vifit of fome of the overmen, whofe office it is to examine the old workings called "waftes:" fometimes for want of due caution it caufes the death of many of the miners, being fet on fire with their lights. On thefe occafions the men throw themfelves on their faces to the ground to avoid the return of the blaft, as there is more danger to be apprehended from the vacuum formed by the total confumption of the inflammable gas, than from the effect which the fire has upon them. It rarely happens after an explofion that the men are much burnt; they fuffer more by the violent concuffion of atmofpheric air, rufhing into the workings to fill up the vacuum, than from any other caufe. After an accident of this kind, it is generally confidered dangerous to enter the pit for fome days, on which account it is to be feared many lives are loft which might have been faved by immediate affiftance. At Whitehaven and Workington, where the inflammable gas is very prevalent, the miners often work without candles, in driving their adits for ventilation, by the light of a flint mill, or of fparks produced fomewhat in the manner of a razor grinder's wheel: but the only effectual method of preventing accidents of this nature, is to pay due attention to the ftate of the old workings, and to caufe a thorough ventilation by the methods ufually adopted, which are the following: the air is put in motion by means of a large furnace placed near the edge of one of the fhafts inclofed in a covered building from which is a tube defcending into the pit. The heated air, thus afcending through the chimney, is fucceeded by cold from the fhaft, which in its turn is replaced from the loweft part of the mine. The whole is thus fucceffively removed, and its place is fupplied by air which finds its way from above, through another communicating fhaft open to the day. The certainty of this operation has evidently no dependence on the depth of the mine, its extent, or its form. The brifk current thus produced below, naturally takes the moft direct courfe betwixt the two fhafts. The ventilation on each fide is therefore accomplifhed, by means

means of a continued communication formed betwixt the two ſhafts in any required direction, by opening the proper avenues, and cloſing all others. A continued current is ſometimes made to paſs in this manner for twelve or eighteen miles, ſee *fig.* 4. *Plate* I. where S repreſents the ſhaft, and A the adit or working of a mine which is ſubject to damp or foul air; *a a a* is a cloſe pipe, leading from the part moſt affected to the ſurface of the ground, and there entering the lower part of a furnace, F, and aſcending through the fire therein, by the heat of which a current of air is conſtantly thrown out of the upper end of the pipe: this method is applicable, and very neceſſary, where particular and diſtant parts of the mine require ventilation; becauſe by this means freſh air can be made to deſcend down the ſame ſhaft, and along the adit through which the pipe and furnace cauſe the foul air to aſcend; for the more general ventilation of coal-mines, and where freſh air can be ſupplied by other ſhafts, as it generally can in mines at work, by means of the winding ſhaft, the water-ſhaft or engine pit, or both, a ſimpler mode is adopted, as at Worſley mine, on the duke of Bridgewater's canal, and other places, ſhown in *fig.* 5. where S repreſents the air or ventilation ſhaft, having a common roll and winch-handle erected over it, from which a cage or iron baſket, *c*, is ſuſpended by a chain, and in which a large fire of coals is conſtantly kept burning, ſome yards below the ſurface of the ground; the winch-handle is made uſe of for drawing the fire to the ſurface as often as the ſame wants repleniſhing.

Choak damp is rarely attended with any ill effects, and is eaſily diſcovered by its extinguiſhing a candle. The ſafeſt method of exploring collieries ſubject to this evil, is to walk as erect as the workings will allow; for choak damp being heavier than atmoſpheric air, occupies, of courſe, the lower part of the mine. It is more difficult to exhauſt this gas by ventilation than fire damp, as the latter aſcends, from its being lighter than atmoſpheric air, whilſt the other, by its gravity, is forced upwards with great difficulty.

It is not exactly determined by what means choak damp is generated in coal mines, but it is generally ſuppoſed to proceed from the putrefaction of vegetable ſubſtances.

After the operation of "hewing," or digging, is performed, the coals are brought to the bottom of the pit, in corves or baſkets, either drawn along the ground in the manner of a ſledge, or upon a ſmall rail or train road as they are called in Shropſhire, hooked on to a chain, and drawn or wound up by a rope to the ſurface. This is often effected by a machine called a gin, wrought by horſes. Of theſe winding machines there are various kinds; ſome wrought by water, others by the fire engine; either of the laſt named, are only convenient in ſome particular ſituations; that wrought by horſes is therefore in moſt general uſe. There are, beſides, a ſort of gins called "whim gins," and another known by the name of "macaroni gins." In the whim gin the ropes run upon two wheel-pullies over the ſhaft, the roller is at ſome diſtance, and the circular track of the horſes is not round the ſhaft. See our article *Mine* WINDING *Engine*, and *Apparatus*. To receive the coals, there are two "banksmen," who take off the corves at the top of the pit, and empty, or, as the workmen call it, "teem" them. The coals, by teeming, are diſcharged into waggons, by means of a grated ſpout, which allows the ſmall coals to go through it, whilſt the large paſs into the waggon. Boys or women attend to throw aſide the pyrites, or, as they are technically called, "braſſes," or in other places, "ſlates," which are ſold to the copperas manufacturers. See COPPERAS.

The coal-waggon has been already ſhortly deſcribed under our article CANAL; and for a fuller account, we refer to WAGGON. Our account of the waggon-ways, and rail-ways, alſo occurs under the article CANAL; and for other particulars relating to the conveyance of coals from the mines to the wharfs and veſſels: See WAGGON, RAIL-WAY, and STEATH.

Having thus given a deſcription of coal-mines, we ſhall give an account of a viſitation to a pit. That in which the beſt view is gained, and which can be entered with the greateſt eaſe and ſafety, is in the vicinity of Newcaſtle, *viz.* Eaſt Kenton colliery, the property of Meſſrs. Knowſley and Chapman. Having previouſly obtained permiſſion of a viewer, or ſome other perſon concerned in the colliery, a ſmall hand lanthorn muſt be provided, a light being neceſſary for each perſon. It is alſo adviſable to take a change of dreſs, at leaſt of upper cloaths; ſtrong boots to keep the feet dry, and an old hat. Being thus prepared, proceed to the ſteath, which is by the river ſide, about four miles above Newcaſtle, a pleaſant excurſion by water. When there, ſome of the men, who have been apprized of your coming, will aſſiſt in ſeating you on a ſet of ſmall empty coal waggons, capable of containing two perſons each, ſeven of which are drawn along a rail-way by one horſe. As ſoon as you are placed, with your candles lighted, you ſet off at full ſpeed, with a boy in the firſt waggon, for a charioteer, into a tunnel, or ſubterraneous paſſage ſix feet high, about the ſame breadth, and three miles in length. It is particularly neceſſary to guard againſt putting your hands ſuddenly out of the waggon, as the tunnel, in moſt places, is only wide enough to admit the waggon and horſes, and you are of courſe by doing ſo in danger of receiving an injury; but by ſitting quietly, you aſcend very ſmoothly, till you arrive at the place where the men are at work. At your firſt entrance into the tunnel you are ſtruck with the noiſe of the waggons, which, being faſtened with chains to each other, and going ſometimes at the rate of ten miles an hour, make a ſound reſembling thunder. The paſſage is in general hewn out of ſolid rock, compoſed of metal ſtone, a ſort of ſchiſtus. Where there is not rock, it is arched with brick or ſtone. The water from the pit runs down by the ſide of the rail-way to the river Tyne.

At intervals there are double rail-ways; and where you come to one of theſe your driver ſtops his horſe, and a dead ſilence enſues; he then calls aloud, and liſtens to hear if any loaded waggons are coming down, that they may there paſs each other; when he is paſt, your driver renews his ſpeed, until he reaches the next interval, when he repeats his call, and ſhould no anſwer be heard in return, he proceeds. If, by the negligence of the boys, the waggons ſhould meet where there is no double rail-way, the boy with the empty waggon unlooſes his horſe, which is taught to turn round, and force the waggons back with its breaſt, until they reach the double part, where they can paſs each other.

On the ſides of the tunnel you will obſerve ſeveral fungi of a pure white, which, by the heat of your hand, or expoſure to the open atmoſphere, diſſolve into water. The air up the tunnel is cold, but perfectly pure, but as you approach the workings a conſiderable degree of warmth is felt. You alight from your waggons in order to view the different operations to which your guide will conduct you.

In the upper ſeam or ſtratum, the coal is not much wrought on account of its inferior quality. Here you will ſee the ſtables for the horſes, the ſteam-engine for raiſing the coals from the lower ſeam, and the ventilating furnace, by which the impure vapours are drawn off. Here you will alſo be ſhown, on the roof of one of the lateral openings of this

this level, a variety of curious ſpecimens of plants, ſomewhat like graſſes, ferns, vetches, &c. impreſſed upon a ſort of blue ſlaty ſtone; the different plants are remarkably diſtinct from each other. There is alſo in one part the trunk of a tree, many blocks of which have been taken out to make ſeats in a neighbouring garden; as far as the ſtone has been cut, the tree has been traced even to its ſmalleſt branches, and the roughneſs of the bark is ſtill preſerved in the ſtone: the whole of this ſtratum is one uninterrupted continuation of theſe impreſſions of vegetables: it is nearly horizontal, and is 112 yards from the ſurface.

In Eaſt Kenton colliery, there are three ſhafts or perpendicular openings, for raiſing the coals. The firſt is the pit at the day, near the village of Kenton: it is circular, 56 fathoms deep, and at preſent only uſed for delivering coals for ſale at Newcaſtle. The coals are drawn up in baſkets. The bottom of this pit is on a line with the rail-way from the river. The ſecond ſhaft is eighteen and a half fathoms deep, and at a ſhort diſtance from the bottom of the firſt. It is ſquare, and juſt admits the waggons, which are drawn up and let down by the ſteam-engine. The third ſhaft is only 7 fathoms deep. After having examined the works, you may be drawn up to the ſurface by the firſt ſhaft in a baſket in about two minutes, in which ſpace of time you will have aſcended 56 fathoms. But ſhould this mode of conveyance not be approved of, you may return again by the tunnel. Brand's Hiſtory of Newcaſtle. Com. Magazine. Dr. Black's Lectures. Wallace's Northumberland. Pennant's Tour. St. Fond's Travels. Picture of Newcaſtle. Papers of the Literary and Philoſophical Society of Newcaſtle upon-Tyne. Philoſophical Tranſactions.

Coal-*balls*, balls made of coal and clay, or ſlack, for firing. Theſe balls are made with $\frac{1}{3}$ of clay, without ſand or gravel, and $\frac{2}{3}$ of *coal-duſt*, or *culm*, well mixed, and formed either into round balls or into bricks. This coal-duſt being the refuſe of the mine, makes this ſort of firing cheap. See Phil. Tranſ. N° 460. ſect. 3. See *Patent* Coal.

Coal *buſhel*. The meaſure directed to be uſed in London and other places for retailing coals, is different from the Wincheſter buſhel for corn, or malt buſhel, $18\frac{1}{2}$ inches wide, and 8 inches deep, containing 2150.42 cubic inches, deſcribed under our article Bushel. By the act of 12 Anne, the coal-buſhel is directed to be round, with an even bottom, and to be $19\frac{1}{2}$ inches diameter, from outſide to outſide, capable of containing one Wincheſter buſhel and one quart of water; of which a ſtandard is to be kept in the exchequer, and 36 of ſuch buſhels, heaped up, are to make one chaldron. By the act 43 Geo. III. the coal-buſhel was directed to be heaped up in the form of a cone, but the exact height, or proportion thereof, to the baſe or top of the buſhel ($19\frac{1}{2}$ inches) not being fixed in this act, the principal land coal-meters have, from careful and long continued obſervations of the cuſtom or practice of meaſuring coals, fixed the height of the cone at 7 inches above the top of the buſhel; this we learn from Mr. Robert Vazie, a gentleman who has laudably taken much pains, in endeavouring to introduce a bow-gage to coal-buſhels, nearly ſimilar to the bail or handle of a water-pail, which ſhould at all times, by being lifted up and ſwept over the buſhel, determine the proper quantity of the heaped part, which is now left to the diſcretion of the fillers, ſubject to the inattention or partiality of the meter, who is, or ought to be, ſtanding by. According to theſe data, the content of the coal-buſhel itſelf ($= 1\frac{1}{32}$ corn buſhel, as above) will be 2217.62 cubic inches, its depth inſide varying, from about 8 to 9 inches, according to the thickneſs of the wood in the ſides, it being the outſide diameter which is fixed by law, on account of the heaping up.

A cone of $19\frac{1}{2}$ inches diameter, and 7 inches high, will contain 696.8482 cubic inches, and therefore 2914.47 cubic inches, will be very nearly the cubic content of a heaped buſhel of coals, = 1.6866 cubic feet, = .062467 cubic yards, = 5.866365 cubic links, = .477126 ſteres or new wood meaſures of France, = $\frac{1}{36}$ chaldron, = 4 coal pecks, = 1.3553 malt, or Wincheſter buſhels ſtruck. From the above calculations, our readers will ſee, what relation the coal buſhel bears to other meaſures. By the late acts for regulating the delivery of coals in and near the metropolis, every waggon or cart uſed in delivering of coals, is required to have a lawful buſhel with it, edged with iron, to prevent wear, and ſealed; and uſing others or altering ſuch buſhels, incurs a forfeiture of 50*l.*

Coal, *Cannel*, or *Candle*. See Coal *Supra* and Ampelites.

Coal *Canal*, or *Somerſetſhire Coal Canal*, commences in the *Kennet* and *Avon* canal, about $3\frac{1}{2}$ miles above the city of Bath, and proceeds S.W. in two branches, with rail-way extenſions to the collieries N.E. of Mendip hills. See Canal.

Coal-*fiſh*, in *Ichthyology*. See Gadus *Carbonarius*.

Coal-*iſland*, in *Geography*, a village in the county of Tyrone, Ireland, where the coal works are carried on with tolerable ſucceſs. In 1800, there were five pits working induſtriouſly, and the works were not much impeded by water. There is, however, great want of encouragement; and the canal, which was made at the public expence, to the Tyrone collieries called Blackwater, has been ſo much neglected, that it is choaked up with mud and weeds. Coal-iſland is about 3 miles W. from Lough-Neagh, and 4 N. from Dungannon. M'Evoy's Account of Tyrone. See Canal.

Coal *Meaſures*, a term among miners, for the ſtrata moſt frequently alternating with beds of coal; theſe often conſiſt of argillaceous ſhale, and contain numerous impreſſions of vegetables upon them, of which there was a very curious collection in the late ſir Aſhton Lever's muſeum. See our article Coal *Supra*.

Coal *Meaſuring*. In the pool or port of London, coals are meaſured out of the ſhip into the barges, or lighters, in a veſſel or low tub, called a vat, holding nine buſhels (ſee Vat), which is heaped up by the porters who fill, until the ſworn meter, who is always in attendance, is ſatisfied with the juſtice of the meaſure, and directs the vat to be emptied over the ſhip's ſide into the room of the barge, &c. below. Out of theſe barges, &c. the coals are again meaſured by a ſtandard coal buſhel (ſee Coal-*buſhel*), in the preſence of another ſworn meter, called a land meter, and are emptied out of the buſhel into ſacks, for delivery to the buyers; a few years ago, this laſt proceſs was improved as follows:

Plate XIV. of *Mechanics*, repreſents a machine for meaſuring coals, for which Meſſrs. Simeon and Thompſon took out a patent in the year 1803. The machine, from which the drawing is taken, was erected in 1803 at the Red-croſs coal wharf, near London bridge, and has been at work ever ſince with great ſucceſs near the water-works. It is erected before the wall of the coal warehouſe, and communicates with the ſecond floor, by a large opening in the wall. The barges, containing the coals, are brought under the wall of the warehouſe, which is by the water-ſide; they are filled into buckets, and then drawn up by a machine into the houſe, where they are emptied into a wheel-barrow, and thus conveyed to the ſtage, A, *fig.* 1, in the floor of which the

the bushels, B, B, B, are placed; these bushels are of cast-iron, of the dimension directed by act of parliament; they have moveable bottoms, opening downwards on hinges toward the wall of the house, and are shut by a chain, which is fastened to the bottom, opposite the hinges, and comes up through a tube, *a*; the other end of the chain goes over, and is fastened to a wheel of cast-iron, E, mounted on a shaft, which carries similar wheels for the other two bushels; it turns on a pivot in the wall, F, at one end, and on another, working in a collar, supported in the wainscoting, G, which forms the other end of the room; the shaft projects some distance through this partition, and has a wheel, H, fixed on it, round which a rope, I K, passes; the end, K, of this rope has a ring tied to it, which is hooked on a pin in the wall, which pin is adjustable by a screw, as shown in *fig.* 2, so that when the ring is hooked on it, the bottoms of the bushels shall be close shut; *b d*, *fig.* 2, is an iron frame screwed to the wall, in which a square piece of iron, *e*, carrying the pin (on which the ring is hooked) slides; *f* is a screw turning in the frame, and passing through the piece *e*, which is tapped, so that by turning the screw by a winch, put on the square at its upper end, the pin can be raised or lowered.

The chains, D, *fig.* 1, have each a screw-link in them, by which the bushels can be all made to shut close at the same time. Beneath each bushel is a wooden hopper, L, into which the coals are emptied when the bottom of the bushel is opened, and the sacks are hung to this hopper to receive the coals; there are two small hooks at the back of the hopper, to which the mouth of the sack, M, is hooked; *h* is an iron bar, with a hook at each end, to fasten to the sack; two small cords are tied to this bar, which pass over two pulleys, and are both fastened to a ring that is hooked on a pin, driven into the hopper, in order to keep the sack's mouth close up to the hopper.

The operation of the machine is as follows: the coals are filled into the bushels by three men, and are heaped up until they touch the plummet, *d*, suspended by a chain from the ceiling; when the coal-meter, who sits before the desk, N, sees, through the window, that they are properly filled, he takes the rope, I, with one hand, and with the other slips the ring, at the end of K, off the pin, as before described; the weight of the coals, resting on the bottoms of the bushels, then causes them to open, and the coals fall into the sacks beneath; he holds down the rope, I, until the bushels are all emptied, then lets it return, and hooks the ring on the pin. The bottoms of the bushels are made to shut, by one of the spaces between the arms of each wheel, E, being filled with lead, which is equal to about half the weight of the coals; when the sacks are filled, they are placed in a hand-barrow, and are wheeled into the waggon, the stage, R, being just the same height from the ground, as the floor of the waggon, which is backed up against it.

COAL-*Mines.* See COAL. By 10 G. II. c. 32, if any person shall wilfully and maliciously set on fire any mine, pit, or delph of coal, or cannel-coal, he shall be guilty of felony, without benefit of clergy. By 13 G. II. c. 21, if any person shall convey water to any coal-work, with design to destroy or damage the same, he shall pay to the party aggrieved treble damages with costs, recoverable in any court of record at Westminster. By 9 G. III. c. 29, any person demolishing engines, waggon-ways, bridges, &c. belonging to coal-mines, or causing the same to be done, shall be guilty of felony, and be transported for seven years: the prosecution on this act being within 18 months. By 39 and 40 G. III. c. 77, any person, destroying or damaging mines or roads leading to or from the same, shall be deemed guilty of a misdemeanor, and may be imprisoned, on conviction, for any time not exceeding six months. Colliers and others, who wilfully and obstinately work in a manner contrary to their agreements, or who do not fulfil their contracts, shall, on conviction, upon the oath of one witness, before one justice, forfeit not exceeding 40*s.*, and upon non-payment, be committed to the common gaol without bail, for a time not exceeding six months, or till such penalty and costs shall be paid; and the contract shall become void. Persons convicted of fraudently walling or stacking coal, &c. shall, on conviction, by confession or oath of one witness, before one justice, be committed to the common gaol or house of correction, for any time not exceeding three months. If any person shall steal coals or implements, not exceeding the value of 5*s.*, he shall, for the first offence, forfeit not exceeding 10*s.* over and above the costs, or be committed to hard labour for one month; for the second offence, not exceeding 20*s.*, or be committed to the house of correction for three months; and for the third, or any future offence, not exceeding 40*s.*, or be committed to hard labour for 6 months. All prosecutions under this act shall commence within nine months after the offence is committed.

COAL, *Old,* an inferior sort of charcoal, made in Kent, and other places, from the roots of trees and underwood, for sale to the founders, and others, in London, who use it for some common purposes, as a substitute for charcoal.

COAL-*Orton,* or *Cole-Orton,* a rectory in the hundred of East-Goscote, in Leicestershire; it is situate very high, yet its coal-mines have attracted the rail-way extensions of canals, in two different directions, *viz.* the *Leicester* and the *Ashby-de-la-Zouch.* See CANAL.

COAL, *Patent,* is applied to a substance manufactured in Millbank Street, Westminster, under a patent, granted to Mr. Chabannes, (see *Repertory of Arts,* XV. 367.); it consists of the smaller parts, sifted out of the sea-coals, used for culinary purposes, before they are sold, mixed up with a certain proportion of dirt and sweepings of the streets, which mixture is watered and tempered together, until fit for making into small bricks, of which great numbers are set to dry in a large open-boarded shed. One or two of these coal-bricks, put into a coal-fire, are said to continue the intensity of its heat for a long time. See COAL-*balls.*

COAL-*Port,* the name given by the late Mr. William Reynolds, to a new town which he founded on the banks of the Severn river, at the entrance of the Shropshire canal. See CANAL.

COAL, *Small,* is a sort of charcoal, prepared from the spray and brush-wood, stripped off from the branches of coppice-wood, sometimes bound in bavins for that purpose, and sometimes prepared without binding.

The wood they dispose on a level floor, and, setting a portion of it on fire, they throw on more and more, as fast as it kindles; whence arises a sudden blaze, till all be burnt that was near the place. As soon as all the wood is thrown on, they cast water on the heap from a large dish or scoop; and thus keep plying the heap of glowing coals, which stops the fury of the fire, while, with a rake, they spread it open, and turn it with shovels till no more fire appears. When cold, the coals are put up into sacks for use. Small coal was formerly much more in use in London than it is at present. The siftings of charcoal are called *charm* by the London dealers.

COAL-*foot.* See SOOT.

COAL-*spirits.* Coals distilled in a retort not only afford a phlegm and black oil, but a spirit, or gaseous matter, which is

apt

apt to force the lute and break the glaffes, now known to be hydrogen gas: bladders may be filled with this inflammable air, which may be kept a confiderable time. If the bladder be pierced with a pin, and fqueezed near the flame of a candle, the gas will take fire, and afford an amufing fpectacle. See Phil. Tranf. N. 452. fect. 5. See DAMPS and GAS-*Lights*.

COAL-*tar*. See TAR.

COALBROOK DALE, in *Geography*, a village of Shropfhire, about 13 miles from Shrewfbury, which exhibits to the traveller the beneficial effects of manufacture and commerce, in its celebrated iron-works, as well as a variety of romantic fcenes. The river Severn winding between high wooded hills, oppofite to the forge of Brofeley, is croffed by a bridge of one arch, 100 feet in length, and formed entirely of caft-iron, with ftrong ftone abutments, which prefents at once a ftriking effect in landfcape, and a ftupendous fpecimen of the powers of mechanifm. This was the firft iron bridge erected in England, and was caft in 1779, under the direction of Mr. Abraham Darby. Befides the communication of thefe works with the Severn river, they have a branch of the Shropfhire canal extended to connect with their rail-ways. See CANAL.

COALESCENCE, the union or growing together of two bodies before feparate. It is principally applied to fome bones in the body, which are feparate during infancy, but afterwards grow together; or to fome morbid union of parts which fhould naturally be diftinct from each other. Thus there is a coalefcence of the fides of the vulva, anus, and nares; of the eye-lids, fingers, toes, and many other parts.

COALITION, the re-union, or growing together of parts before feparated. See CONGLUTINATION, &c.

COAMANI, in *Ancient Geography*, a people of Afia, in the vicinity of the Paropanifiani, according to Mela; the fame with the Comani of Pliny, who probably inhabited the country called by Xenophon *Comania*.

COAMINGS, in *Ship Building*, are thofe planks, or that frame, forming a border round the hatches, which raife them up higher than the reft of the deck. Loop holes for mufkets to fhoot out at, are often made in the coamings, in order to clear the deck of the enemy when the fhip is boarded.

COANCA, in *Ancient Geography*, a town of India, placed by Ptolemy on this fide of the Ganges.

COANE, among the Greeks, a name given to a peculiar fpecies of tutia or tutty, which was always found in a tubular form. It has its name from κωνη, a word ufed to exprefs a fort of cylindric tube, into which the melted brafs was received from the furnace, and in which it was fuffered to cool. In cooling, it always depofited a fort of recrement on the fides of the veffel or tube; and this was the tutty called *coane*.

COANEPILLI, in *Botany*, Hernand. See PASSIFLORA *n. n.*

COANGO, in *Geography*, a river of Africa, in the kingdom of Congo, called *Zaire*, which fee.

COANZA, a large, deep, and rapid river of Africa, which rifes in the unknown interior parts towards the eaft; and, after receiving many rivers in its courfe, and bounding the kingdom of Angola on the fouth, empties itfelf into the Atlantic, about 9° 20′ S. lat. and about 12 leagues S. of St. Paulo Loando, the capital of Angola. It is navigable about 150 miles upwards, quite to *Cambamba* (which fee); and abounds with variety of fifh, forms feveral iflands, and has fome cataracts, one of which, in particular, bears its name. Its mouth, between the capes Palmerino and Lego, is above a league wide; and its fall into the ocean is fo rapid, that the fea is rendered muddy 2 or 3 leagues below it. Its mouth is not eafily perceived from the open fea, on account of an ifland quite covered with high trees, which lies juft before it. About 15 or 16 leagues above, it divides its waters into two ftreams, of which the fouthern is the deepeft, and moft frequented. The two chief iflands formed by this river, are *Maffander* and *Motchiama*, which fee.

COAPAIBA, in *Botany*, Marcgr. Pif. Rai. See COPAIFERA.

COARA, in *Ancient Geography*, a town of Syria, in the province called *Chalcidene*, which fee.

COARI, in *Geography*, a river of South America, which runs into the river of the Amazons, in Terra Firma.

COAS, in *Ancient Geography*, a river of India, fo called by Ptolemy, but by others called *Choes*. See COPHENES, and COW-*river*.

COASINA, a town of the French department of Liamone, on the ifland of Corfica, and chief place of a canton in the diftrict of Sartene; 5 miles N. of Cervione. The canton contains 2631 inhabitants.

COASSE, in *Zoology*. See VIVERRA *Vulpecula*.

COAST, in *Geography*, a fea-fhore, or the country, adjoining to the edge of the fea. Buffon diftributes the coafts of the fea into three kinds; *viz.* 1. High coafts, compofed of hard rocks, commonly perpendicular, and of a confiderable elevation, rifing fometimes to the height of 700 or 800 feet. 2. Low coafts, of which fome are almoft level with the furface of the water, and others have a fmall elevation and are often bordered with rocks nearly on a level with the water, which give rife to breakers, and render the approach of fhips very dangerous. 3. Downs, or coafts formed by fand, either accumulated by the fea, or brought down and depofited by rivers; thefe downs form hills of greater or lefs elevation, according to circumftances. The depth of the water along the coaft is generally proportional to their elevation; fo that a high coaft indicates a deep water, and, on low coafts, the water is commonly fhallow. See SEA.

COAST, *Gold*, fometimes called *Guinea Proper*, a province of Guinea on the coaft of Africa, fo called from the abundance of gold which it produces, is bounded by Nigritia or Negroland on the north; by the Slave coaft on the eaft; by the Ocean on the fouth; and by the Tooth or Ivory coaft on the weft. It commences at the river Ankobar, or Cape Apollonia, and extends to the Rio Volta, comprehending from 100 to 120 leagues from weft to eaft. The Gold coaft, ftretching along the fea, contains a variety of different kingdoms and ftates, *viz.* Adomir, called likewife Saku and Avira; Axim, Ankobar, Adom, likewife called Little Inkaffan, or Warthes; Jabi or Jabs; Commendo or Guaffo; Fetu; Sabu; Fantin; Acron, or Akron; Agonna, or Anguirra; Amra, or Aquamboe; Labbade; and Ningo, or Lambi. Each of thefe kingdoms or provinces has one, two, or more towns or villages on the fea coaft, between, or under the European forts and fettlements. Some of them are monarchies, having their own proper kings, and others are republics, governed by magiftrates, who are fubject to the laws and periodical changes. The gold of this country is generally found in three different kinds of places; the firft and beft in vallies, fituated between mountains; the fecond at and about rivers and falls of water; and the third at the mouth of rivers and rivulets on the fea coaft, which laft the negro women, after a fall of rain, collect, by wafhing the earth that contains it, in bowls, and thus feparating the one from the other. The negroes practife various methods for fophifticating the gold, which they obtain. One is the cafting of it into fetiches, mixed with half or a third part of filver and copper. (See FETICHE.) Another method of adulteration is that of cafting pieces

pieces of gold ſo artfully, that the external cruſt, about the twelfth of an inch thick, ſhall be pure, while the inſide conſiſts wholly of copper, or of iron. The third method by which they attempt to deceive the Europeans, is by means of a powder of coral or of copper filings, tinged ſo exactly like gold, that only ſcales can detect the counterfeit.

The natives of the Gold coaſt are in general tall, ſtraight, and well-proportioned, with oval faces, ſparkling eyes, regular and white teeth, thick eye-brows, and ſmall ears; mouths moderately large, and lips tinged with a better colour, and thinner than thoſe of the negroes of Angola. With regard to their mental faculties they have a quick apprehenſion and retentive memory, and a ſurprizing degree of ſelf poſſeſſion upon the moſt ſudden and alarming occaſions. As to their diſpoſition and character, they are, in general, extremely indolent in the exerciſe of the talents with which nature has endowed them; they are crafty, fraudulent, and diſſembling; covetous and intemperate. When they obtain a victory over their enemies, they return home dancing and ſinging; and, if they are defeated, they do the ſame round the graves of their friends and fellow-ſoldiers; ſo that a ſtranger cannot diſtinguiſh a victory from a defeat, except that after the latter they ſhave their heads. The women are handſomer than the men, ſtraight, ſlender, and well-limbed; with high cheſts, ſmall mouths, and eyes ſpirited and lively. They are cheerful and loquacious; gay in their diſpoſition, and looſe in their principles as to gallantry, but temperate in their diet. Both the men and women, when neceſſity ſurmounts their natural indolence, are ingenious, diligent, and laborious; and when they are excited by avarice or indigence, they apply themſelves with great aſſiduity to agriculture and fiſhing. Upon the whole, their natural talents are good, but their paſſions are ſtrong, their ignorance great, and they abandon themſelves to the calls of nature without dread of ſhame, that ſhield of decorum, decency, and virtue. Their dreſs is various, depending upon fancy and circumſtances; ſome wear long hair, curled, plaited, or tied upon the crown of the head in the form of a roſe, which they moiſten with oil, and tinge with different colours, and others wear it ſhort, for conveniency; or looſe, either for ornament or from negligence. Their hair, however, is generally adorned with gold fetiches; a ſort of collar, called "conte de terra," four times the value of gold; or with a blue coral, which they call "accori," eſteemed of equal value with the precious metal. Their arms, legs, and likewiſe waiſts, are ſet off with gold, conte de terra, and accori. Their uſual dreſs is a petticoat of velvet, ſilk, cloth, or ſome ſtuff; and thoſe who pretend to a taſte ſuperior to the vulgar, make their "paans" of a mixture of 50 different kinds of cloth. This paan they plait ſo artfully that it fits neat round the middle, hanging half way down the legs; round their necks they wear ſtrings of gold and coral, amounting ſometimes to 100*l.* in value; and by theſe worth among them is eſtimated, ſo that thoſe who want them are excluded the company of thoſe who poſſeſs them. The common people, as fiſhermen, &c. are very poorly attired, with a yard or two of mean ſtuff formed into a kind of petticoat, or with a girdle drawn between their legs; to which they frequently add a cap made of ruſhes, or when they can obtain it by ſtealth or intereſt, a ſailor's old hat, which they wear in hot as well as cold weather. The rage of dreſs is chiefly prevalent among the women, ſo that the ladies are loaded with gold, coral, and ivory trinkets. In the manners of all the negroes, both male and female, there is a neatneſs peculiar to warm climates, and indeed neceſſary in ſuch climates, which is a practice of waſhing their bodies twice every day, either in ſalt or freſh water. With this view they fix their habitations either on the ſea-coaſt or on the banks of rivers; and in defect of theſe, they make tanks or baths; habit rendering cleanlineſs no leſs eſſential to them than food. They teach their children to ſwim when very young: and thus they become expert divers, and are able to continue for a long time under water. So fond are they of this element, that half their time is ſpent in it, and they may not improperly be denominated amphibious.

Beſides the natural inhabitants of the Gold coaſt, there is a great number of Mulattoes, a mixed progeny, ariſing from the commerce of Europeans with the black women. This ſpurious race, it is ſaid, form gangs of thieves and robbers, void of decency, honour, honeſty, or principle, in their dealings with each other, with the negroes or Europeans. They call themſelves Chriſtians, but in reality are the groſſeſt idolaters; and their women very generally proſtitute themſelves, publicly to Europeans, and privately to the negroes.

The towns and villages of the Gold coaſt conſiſt of a multitude of little huts or cabins, diſperſed in groups, without order or deſign, and communicating with each other by narrow crooked roads, which terminate in the centre of the town or market-place. The farther you remove from the ſea-coaſt the more civilized do the natives appear, at leaſt, as to their building and mode of living. On the coaſt the towns and villages are ſituated in dry, barren, ſandy lands, or upon rocks and precipices; but, in the interior parts, they occupy the moſt delicious ſpots that can be choſen; they are better built, kept in a neater and cleaner ſtate, generally paved and better peopled.

The diet of the negroes on the Gold coaſt is neither delicate nor expenſive; conſiſting commonly of a pot of millet boiled to the conſiſtence of bread, yams, and potatoes, over which they pour palm-oil; and the diſh is garniſhed with herbs and putrid fiſh. On holidays they feaſt upon beef, mutton, and fowls. The diſh called "malaguet," which is uſed by people of a ſuperior rank, conſiſts of fiſh, corn, dough, palm-oil, and herbs, boiled in water and ſeaſoned with ſalt and pepper. The negroes, though ſomewhat temperate in eating, indulge to a great degree in drinking. The morning is uſhered in with brandy, and the evening concludes with palm-wine, mirth, riot, and tobacco, of which they are extravagantly fond.

In their marriages they have no ceremonies, nor have they any previous courtſhip, or any diſputes about marriage-ſettlements. Polygamy is allowed among them without any reſtriction beſides what reſults from humane or worldly circumſtances; however, the uſual number of wives is from two to ten, and ſeldom exceeds twenty. The women conſtitute the labouring part of the people, and are employed in cultivating the ground, and providing ſubſiſtence for the huſband, who ſpends his time idly in goſſipping, drinking, and ſmoaking. On the coaſt, however, the caſe is different; for in many towns and villages the men toil and labour for the females. The rich have two wives, exempt from ſervile employment, to whom the management of the houſe is entruſted, and who exerciſe a delegated authority over all the other women. Of the honour of theſe the huſband is particularly jealous; but as to the reſt he is unconcerned, provided that he can profit by their incontinence; for among the negroes it is not uncommon for the huſbands to derive ſupport from the voluntary proſtitution of their wives; and as the wealth of the negroes conſiſts chiefly in the number of their family, they direct their chief attention to the increaſe of their children; accordingly great reſpect is paid to a woman with child; and ſhe is delivered without much pain or or anxiety. Besides their lawful wives, the negroes often keep concubines, who are frequently preferred, and more tenderly treated than those to whom they are actually married; but their children are illegitimate, and, if begotten upon a slave, are retained as such by the heir of the father's fortune, unless he previously manumits them with the usual ceremonies; in which case they are free after his death, and enjoy every right of free-born persons. Legitimate children never inherit the fortune of parents in any kingdom on the Gold coast, except at Acra. The eldest son of a king or chieftain succeeds his father in his employment; but, besides his shield and sabre, he has no claim on any other part of his fortune. Among the negroes, masters are accountable for their slaves, and are obliged to repair the injury they commit by theft, robbery, adultery, or murder. They are likewise responsible for their sons, nephews, and other relations; and unless the imposed fine be paid, the delinquent must suffer corporal punishment, and even death, if the crime be of a heinous nature. He who debauches the wife of another man in the interior countries, is not only ruined himself, but entails destruction on all those who are connected with him by blood. If the delinquent be a slave, the punishment is a cruel death, besides a fine imposed upon the master. If a woman be caught in adultery, her life is forfeited, unless it be redeemed, at a great expence, by her relations; and the woman who indulges her passion for a slave dies, without possibility of redemption. The slave also perishes with her, and her relations are obliged to pay a considerable sum of money to the injured husband. In this case every considerable negro is his own judge. The woman, on the other hand, has no redress, if the husband should prove unfaithful. On the sea-coast all the women marry young; and many families ally themselves by marriage as soon as the children are born. Chastity, however, is held in no high estimation; for those who violate it before marriage forfeit no respect either from their husbands or the world; nay, they are esteemed the better qualified to enter into matrimony, and are consequently preferred to absolute vestals. In the countries of Eguira, Axim, Ancobar, Anta, and Adom, there are certain females who never marry, but are dedicated by profession to the public use, and formally initiated in their vocation. The negroes, though in various respects unpolished, are by no means deficient in a certain exterior politeness in all their mutual intercourse. When they first meet in the morning, they clasp each other in their arms, and pray that the day may be prosperous. Upon an accidental meeting, after they had before seen each other, and the usual compliments had passed, the negroes on the coast pull off the hat or cap; but the interior negroes do not esteem uncovering the head as any token of respect. At Elmina, when a stranger from another country is introduced, after the first compliments, the wife, or female slaves, bring water, grease, or ointment, to wash and anoint him; which office they perform with their own hands. The visits of kings and persons of superior rank, are attended with several peculiar and extraordinary ceremonies, which it is needless to recite.

Few families on the coast keep any considerable number of domestic slaves; nor do they make any great parade of them at their festivals or visits. The exclusive right of selling slaves is vested in the rich, not so much by law as from the necessities of the meaner rank, which render them unequal to the purchase and maintenance. Those who are employed in this capacity in almost all the maritime parts, consist of such as have bartered their freedom to the rich for sustenance, and are marked by them with certain signs, that attest them to be their property. If after this any attempt should be made to run away, they lose the left ear for the first trespass, the right ear for the next, and the third fault is punished either by death, or selling them as slaves to Europeans. Those who are born slaves are treated with a degree of tenderness on the coast which is uncommon in the inland countries. They are chiefly employed in fishing, agriculture, and those arts that are necessary for the support of their masters and themselves.

Among the negroes, there is a variety of mechanical arts, in which they are considerable proficients; such as making wooden and earthen vessels and plates, chair-matting, copper ointment-boxes, bracelets, necklaces, rings, and ear-rings of gold, silver, or ivory. Their chief excellence consists in the manufacture of all sorts of weapons and instruments of war, and all kinds of smith's work; their tools, however, are very rude and simple. They also manufacture gold and silver hat-bands of a very fine thread and exquisite workmanship. In building canoes of various sizes, and used for trading from one port to another, loading and unloading ships, and fishing on the coast, they are very ingenious; as well as in the use of them. Their agriculture is chiefly performed in the rainy season; the ground being at other times too hard for tillage. At seed-time they choose a convenient spot of ground, which is easily obtained with the consent of the king, who claims a nominal jurisdiction; and in three days after it is sown the whole field is covered with a beautiful verdure, and the crop is ready for reaping in less than three months. For maize they select an elevated ground; and for rice and millet, low marshy lands. The natives of the coast find it so easy a matter to dispose of all their grain, that they have established corn-markets in every village, where the current money is gold dust, cowries, and bujis. The price of grain is rated by police officers of the king's appointment; and to these markets the men and women resort early in the morning to buy or sell, or to exchange one sort of grain or fruits for another. Such are the industry and strength of the negro women that they frequently travel from the interior country six miles to market, under heavy loads, and sell their fruits or grain at the sea-port markets for European commodities, looking-glasses, bracelets, ear-rings, glass-beads, and other female trinkets, so passionately fond are they of dress and finery. The markets are exempted from all sorts of duties and imposts. At mid-day, the wine merchants bring their pots of palm-wine to market; and when the business of the day is finished, multitudes of men and women are to be met on all the roads, singing and dancing with an enviable cheerfulness, and without the smallest remaining vestige of the care and fatigue of the day. Besides these markets, they have also fairs, which regularly occur twice a-year, whither the natives resort to purchase European wares, which they transmit to the inland countries. On these occasions the women assemble in the evening to dance, sing, and make merry for an hour before they go to bed. They appear in their best habits, and the women in particular rival each other with all the emulation and jealousy of dress conspicuous among European females. Their dance is a kind of regular confusion, which, with the appearance of disorder, preserves a certain method adjusted to the music, which is composed of horns, trumpets, flutes, and other instruments. The women wear on their legs a number of small bells, which jingle as they move in their dance; and the men hold in their hands a kind of fan, made of horse-tail, or the extremity of an elephant's rump, with which they strike each other's shoulders as they pass. The dances performed in honour of the fetiche are more grave and solemn, bearing about them an air of religious devotion. At Abramboe, they have dances for eight succeeding days, in honour of the king, which they call the dancing season: to these

these there is a resort of a large concourse of negroes of both sexes; and the whole is conducted with extraordinary pomp. All the diversions among the negroes consist of these dances, music, and mock-combats, which latter often terminate tragically. Among other customs and manners that distinguish the negroes, we cannot forbear mentioning one excellent institution, in consequence of which a common beggar is not to be seen on the coast. When a negro is unable to subsist by labour, he binds himself to a master, who is obliged to supply him with all necessaries. In return he engages to defend his master with all his power, to watch his affairs, and, in seed and harvest time, to labour as a husbandman. Thus every man becomes usefully employed, and the infirm and aged are taken care of by their friends.

Among the negroes, the fear of death is a very general and distressing passion; and, accordingly, for prolonging life, they recur first to medicines and natural remedies; and when their case is deemed peculiarly dangerous, they have recourse to their superstitious religious worship, as the most effectual antidote. The priest of course diverts the patient by liberal offerings to appease the fetiche; nor does he on this occasion neglect his own interest. If the diseased person recover, the priest is sure of ample recompence. The chief medicines used by the negroes are lime-juice, malaguet, or cardamoms, the roots, branches, leaves, bark, and gums of trees, and about 30 different kinds of green herbs.

When all the arts of the priest and doctor have proved ineffectual, diligent inquiries are instituted concerning the death of the patient. Having ascertained that it has not been owing to poison or incantation, his relations are examined, whether he has been attended with due care, and the necessary offerings have been made to the fetiche and priest. Should no defect in these particulars appear, they satisfy themselves with attributing his death to his neglect of religious duties, and the performance of those rites which can alone prolong life. The priest proceeds to interrogate the deceased, and then returns to the assembly of his friends and kindred with such an answer as best suits his interest; and they are then satisfied. As soon as the patient has breathed his last, his relations unite in dreadful howlings and lamentations; and then preparations are made, by a variety of ceremonies, in which the fetiche and priest have an interest, for his funeral. Presents are made in order to obtain repose for his soul, and to secure his safe passage into the other world. In his coffin several articles of value are deposited, costly in proportion to his wealth; and when his assembled relations or friends have continued for two or three days to drink brandy and palm wine, and other ceremonies are finished, the corpse is carried to the grave, preceded by a number of young men, who continually discharge vollies of arms, till the deceased is laid in the ground. Men and women, in great crowds, follow, some dancing, some singing, and others crying or laughing. When the corpse is covered, and the grave filled, every one departs where he pleases. But the greater number usually adjourn to the house of the deceased, there to prolong their mirth and feasting. When a king, or any eminently distinguished person dies, his body is generally kept a year above ground; and, in order to preserve it from putrefaction, it is laid over a gentle fire, upon a wooden utensil, resembling a gridiron, to dry by slow degrees. Others inter their dead privately in their own houses. At the funeral of a king, several of his slaves are sacrificed in order to attend him to the other world; and especially his favourite wife. But the most abominable rite is the practice of selling those who, through age and infirmity, have been rendered incapable of labour, to become victims in these horrible solemnities. The negroes usually build a little hut, or plant a small garden of rice or maize upon the grave, into which they throw all the effects of the deceased, of the least value to his heirs. Sometimes an oration is pronounced at the funeral of a negro, which sets forth, at the grave, the virtues of the deceased. In some countries they do not bury slaves, but throw their bodies into the fields, as a prey to beasts and birds; in other countries they cover them with earth, without any attendant ceremony.

As to the religion of the Gold coast, it is diversified among a number of sects, proportioned to the number of nations, or rather families, on the coast. All the negroes, however, profess to agree in their belief of one true God, the creator of the world; but his omnipotence is the only attribute of which they have any distinct idea. Some have said, that they conceive of the Deity as partial to the Europeans, and taking pleasure in afflicting them with a thousand evils. Dapper says, that the negroes sacrifice to the devil; but Bosman asserts, that their devotion is wholly paid to the priest, the mediator between them and their divinities. Nothing religious is undertaken without the priest or fetichere, who is consulted on a variety of the most interesting occasions. The practice of exorcism is prevalent among them. All promises of importance, and obligatory oaths, are confirmed by drinking what is called an "obligatory draught;" this is accompanied with an imprecation, that the fetiche may destroy them, if they are unfaithful; but oaths of this nature have been so often violated by nations and individuals, that they are fallen into disrepute. Their public religious ceremonies, on occasion of droughts, floods, barren and unhealthy seasons, &c. are performed by offerings to their idols in groves, which are held peculiarly sacred; and whenever the chiefs of a town or nation assemble, the priests are consulted as to the measures that are most likely to suspend or avert public calamities, and their decrees are solemnly published by a crier. Every negro has his peculiar and appropriate *fetiche*, which he worships on the day of the week when he happened to be born. See FETICHE.

The notions which the negroes entertain of a future state, are very various. Some maintain, that immediately upon the death of any person, he is removed into another world, where he assumes the same character in which he lived on earth, and supports himself by the offerings and sacrifices his friends make after his departure. Bosman affirms, that the greater number of negroes have no idea of future rewards and punishments, annexed to the good or evil actions of this life. Some few, however, he allows to have some gross notions of future judgments, which consist in being wafted away to a famous river, situated in a distant inland country, called "Bosmanque." Here their god interrogates them concerning the life they have led, whether they have religiously kept the holy days dedicated to the fetiche, abstained from all meats, and inviolably kept their oath? those who can answer in the affirmative, are conveyed over the river to a land abounding in every kind of luxury and felicity. Those who have offended in any of the abovementioned particulars, held of principal importance, are plunged by the god into the river, and buried in eternal oblivion. Others believe in a kind of metempsychosis, or transmigration; supposing that they shall be transported to the land of white men, assume that complexion, and be endowed with similar souls; but this doctrine is only maintained by those who think highly of the intellectual faculties of the white men. The inland negroes tell the maritime negroes, that, in a distant interior country, there lives a great fetichere, in a splendid house, who possesses extraordinary powers, and exercises dominion over the elements of nature, and foretels the events of futurity. All persons in his vicinity are examined

amined before him after death, and if the result be unsatisfactory, he kills them a second time; but if their conduct appears to have been pious and exemplary, he furnishes them with a passport to a state of true and perfect felicity. Hence proceeds the deep veneration in which they hold this priest, so that they esteem him little inferior to a god. The negroes, it is said by some, are not ignorant of the devil, whom they regard as a malicious, deceitful being, resembling a white man; but Bosman denies that they pray or sacrifice to him, as most other authors have affirmed. Instead of paying any worship to him, the devil is exorcised out of all their towns at stated festivals, and with abundance of ceremony. The negroes firmly believe the reality of ghosts, spirits, and apparitions; and that they walk up and down the earth, terrifying and beating people, especially the unbelievers. Some have said, that the negroes use circumcision, prayers, and ablutions, and seem to have an indistinct idea of futurity. They believe that good men shall, after death, enjoy happiness, and bad men be doomed to misery; that the former shall live with fine women, upon luxurious diet, and the latter stroll, as vagrants, round the earth, always in motion, and always unhappy. The negroes, in general, have no solemn festivals, besides one at the conclusion of their harvest, which they call a fair, and that already mentioned for exorcising the devil; nor have they any distinction or division of time, except what they have been taught by Europeans. Months and weeks are altogether unknown to them; their method of reckoning being by the shining of the moon, whether it be in the change or in the quarters. Hence they determine their seasons for sowing the different kinds of grain. It is probable, however, that the division of time into weeks and days cannot be of very late date, as all have respectively their peculiar names, which are perfectly familiar even to children. Their sabbath falls on the Tuesday, except at Anté, where it happens on Friday; and it differs from other days in no particular, but that they abstain from fish; all other kinds of food and employments being permitted without any restraint. The negroes of the interior countries divide time into fortunate and unfortunate days; in some countries the great unfortunate days are 19, and the lesser, which differ from the other, 7. Between these intervene 7 unfortunate days, which are a sort of vacation from all occupations and bodily labour. In some countries the lucky days are particularly observed, in others the unlucky ones are no less religiously kept; but the maritime negroes disregard all distinctions, and esteem one day the same with the other.

The government of the negroes is, in general, licentious and irregular: and its forms are divided into five distinct kinds. The first is that of pure monarchy, where the king is despotic; the second is a kind of aristocracy, the chief power being lodged in the hands of the caboceroes or chiefs; the third is vested with those who have acquired weight and influence from their great wealth, which body some have represented as the nobility; the fourth is an absolute democracy, where all are equal with respect to dignity and power, whatever may be their wealth; and the fifth class of persons, rather than government, consists of those slaves, who have been sold by their parents, those who were born slaves, or those whose poverty has reduced them to this unhappy condition. On the Gold coast the crown descends from father to son by right of inheritance, and in default of heirs male, it passes to the nearest of blood; although sometimes a man's wealth in gold and slaves procures him this honour, in prejudice to the lawful heir. The royal government is supported rather by force than by authority; the respect of the people being proportioned to the number of king's slaves and the greatness of his wealth, without which sovereigns find but little respect and submission from their subjects, and are obliged to pay them for the smallest services. But when their kings are rich and powerful, they are elevated by the servile homage of the people above all law and control. Negroe sovereigns are obliged to exercise great liberality, and the first entertainments they give costs a year's revenue. A negroe king is always disposed to aid a neighbouring sovereign with his troops, because the greater part of the subsidy goes into his own pockets. There is nothing peculiar in the education of princes, and it differs little from that of the poorest subjects; so that it is common to see a man taken from the plough-tail to wield a sceptre; and he who was yesterday driving a flock of sheep, shall to-day be at the head of an army. The judges, among the negroes, or the supreme officers of the courts of justice, are chosen from the most considerable persons in respect to wealth and influence. To these belongs the decision of all causes, civil and criminal; and from their decision an appeal lies to the king. War is declared by the negroes either from views of revenge, ambition, or plunder, or as auxiliaries to some injured neighbouring state, or, which is most common, for a subsidy. Many wars are undertaken for the recovery of private debts. When war, from whatever cause it originates, is projected in the king's council, a general assembly of the nobility is summoned, and the matter is deliberately debated. An army is instantly raised, and no time is lost in making an incursion into the enemy's country, and proclaiming war, which is carried on at a small expence. In their engagements, the negroes observe no order or discipline. Their principal arms are muskets or carabines; besides which, they have a kind of swords shaped like chopping-knives; a sort of dart called assagay; and a shield made of twigs and osiers, covered with leather, and sometimes plated on the inside with copper, to ward off the assagays, as well as the blows of the sword. Some few negroes have cannon, but their engineers are so ignorant, that their artillery is of no importance. When the negroes are exhausted with war, which between two despotic sovereigns, who hold their subjects in abject slavery, is generally tedious and bloody, they begin to think of terms of accommodation, and of settling a place of negotiation. This is usually a large plain, on the frontiers of the two contending kingdoms; to this both sovereigns march in full armour, accompanied by a crowd of feticheres, the emblems and mediators of peace. The priests of both nations engage by oath to terminate all hostilities, to live in perfect friendship, and to give pledges of their faith; but the prisoners on either side are considered as the absolute property of the sovereign who possesses them. As soon as these ratifications are exchanged, a loud peal of warlike instruments publishes the general tidings; arms are thrown down on both sides; and the day is closed with festivity.

As the Gold coast is situated near the 5th degree of north latitude, the heat of the climate may be supposed to be extreme; and yet it is more healthy than many voyagers have represented it. During the interval from October to March, the air is very hot, and the other months are tolerable; and through the whole year the extreme heat of the day is moderated by the refreshing and cool sea and land breezes of the evening and morning. It has been observed, that on account of the high mountains that abound on the Gold coast, and the deep vallies that lie between them, the climate is rendered insalubrious by a thick fog, which prevails particularly in marshy grounds and near rivers. From March to October, and in the months of July and August, fogs are very prevalent; and added to the beastly uncleanliness of the negroes themselves, they contribute to render the climate unhealthy, and particularly noxious to strangers.

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The negroes, however, notwithſtanding all the diſadvantages of their climate and manners, enjoy good health and live to old age.

Boſman divides the ſeaſons on the Gold coaſt into ſummer and winter: the latter admitting of three ſubdiviſions, *viz.* two rainy, two foggy and hazy, and two windy months; but the changes are ſo frequent and irregular, that we cannot lay great ſtreſs on ſuch a diſtribution. This coaſt, however, is ſubject to heavy rains and boiſterous winds; but it derives great benefit from the land and ſea breezes.

On this coaſt the true trade-winds are weſterly, keeping a tract with the ſhore, where it ſtretches eaſtward.

Among the tame animals of the Gold coaſt, the firſt in rank, on account of their utility, are horned cattle, ſuch as bulls, cows, ſheep, and goats, with which Dinkira, Aſſiento, Axim, and all the inland countries abound, though only a few black cattle are brought to the coaſt. It has been obſerved by ſeveral writers, that all the animals are ſpecifically lighter on this coaſt, than in any other part of the globe, a circumſtance which is ſuppoſed to proceed from the nature of their aliment, that, inſtead of firm and ſolid, produces only a ſpongy, looſe, and tough fleſh. The ſheep are much ſmaller than thoſe of Europe, and covered with hair inſtead of wool; nor does their fleſh at all reſemble mutton in its taſte, being dry, lean, and hard. Goats are innumerable, but they are of a very ſmall ſize. Their fleſh, however, is ſweet, fat, and delicate. The horſes produced on the Gold coaſt are of a ſmall ſize; they are ſcarce in the maritime kingdoms, but plentiful in the interior countries. The country likewiſe produces a few aſſes, taller and handſomer than the horſes, and generally preferred for riding. Hogs abound; but their fleſh is lean and hard. Of all animal food, dog's fleſh is moſt valued among the negroes. The dogs of this country, which neither bite nor bark, and which are of all colours, are bred with great care, and driven to market like flocks of ſheep, where they fetch a high price. A cat is much eſteemed among the negroes, ſome of whom eat its fleſh.

Among the wild quadrupeds of this coaſt, we may reckon the elephant, which is of ſomewhat a ſmaller ſize than that of the Eaſt Indies, and which the negroes diſtinguiſh into three kinds, *viz.* the river, the wood, and the mountain elephant; tigers, which are very numerous in almoſt every part of the coaſt; the buffaloe, which is here very ſcarce; the jackall; a ſpecies of wild boar, leſs fierce than that of northern and cold countries, whoſe fleſh is tender, fat, and delicious; deer of all kinds and ſizes; hares, rabbits, and foxes, and a few porcupines. On the Gold coaſt is found a quadruped which the negroes call "potto," the ſluggard; the "berbe," or wine-bibber, ſo called from its fondneſs for palm-wine; the "kokebo" of the negroes; and their "arampo," or man-eater, ſo called becauſe it digs up graves, and prefers human fleſh to all others; and rats and mice, which are the moſt numerous and deſtructive quadrupeds on the Gold coaſt. Lizards, aligators, and cameleons, are alſo found in this country.

The Gold coaſt affords alſo a great variety of birds; its pheaſants are peculiarly beautiful, and it has various others of the feathered tribe, which our limits will not allow us to enumerate. Its reptiles and inſects are alſo very numerous, and of great variety. The coaſt, as well as the lakes and rivers, furniſh great abundance of various kinds of fiſh.

Among the trees, ſhrubs, &c. we may enumerate the palm, which furniſhes the negroes with wine and oil; the cocoa-tree; ſweet and ſour oranges, and lime trees; the papay-tree; the banana-tree; and vines. In a word, the Gold coaſt affords fruit-trees of all ſorts, and wood for all purpoſes.

As to the grain of the coaſt, it conſiſts of the great and ſmall milhio, ſuppoſed to be the Turkiſh wheat, which affords two crops in the year; and rice, which is yielded in great abundance. Its other vegetables are yams, potatoes, and beans, ſome of which are peculiar to the country. It furniſhes alſo the Guinea pepper, Spaniſh pepper or pimento, cardamoms, and a number of fruits, and grains, common to almoſt all countries.

Tobacco is alſo produced in great plenty on the Gold coaſt, to the uſe of which the negroes are much addicted. We ſhall cloſe this detail with obſerving, that the Gold coaſt furniſhes a vaſt quantity of ſalt.

Of the inland country, little more is known, than that it conſiſts of three extenſive kingdoms, called Aſſiantee or Shantee, Akim, and Aquamboe, each of which ſupplies the maritime ſtates with a great number of ſlaves, whom they ſell to the Europeans. In the Britiſh Weſt Indies moſt of the negroes purchaſed on the Gold coaſt, are known by the general appellation of Koromantees, from *Koromantyn*, which ſee. The number of ſlaves furniſhed of late years by the Gold coaſt has been eſtimated at 10,000.

Coast, *Grain*, *Pepper*, or *Malaguetta*, is the moſt weſtern diviſion or province of Guinea, and bounded by Nigritia on the north; the Ivory coaſt on the eaſt; and on the ſouth and weſt by the ocean. It is contained between the Rio Seſtos and Grova, a village two or three miles from cape Palmas, extending for a ſpace of 55 miles along the ſhore. But if it commence at the river Sanguin, and ſtretch to Cape Palmas, its limits will be enlarged about 60 miles. Within theſe frontiers are the towns and villages of Seſtos, or Seſtro, W. of the river Sanguin, Bottowa, or Battaway, Seno, Seſtro Krou or Kro, Wappo, Bado, Great Seſtro, Little Seſtro, Goyava, Garaway, &c. &c. The chief rivers are the Rio de Seſtro, the Rio de St. Paul, and the river de Sierra Leona. The climate on this coaſt is materially affected by the exhalations raiſed by the ſun from the rivers and ſea-coaſt, which are ſaid to occaſion putrid fever, almoſt always fatal to Europeans. The productions of the earth are peaſe, beans, gourds, lemons, oranges, and bananas. The palm-wine and dates of this country are excellent. Cows, hogs, ſheep, and goats abound; but that which conſtitutes the chief wealth of the Grain coaſt is the abundance of Guinea pepper which it produces. But the principal commerce of the Grain coaſt conſiſts in ivory and ſlaves. As to the manners of the natives, they are not chargeable with any kind of intemperance; but they allow their women, who are well-formed and handſome in their perſons and features, every kind of intercourſe with Europeans, and ſome of them are guilty of the moſt infamous proſtitution. Theft is common among them, as it is among all negroes. Their language is altogether unintelligible not only to Europeans, but to their neareſt neighbours; and as they have no interpreters their commercial tranſactions are carried on by ſigns and tokens. Among theſe people there are many excellent mechanics, and particularly ſmiths, who underſtand the art of tempering ſteel, and making arms: their ſhipwrights are alſo expert in the ſtructure of canoes. They have likewiſe derived from experience many improvements in huſbandry, eſpecially ſuch as regard the culture of rice, millet, and Guinea pepper, which are the chief articles of their ſubſiſtence and commerce. Their government is arbitrary and deſpotic; and their ſovereign, who on all occaſions appears among them with pomp and magnificence, is regarded with a kind of awe, as if he were a ſuperior being. Although

though ignorance attaches them to the rites of paganiſm, natural reaſon ſuggeſts to them ſome ideas of a future ſtate, as we may infer from the ceremonies performed in relation to the ſouls of the deceaſed, which they hope to find in a ſtate of happineſs. They welcome the new moon with ſongs, dances, and various kinds of diverſion; and their ſuperſtitious regard for ſorceries is extreme. For a further account of theſe people, we refer to the article SESTOS. The months moſt favourable to trade on this coaſt are February, March, and April; and ſmall veſſels are more convenient than large ſhips, as they are better adapted for entering the rivers and ſailing up the country. The ſouth-ſouth-eaſt winds begin to blow on this coaſt in the month of May, and they are conſtantly attended with heavy rains and ternadoes, extremely dangerous to ſhipping, with thunder and lightning that are terrible.

COAST, *Ivory*, *Tooth*, or *Quaqua*, ſo called from the elephants' teeth which are found here, is a province of Guinea, bounded by Nigritia on the north; by the Gold coaſt on the eaſt; by the ocean on the ſouth; and by the Malaguetta, or Grain coaſt on the weſt. Geographers and ſeamen are much divided in their ſentiments concerning the extent and limits of this coaſt: ſome confining it between the Rio Suero da Coſta, where the Gold coaſt begins, and Grova, about three miles from Cape Palmas; whilſt others ſtretch its boundaries from Cape Palmas to Cape Tres Puntas, the whole of that ſhore being known to mariners under the appellation of the Tooth coaſt. However, the moſt preciſe and accurate limits are contained within Cape Apollonia to the eaſt, and Cape Palmas to the weſt. The principal towns of the Ivory coaſt are Grova or Grua, Great Tabo, Little Tabo, Great Drewin, Batrou, Laho, Apollonia, and Vallo, each of which ſtands at the mouth of the river, whence it reſpectively derives its name. As for the interior country, it is but little known; the natives refuſing the Europeans leave to eſtabliſh ſettlements, or even to trade among them, except by means of the coaſt-negroes, and this they allow with the moſt circumſpect caution. The ſame commodities are found here as in the other provinces of Guinea; *viz.* gold, ivory, and ſlaves. Grova ſtands three miles E. of Cape Palmas; Great Tabo, 30 miles from Grova, eaſt; Little Tabo four miles farther eaſt; thence to Great Drewin 11 miles, thence to Batrou 19 miles, to Laho 7, and from thence to Cape Apollonia 20 miles:—the whole amounting to 94 miles. The river St. Andrew on this coaſt is a fine, deep ſtream, increaſed near its mouth by the influx of another river, both which unite in forming a large road. The entrance is ſurrounded with lofty trees, beautiful verdant meadows, and rich fields of great extent. About 500 paces from the mouth of the river a peninſula runs a great way into the ſea, joined to the continent by a ſlender neck of land, about 5 or 6 fathoms broad. The whole peninſula is a high level rock; having a platform 400 feet in circumference, and commanding the whole neighbouring country. At the foot of a little eminence, N. of the neck of land, there is a fine freſh water ſpring, capable of ſupplying a large garriſon, and of being ſecured by the cannon of the fort. The land-marks here are ſo diſtinct that it is impoſſible for ſhips to miſtake them. They conſiſt of lofty, thick, and ſhady trees, with three or four large villages, within leſs than half a mile of each other. The fields and meadows near the mouth of the river are fertilized by meandering ſtreams, and are thus rendered fit for producing every ſpecies of grain, fruits, and roots; but eſpecially maize, millet, rice, peaſe, yams, and melons. Here alſo grow oranges, limes, cocoa-nut trees, and citrons, forming large groves; and here alſo the ſugar-cane, and a thouſand other plants, which ſpring up without cultivation are abandoned to the ravages of the elephant, and as haunts for wild beaſts. Whatever the Gold coaſt produces is alſo found here, in greater abundance and perfection; and, indeed, the fruits and vegetables of the warmer climates ſeem to be all united on the Ivory coaſt. As to the manners of the natives in this diſtrict, the men wear a looſe dreſs which hangs down to the knees, and the women, a narrow cloth round their waiſts. Many of them are naked. The richer of both ſexes have a paan of fine cloth, and the men wear poniards, or long knives by their ſides. The women are ſmall, but neatly proportioned. Their features are regular, their eyes lively, and their teeth white, ſmall, and even. The men are likewiſe well-formed; and are not deficient, either in courage or underſtanding. They are very fond of bracelets of iron and ivory, mounted with little bells, which they put round their arms and the ſmall of each leg. Theſe bells inſpire them with additional joy in dancing, to which they are much addicted, as well as all the negroes. Eaſt of the river St. Andrew are at leaſt a dozen of craggy, rugged mountains, ſtretching three or four miles along the coaſt; but the intermediate fields, well watered by nearly twenty rivulets, are rich and fruitful: ſo that if the inhabitants were ſomewhat more civilized, no country on earth bids fairer for a profitable commerce. The elephants are of an enormous ſize: ſlaves and gold are alſo very plentiful.

From the Rio de Suero da Coſta to Cape Apollonia, the coaſt is low and even, extending itſelf 12 miles towards the eaſt, bordered with large trees, and covered with villages, the chief of which are Boquun, Iſſini Peguena, Great Iſſini, Albiani, Jabo, and Akammina. Between Boquun, which ſtands at a ſmall diſtance from the ſhore, near the mouth of the river Da Coſta, ſurrounded by woods, and pleaſantly ſituated, and Akammina, ſeated on a riſing ground half a mile W. of Cape Apollonia, and commanding an extenſive ſea and land proſpect, the interior country is high, rugged, and mountainous, but affording ſome fine gold, ivory, and a few ſlaves. Near Cape Apollonia is the kingdom of *Gu[illegible]re*, which ſee. The whole coaſt from Cape Palmas to Cape Apollonia, a few capes excepted, appears ſo low, but ſo equal and ſtrait, that places cannot be eaſily diſtinguiſhed, and, beſides the capes, the only diſtinct land marks are the heights and mountains about Drewin. The landing is dangerous, on account of high ſurfs and ſwelling waves; and the negroes alone are ſo acquainted with the coaſt, and ſo reſolute, as to encounter its dangers in their little canoes; which are employed in loading and unloading the ſhipping. Round Cape Apollonia there are large tracts of fallow land, in which the negroes ſow Indian corn. The complexion of the natives is ſo black, that it has been compared to the fineſt jet; in their diſpoſition they are lively and enterpriſing, and in commerce indefatigable. Their huts are neater and cleaner than thoſe of their neighbours, and their dreſs more elegant, being ſet off with ornaments of gold, ivory, and cowries. The hair or wool of their heads is divided into innumerable ſmall treſſes, which they adorn with fragments of oyſter ſhells and other ſhining baubles. On the left cheek they have a ſcar, of the figure of a poniard, and the reſt of the body is often marked in the ſame manner, to denote the warlike diſpoſition of the perſon; this cuſtom is very ancient, and ſerves to diſtinguiſh the inland from the maritime natives; the former of whom are often reduced to ſlavery by the latter, and ſold as ſlaves. From Cape Apollonia to the river Mankaw, where the province of Axim, the firſt diviſion of the Gold coaſt, begins, are two or three fine villages. From hence to Axim, the ſhore takes its courſe S.S.E., and near the village of Boggio the river

Mankaw empties itself into the sea, at the mouth of which the negroes find a considerable quantity of gold.

Every country within the limits of the Ivory coast is fruitful in rice, pease, beans, gooseberries, citrons, oranges, and cocoa nuts; and sugar-canes might also be cultivated here to great advantage. Upon the whole, the Ivory coast is reckoned one of the finest divisions of Guinea; the prospect of the mountains and vallies, filled with villages, is delightful; most of these little towns being surrounded with lofty palms and cocoa trees. The soil of the high land is a reddish earth, which, with the perpetual verdure of the trees, forms an agreeable mixture of colours. Cotton and indigo are the spontaneous growth of the districts of Great Drewin and St. Andrew, which are indeed the richest of the whole. Palm-wine and oil are plentiful; together with a species of fruit, growing on a sort of palm-tree, called by the natives "tombo," or bourbon." All sorts of tame animals, sheep, cows, goats, and hogs are very numerous and cheap: and the coast supplies great abundance and variety of fish.

The natives, in general, are above the common stature, well-limbed and well-proportioned, though their features on the first glance are hideous: and yet they are deemed the most rational, civilized, and polished people in Guinea; applying this character to the natives of the Quaqua coast, or from the river Drewin to Cape Apollonia; for as to the others, authors concur in representing them as the most barbarous, cruel, and savage of all nations. Their diet is coarse and indelicate. Black soup is a favourite dish all over Guinea, both among Europeans and negroes. The Europeans make it of flesh or fowl, with pepper, vinegar, salt, and some sweet herbs peculiar to the country; but the negroes add fish, ocra, which is a viscous vegetable substance well known in our West Indian islands, where it is used to thicken soup, and palm-oil. The men are fond of a great quantity of hair, with which they are supplied by the women, who cut off their own for this purpose. Some of the women, who wear their hair, adorn it with little plates of pure gold. Their form of salutation they have in common with all negroes; which is that of laying hold of the fingers, making them crack, and repeating the word "quaqua" several times, in a low voice. It is a constant rule, that the son follows the profession of his father. In the mechanic arts they are unskilled, insomuch that a common door-lock is reckoned among them as a very great curiosity; a watch still further increases their admiration; and making paper to speak, as they express it, is a perfect miracle. Their religion, like that of the inhabitants of the Gold coast, is founded in ignorance and superstition. They revere their princes and priests, under a persuasion that magic and sorcery are qualities inseparable from majesty and priesthood. The usual trade carried on with the inhabitants of this country, who are generally very timid and jealous in their intercourse and commercial transactions with Europeans, consists of cotton cloths, ivory, gold, and slaves. From the river Babas to the Rio de Suero da Costa, the country produces great abundance of good cotton, which the negroes of the interior country manufacture with great industry, and which they sell to the inhabitants of the Gold coast, and to those who fetch it from it central parts of Africa. The Quaqua negroes manufacture a kind of plant, resembling hemp, into a strong cloth, to which they give a beautiful colour, and some pretty flowers and designs, that indicate them to be no bad artists in this way. They have also a considerable trade in salt, with their inland neighbours. All the countries behind Quaqua furnish a large store of the most beautiful ivory in the world, which they sell principally to the English and Dutch. They obtain likewise from the mountains a considerable quantity of gold. The European commodities, which the negroes accept most readily in exchange for their own, are of much the same nature as in other parts of Guinea. When the natives of this coast trade with any European ship, they let fall a few drops of water into their eyes, by which symbol, equivalent to a kind of oath, they intimate that they would sooner lose their eye-sight than cheat those with whom they trade. They are no less averse to drunkenness than to fraud; for though their country abounds with palm-trees they drink no palm-wine, but only a certain small liquor which they mix with water. Although this country be divided into a variety of petty states and kingdoms, yet they have scarcely any separate interests: for among themselves war seldom happens; and, consequently, the slave trade here bears but a small proportion to that traffick on the Gold and Slave coasts.

Coast, *Slave*, is generally included by European navigators under the limits of the kingdom of Benin. It is bounded by the Rio de Lagos in this kingdom, and extends to the Rio da Volta, the boundary on this side of the Gold coast. The coast is generally distinguished by the appellation of Great Benin. (See Benin.) From port Douarre it extends towards the south of Cape Formosa; then turning eastward to Rio del Rey, and again inclining to the south of Cape Gonsalvo, towards the equator, it forms the gulf of Guinea. Thus, in its whole length, it measures about 350 leagues in a curve line, or arc of a circle. The Slave coast comprehends the coasts and kingdoms of Coto or Koto, Popo, Whidah, and Ardrah: which see respectively.

Coast, *Windward*, an appellation commonly given to that part of Africa, which extends from Cape Roxo, or Rouge, to Cape Apollonia. The European settlements on this coast, except a small English factory in the river Sierra Leone, are chiefly those of the Portuguese. The negroes obtained from them, as well as from the English factory, have been called "Mandingoes," though not with strict propriety, as many different languages are spoken on the coast between Senegal and Apollonia.

Coast, *Cape*, the chief settlement of the English on the Gold coast in Africa: the ancient Portuguese appellation is "Cabo Corso." This Cape is formed by an angular point, washed on the south and east by the sea, upon which stands the English fort, about 9 miles from Elmina. Here the Portuguese settled in 1610, and built the citadel of Cape Coast, upon a large rock that projects into the sea. Some few years afterwards they were dislodged by the Dutch, to whom this place owes its principal strength. In 1664, it was demolished by admiral Holmes; and in 1665, De Ruyter, the famous Dutch admiral, had orders from the states to retaliate the injuries committed by the English. But though, with a squadron of 13 men of war, he attacked all the settlements of this nation along the coast, ruined all the factories, and took, burnt, and sunk all the shipping of the English company, he was frustrated in his attempts upon this fort, which had not at that time recovered the damage which it had sustained in the expedition of Holmes. The treaty of Breda having confirmed Cape Coast to the English, and the king granting a new charter in 1672, the directors applied all their attention to fortifying and rendering commodious this, their chief possession. The walls are high and thick, especially on the land side, built partly of stone, but chiefly of brick, which the English made at a small distance. To the height and strength of its walls the fort owes its chief security, and the neighbouring negroes dependent on the company, derive from them a protection against the incursions of the Fantins. The interior parade, raised 20 feet above the surface of the work, forms a quadrangular space, cooled by the gentle refreshing

freshing sea-breezes to which it lies open, and pleasantly situated, having queen Anne's point, and all the shipping in the road of Anamaboa in view. The platform is defended by pieces of artillery, which command the road and its entrance. The fort has four bastions, mounted with cannon; other pieces are placed on the battlements, and others on the wall towards Tabara for the purpose of keeping the negroes in awe; towards the sea, the perspective of Cape Coast is beautiful and regular; the fortifications are well conceived, and the advantages of natural situation are aided by art. Cape Coast, however, has inconveniences, among which we may reckon some neighbouring hills, by means of which an enemy might without difficulty embarrass and annoy the fort. The soldiers are lodged in the best barracks of any on the coast of Guinea. The governor's apartments communicate with the chapel: near the gate is a prison for criminals, and beneath the platform, a large vault is cut in the rock for the confinement of slaves. The presidency of Cape Coast is lodged in the hands of a single person, appointed by the directors of the African trade; and the usual commerce consists chiefly in gold dust and slaves. The company's gardens occupy a space of no less than 8 miles in circumference, being surrounded by trees; and the soil is every where so fertile, that it produces every sort of fruit commonly found in the warmer climates, as lemons, oranges, citrons, guavas, mangoes, plantains, bananas, pine-apples, tamarinds, cucumbers, water-melons, cocoa-nuts, and every kind of sallad and roots.

In the neighbourhood of Cape Coast, the English have built two forts, the one called "Philips's tower," and the other "Fort Loyal," or "queen Anne's fort," each of them being three-quarters of a mile distant from the Cape Coast. The first stands on an eminence on the side of the garden S. E. of the fort. The second is situated near the village of Manfro, upon a hill called Danistein, where Fredericsburgh formerly stood. Cape Coast is in N. lat. 4° 58′. E. long. 1°.

COASTING, that sort of navigation, wherein the places, sailed to and from, are not far distant; so that a ship may sail in sight of the land, or within sounding, between them. Such are the voyages on the Narrow, or British seas, between England, Holland, and France; also those about the British seas, and in the Mediterranean, &c.

For the performance of this navigation, there is only required good knowledge of the land, of the time and direction of the tide, of the reigning winds, of the roads and havens, the use of the compass, and of the lead, or sounding-line.

[illegible] Sail[illegible]

[illegible]. See Pilot.

Coasting, in *Agriculture*, &c. denotes the transplanting of a tree, and placing it in the same situation, with respect to east, west, north, &c. as it stood before.

COAT, in *Anatomy*. See Tunica and Eye.

Coat *of Arms*, in *Heraldry*, a surcoat reaching to the waist, open at the sides, and ornamented with armorial bearings, worn by the ancient knights in times of war, or at tournaments over their armour, being the principal characteristic by which they were distinguished from one another, the [illegible] being covered with the helmet.

During the period of five centuries after the conquest, the variation in the mode of exhibiting coat-armour was very trivial.

The Norman in the field being closely invested in armour, which exactly fitted his shape, threw over it an ornamented surcoat without sleeves, at first loose; but during the successive reigns of the three first Edwards, it was confined to the body in narrow folds. After that, the mixed armour (composed of mail and plates) became common, and the steel boddice was gilt and otherwise ornamented. This armour did not, however, long continue in fashion, but was succeeded by tabards of arms, larger than the original surcoat and made of the richest silk stuffs, sumptuously embroidered, which afterward became the dress worn by the nobility and gentry, till the commencement of the sixteenth century: since that time they have been continued only as the state dress of the officers of arms. See *Plate* of *Heraldry*.

Coat *of Mail*, in French *cotte de mailles*, in *Military Language*, armour made of scales or iron rings connected together net-wise.

Coat, in a *Ship*, a piece of tarred canvas put about that part of the masts, or bowsprit, which joins to the deck, or lies over the stem of a ship. They are also put about the pumps at the decks, that no water may go down there; and they are also used at the rudder's head.

Coat likewise denotes the materials with which the ship's sides and masts are varnished, to preserve them, as tar, &c.

COATI, in *Zoology*, the name given by Seba to the little ant-eater, Myrmecophaga *didactyla*.

Coati is a name also assigned by Marcgrave to the Brasilian weesel, the animal described in the Transactions of the French Academy under that of *Coati mondi*, Viverra Nasua of Gmelin.

Coati, of Ray's quadrupeds, is the animal commonly called the racoon, Ursus Lotor of Schreber, and Gmelin.

COATING, in its general sense, denotes the covering of a body, or the spreading of one substance over another; and this is practised, with various views, in civil economy, in the arts, and in some scientific branches of knowledge. Thus, human beings are covered with various garments, both for defence and for ornament; houses, vessels, and most works of wood, are covered with paint, or pitch, or lead, or copper, or other matter, for the same purposes; the baser metals are covered with the richer, silver is coated with gold, copper with gold or silver in ornamental works; iron or copper is coated with tin for culinary purposes, in order to prevent the rusting of the former, and the noxious effects of the latter; and so forth. See the practical methods of performing these operations under the articles Painting, Plastering, Gilding, Silvering, Tinning, &c.

Coating, in *Chemistry*, is used principally for the purpose of defending certain vessels from the immediate action of fire; thus, glass retorts and the inside of some furnaces are coated with various compositions. See Lorication, and Luting.

Coating, in *Electricity*, means the covering of electric bodies with conductors, or the latter with the former, or, lastly, electrics with other electrics. Electrics are coated with conductors, for the purpose of communicating to, or removing from, their surfaces, the electric fluid in an easy and expeditious manner; otherwise an electric body, on account of its non-conducting property, cannot be electrified deprived of the electric fluid, without touching almost every point of its surface with an electrified or other body. This coating generally consists of tin-foil, sheet-lead, gilt paper, gold leaf, silver leaf, or other metallic body, either in the form of a thin extended lamina, or in small grains, such as brass filings, and leaden shot. The coating may be fastened to the surface of the electric by means of paste, glue, wax, or other adhesive matter. In lining Leyden phials, care should be had not to fasten the coating (if it consists of brass filings or gold leaf) with varnish; for this is apt to take fire on making the discharge. But in some cases the metallic coating is merely laid upon the electric; for instance, in certain experiments, a piece of tin-foil, or a brass plate, is laid

laid upon a pane of glafs, fo that after having charged the glafs, the coating may be eafily fhook off; and a Leyden phial is, fometimes, partly filled with leaden fhot, which performs the office of an inner coating, and may be eafily poured out of it. Alfo, when two extended parallel metallic furfaces are placed at the diftance of about an inch or two from each other, the intervening ftratum of air (being an electric) is faid to be coated, and may be charged and difcharged like a Leyden phial. When the electric is of a very fufible nature, fuch as fulphur, fhell-lac, fealing-wax, &c. a cafe of it may be coated by pouring it melted upon a metallic plate, or in a cup, which is required in certain experiments. See ELECTRICITY, ELECTROPHORUS, and LEYDEN *phial*.

In certain cafes conductors are coated with electrics, either partially or entirely, for the purpofe of preventing the abforption or diffipation of the electric fluid from their furfaces. This is done with varnifh, or more effectually with fealing-wax, the latter of which, when the fhape and fize of the conductor allows it, may be eafily performed by warming the conductor to a certain degree, which is indicated by actual trial, and then rubbing a ftick of fealing-wax over its furface.

Laftly, the coating of electrics with other electrics, is principally, if not exclufively, practifed with articles of glafs; for, fince moifture eafily adheres to the furface of glafs, the infulating quality of the latter is thereby greatly diminifhed and often annihilated; hence the glafs feet of infulating ftools, the glafs handles of directors, the pillars of fome electrical machines, &c. are generally covered with fome other electric fubftance of a refinous quality, which is not apt to attract moifture. The fubftances principally ufed for this purpofe are fealing-wax and varnifh. When the glafs article is fufficiently fmall, the beft way of covering it with fealing-wax is, to heat the former, and then to rub a ftick of fealing-wax over it, fo as to form an equal coat of the wax over the furface of the glafs; and this is, by far, the beft mode of obtaining the defired object; but when the piece of glafs is too large, then the fealing-wax muft be diffolved in fpirit of wine, and muft afterwards be fpread over the glafs with an hair pencil; having previoufly wiped the glafs perfectly clean and dry. In this cafe, however, care muft be had to ufe the beft rectified fpirit of wine, or alcohol; for if impure fpirits be ufed, the folution of fealing-wax, when fpread upon the glafs, will infulate very imperfectly, or even not at all. Of the diffolved fealing-wax you may lay two, three, or more, coats upon the glafs, always allowing one coat to become perfectly dry, before the next is put on.

With refpect to the ufe of varnifh, it muft be obferved, that very few of the common varnifhes will anfwer this purpofe in any tolerable degree. This is one, however, which, when properly made, and carefully applied, anfwers as well as the fealing-wax coating. This varnifh, which was long kept a fecret, is made in the following manner: Take half a pint of linfeed-oil, one ounce of faccharum faturni, and one ounce and a half of litharge. Set them in an iron veffel to boil over a fmall charcoal fire (*viz.* fuch as is barely fufficient for the purpofe), ftirring the materials frequently with an iron fpatula or an old knife. As foon as thefe ingredients are incorporated, add one ounce and a half of prepared amber, and let it continue to boil, ftirring the materials frequently, until you find upon trial, that a drop of the liquor, placed between two knife blades, ftretches like thick glue, or like turpentine. When this takes place, remove the veffel from the fire, fuffer it to cool a little, and then mix fpirit of turpentine with it, ftirring the whole together, which will thin it; but take care not to render it too thin; for by keeping, in a few days, it will of itfelf grow thinner. Laftly, keep it in bottles for ufe. *N. B.* The iron veffel muft be much larger than the quantity of ingredients might require, and it muft be furnifhed with a handle, becaufe the oil, &c. in boiling, is apt to fwell and will run over, if the veffel be not quickly removed from the fire. The amber is prepared, firft, by powdering it; fecondly, by melting, or rather charring it, in a fhovel over the fire; and, laftly, powdering it again in a mortar. This varnifh is ufed in the fame manner as the above mentioned folution of fealing-wax; but you need not lay on more than one coat of it, or, at moft, two.

COATZACUALCO, in *Geography*, a navigable river of Mexico, or New Spain, which difcharges itfelf into the gulf of Mexico, near the country of Onohualco.

COAVO, or CUAVO, a river of Africa, which runs into the Indian fea. S. lat. 8° 40′. E. long. 38°.

COB-*Nut*. See HAZLE.

COBA, or COBE, in *Ancient Geography*, a trading town or emporium of Ethiopia; feated on the Avalite gulph, according to Ptolemy.

COBÆA, in *Botany* (fo named by Cavanilles, in memory of father Barnabas Cobo, a Jefuit, who, after living forty-five years in North and South America, compofed a natural hiftory of the new world, ftill extant, but never publifhed), Vent. v. ii. p. 401. Cav. Ic. 16, 17.

Gen. Ch. *Cal.* pentagonous, one-leafed, with five expanding fegments. *Cor.* monopetalous, funnel-fhaped; tube very long, gradually dilated; border campanulate, five-cleft; fegments open, flightly crenated. *Stam.* Filaments adhering to the lower part of the tube, declining,; anthers oblong, verfatile, at firft fhorter than the corolla, afterwards longer, and becoming twifted in a fingular manner. *Pift.* Germ furrounded at its bafe with a pentagonous glandular rim or nectary; ftyle longer than the ftamens; ftigmas three or five, reflected. *Capfule* from three to five-celled. *Seeds* numerous, imbricated.

Sp. C. *fcandens*, Cav. Icon. tab. 16, 17. Bot. Mag. 851. (Cobbea, Bot. Rep. 342.) An elegant climber. *Leaves* alternate, equally pinnated, terminated by a dichotomous tendril; leaflets egg-fhaped, acute. *Flowers* at firft green, finally changing to a bright violet, large, axillary, folitary. A native of Mexico, where it is called yedra, morada, or violet ivy. It grows with aftonifhing rapidity, and is eafily propagated by cuttings. Firft raifed by Cavanilles in the royal garden at Madrid, and fince both in France and England

COBALT, *Kobolt*, Germ. in *Mineralogy*. Cobalt is a metal of a white colour, inclining to bluifh, or fteel-grey; when tarnifhed, acquiring a reddifh tinge; its fracture is compact, fine-grained, and uneven. Its fpecific gravity is 8.53. It is attracted by the magnet, and is itfelf capable of polarity. At a common temperature it is brittle, and eafily reduced to powder, but when red hot may be flightly extended under the hammer. It requires for its fufion nearly the fame heat as caft iron does. When in the ftate of oxyd it tinges the faline vitreous fluxes of a deep blue. It is foluble in nitro-muriatic acid, and the folution forms a blue-green fympathetic ink.

§ 1. *Ores of Cobalt.*

Cobalt occurs, 1ft, mineralized by arfenic; 2d, as an oxyd; 3d, combined with arfenic acid; 4th, combined with fulphuric acid.

Sp. I. *Arfenical Cobalt.*

Cobalt is never found pure in the metallic ftate, but is always

always alloyed with arſenic, and often beſides contains iron and ſulphur, and ſometimes nickel, biſmuth, and ſilver.

Of the ſub-ſpecies only the cryſtallized (3d ſub-ſpecies) has been analyzed, and both by Klaproth and Taſſaert. The following are the reſults. Klaproth obtained

Cobalt -	44.
Arſenic -	55.5
Sulphur -	0.5
	100.0

Taſſaert obtained

Cobalt -	36.66
Arſenic -	49.
Iron -	5.66
Sulphur -	6 5
	[illegible]
Loſs -	[illegible]
	[illegible]

Similar differences are obſerved between the analyſes of this variety by other chemiſts, ſo that it may be conſidered as allowing conſiderable range both in the proportion and nature of its conſtituent parts, without materially affecting its cryſtallization. It appears, however, from Hauy, that when the cryſtals diſplay a lamellar fracture, they contain a notable proportion of ſulphur and iron. We ſhall follow Brochant's arrangement of the ſub-ſpecies.

1. Sub-ſpecies. White cobalt. *Weiſſer Speiſkobolt. Cobalt blanc*, (ſpecies 2 of Kirwan and Hauy).

The colour of this mineral, when recently broken, is tin-white, but its ſurface is generally yellowiſh, bluiſh, greyiſh, or irideſcent, like ſteel that has been heated. It occurs in maſs, diſſeminated, kidney-ſhaped, and rarely in minute quadrangular tables, or imperfect cubes and octohedrons. Their external luſtre is ſlight, but internally is brilliant and metallic. Its fracture is fine-grained and uneven: when broken, it flies into ſharp-edged irregular fragments: when in maſs, it contains fine-grained granular diſtinct concretions. It requires a poliſh by friction, is brittle and hard: when expoſed to the blow-pipe, white cobalt melts with great eaſe, giving out a white vapour, and a ſtrong arſenical odour, and a white brittle bead of metal remains, which gives a blue colour to glaſs of borax, when melted with it.

It is found in Norway, at Tunaberg in Sweden, Annaberg in Saxony, and alſo, rarely, in Swabia and Stiria. In Saxony and Norway, it is contained in beds of micaceous ſchiſtus, accompanied by the red earthy cobalt, quartz, hornblende, and pyrites.

2. Sub-ſpecies. Dull-grey cobalt. *Grauer Speiſkobolt. Cobalt gris*, (ſp. 1. of Kirwan and Hauy.)

The colour of this mineral is a clear ſteel-grey, but by expoſure to the air it acquires an irideſcent tarniſh. It occurs in maſs or diſſeminated, ſometimes in kidney-ſhaped or cluſtered maſſes, and very rarely in ſpecular laminæ. Its external luſtre is very feeble, but internally it exhibits a bright metallic luſtre. Its fracture is compact, generally even, but ſometimes paſſing into flat-conchoidal; its grain is remarkably fine and cloſe. Its fragments are ſharp-edged, indeterminate. It is not ſo hard as the preceding, and is leſs brittle. Its ſpecific gravity varies from 4.3 to 5.3, or even 5.5. It gives a bluiſh-grey metallic ſtreak.

When expoſed by itſelf to the blow-pipe, it gives out an arſenical vapour and ſmell; but ſeldom fuſes: when treated in the ſame way with borax it gives the flux a blue colour, and is reduced to a metallic globule.

A ſpecimen from Cornwall was analyſed by Klaproth, who procured from it about 20 per cent. of cobalt; 24 of iron, and 33 of arſenic, the remainder conſiſting partly of biſmuth and ſulphur, together with earthy matter. Some varieties have alſo been found to contain nickel and ſilver. It is found in Saxony, Bohemia, Swabia, and Hungary; alſo in Stiria, France, Norway, and Cornwall.

3. Sub-ſpecies. Bright white cobalt. *Glanz Kobolt. Cobalt eclatante.*

The colour of this mineral is tin-white, but tarniſhes to greyiſh, whitiſh, or irideſcent. It is found in maſs, diſſeminated or inveſting, or of particular ſhapes, as cluſtered, kidney-ſhaped, globular, or cryſtallized in cubes or octohedrons. The cryſtals are middling-ſized or ſmall, their ſurface is commonly ſmooth and brilliant, and marked with ſtriæ on the ſides of the primitive cube. The fracture of the cryſtals is lamellar, that of the other varieties is fine-grained, uneven, or radiated. When in maſs it preſents granular, or lamellar, or teſtaceous diſtinct, concretions. Its hardneſs is ſomewhat inferior to the preceding ſub-ſpecies: when pulverized, it is of a ſteel-grey colour. Sp. gr. 6.2 It is brittle, and eaſily frangible.

Before the blow-pipe, it burns with a faint white flame, diſengaging arſenical vapours; it then becomes black, is attractable by the magnet, and is, with the utmoſt difficulty, reduced to a metallic globule. It often contains as much as 50 per cent. of reguline cobalt.

This is the commoneſt of all the ores of cobalt: it occurs for the moſt part in primitive mountains, together with the other ſpecies of cobalt ore, with vitreous, red, and native ſilver, with arſenical and cupreous pyrites, &c. It is met with in various parts of Germany; alſo in Sweden, Norway, Stiria, and Cornwall.

Sp. II. *Earthy Cobalt.*

Of this there are the four following varieties:

Var. 1. Friable black cobalt. *Schwarzer Kobolt muhn. Cobalt terreux noir friable.*

The colour of this is black, bluiſh, browniſh, or greyiſh black. It is without luſtre, has a looſe earthy conſiſtence, is friable and meagre, ſtains the fingers in a ſlight degree, and gives a brightiſh ſtreak. It is ſoluble in muriatic acid; tinges borax blue, and very rarely ſhews any indications of ſulphur or arſenic, when treated by the blow-pipe.

Var. 2. Indurated black cobalt. *Verhärteter ſchwarzer kobolt. Cobalt terreux noir endurci.*

In colour it reſembles the preceding, except that it is ſometimes of a dark greeniſh black. It occurs maſſive, diſſeminating, inveſting, kidney-ſhaped, cluſtered, or in veins. It is dull, but takes a poliſh by friction. Its fracture is earthy and compact, paſſing into flat-conchoidal. It poſſeſſes a moderate degree of hardneſs. Sp. gr. from 2. to 4. With nitric acid it gives a red ſolution, and a bluiſh-green one, with muriatic acid. It has not been accurately analyſed, but conſiſts of oxyd of cobalt, with a ſmall variable proportion of arſenic and ſulphur mixed with vitreous ſilver ore, oxyd of iron, and clay.

This, and the preceding variety, are always found together; but the indurated is by much the moſt rare. It is found in Saxony, Thuringia, Swabia, and the Tyrol.

Var. 3. Yellow cobalt. *Gelber erdkobolt. Cobalt terreux jaune.*

Its colour is that of faded ſtraw, paſſing into yellowiſh white, and often ſtreaked with brick-red. It is found in maſs, diſſeminated or inveſting. It is without luſtre, has a fine-

fine-grained earthy fracture, gives an unctuous ftreak, and is foft and friable.

It is infufible *per fe*, gives a feeble, arfenical odour, and communicates a deep blue tinge to borax: but when mixed with iron, as it often is, the colour is greenifh.

This is one of the rareft of the ores of cobalt. It has hitherto been found only in Thuringia, Wirtemberg, and Dauphiné.

Var. 4. Brown cobalt. *Brauner erdkobolt. Cobalt terreux brun.*

Its colour is a clear liver-brown, paffing into grey, yellow, and black. It occurs in mafs or diffeminated; it is dull, but acquires a greafy luftre by friction. Its fracture is fine-grained, earthy. It is eafily broken, being almoft friable. It has been analyfed, but appears to be the connecting link between the fecond and third varieties. When thrown on burning coals, it generally gives out an arfenical odour.

Sp. III. *Red Cobalt.*

Of this there are two varieties.

Var. 1. Cryftallized. *Koboltblute. Fleurs de Cobalt.*

The ufual colour of this mineral is peach-bloffom-red, paffing into cochineal and greyifh-red; by expofure to the air it becomes paler, and almoft white. It is found very rarely in mafs, or diffeminated, and ftill feldomer cluftered, or kidney-fhaped; its moft ufual ftate is that of a thin cryftalline covering, or minute drufes of cryftals. The forms which it generally affects are rectangular tables, or tetrahedral acicular prifms, or hexahedral prifms terminated by dihedral fummits: thefe figures, however, are not often determinable, on account of the minutenefs of the cryftals, and their tendency to form radiates and globular groupes. The furface of the cryftals is fmooth and brilliant, and their fracture lamellar. The fracture of the other kinds is radiated, paffing into fibrous. It is tranflucent, and often, when cryftallized, femi-tranfparent.

Before the blow-pipe it gives a faint arfenical odour, and becomes of a dark-grey colour; it is almoft infufible by itfelf, and gives a beautiful blue tinge to borax.

Var. 2. Earthy. *Koboltbefchlag. Cobalt terreux rouge pulverulent.*

The colour of this is the fame as that of the preceding variety. It occurs in a pulverulent or indurated ftate, diffeminated through, or invefting other minerals, and occafionally in mafs. It is dull, opake, and has an uneven earthy fracture. In other refpects it agrees with the preceding.

Sp. IV. *Native fulphat of cobalt. Naturlicher koboltvitriol. Sulfate de cobalt natif.*

At Herrengrund, near Neufohl in Hungary, is found a faline fubftance, in the form of tranflucent ftalactites, of a pale rofe-red colour. It was at firft fuppofed to be fulphat of manganefe, but from an analyfis of Klaproth, it appears to be a pure fulphat of cobalt.

§ 2. *Reduction of the Ores and Analyfis.*

Cobalt is never employed in manufacture in the reguline ftate; the fole ufe of this very valuable metal being to give various fhades of blue colour to glafs and enamel, and when thus employed, it is in the ftate of oxyd. In this ftate it forms either *zaffre*, or *fmalt*, when prepared in the method, which will be defcribed in the next fection.

Many of the cobalt ores are complicated, and difficult to be analyzed completely, nor is it eafy to obtain the cobalt alone from them in confiderable purity. The metals naturally varied with cobalt are the following: 1ft, arfenic, generally in very large quantity, part of which is in the reguline ftate, and, as appears, another part is in the ftate of arfenic acid, which, uniting with the oxyd of cobalt, forms an arfeniat of cobalt, that has often been miftaken for the pure oxyd. The entire feparation of the two is extremely difficult. 2d. Nickel exifts with many cobaltic ores; and being foluble in the fame menftrua, it is not eafily feparated. 3d. Iron, in variable quantity, is found with moft of the ores of cobalt, and is hurtful, as it impairs and degrades the fine blue for which alone cobalt is valued. 4th. Manganefe, which is a ftill worfe admixture. 5th. Copper, in fmall quantity, is fometimes found, which, however, does not much injure the cobalt.

An imperfect analyfis of the common cobalt ores, and which merely has for its object the extraction of the cobalt, is made in the following way: Mix the ore, in fine powder, with charcoal or faw-duft, and roaft it in a low red heat, till the arfenic is driven off, and no arfenical fumes are any longer perceived. Calcine the refidue fome time longer with a ftrong red heat, and in an open fire, and then mix it with about four parts of a faline, reducing flux, (fuch as that compofed of equal parts of tartar and carbonat of potafh) and heat it in a roomy covered crucible, at firft moderately, till the firft fwelling of the materials has fubfided, and then for a quarter of an hour in a heat fully fufficient to melt iron. When cold, a button of reguline cobalt is found beneath a mafs of fcoriæ of an intenfe blue-black colour. From 100 grains of the Tunaberg ore, Klaproth obtained in this way 44 grains of regulus of cobalt, which, however, muft have been ftill very impure, retaining iron and a portion of the arfenic. It may be further purified by alternate deflagration with nitre, and reduction with a faline carbonaceous flux, repeated two or three times, in the way that Lampadius and Tromfdorf have employed with fmalt, as will be prefently mentioned.

The reducing flux for cobalt ore, employed by Beaumé, is the following: Mix 1 oz. of the roafted ore with 3 oz. of black flux, and $\frac{1}{2}$ oz. of carbonat of potafh, cover it when in the crucible with about 1 oz. of falt, and heat the whole, at firft flowly, and afterwards very brifkly for a quarter of an hour.

But, for the purpofes of mere analyfis, where all the conftituent parts of the ore are required to be known with as much precifion as poffible, thefe methods are much too inaccurate to be depended on, and recourfe muft be had to the more tedious and difficult analyfis in the humid way. The procefs given by Taffaert (An. de Chim. tom. 28.) is highly valuable and inftructive.

The method given by Lampadius, of purifying cobalt by fufion is the following: Project in a red hot crucible a mixture of 4 oz. of zaffre, 2 oz. of nitre, and $\frac{1}{2}$ oz. of charcoal. A ftrong arfenical fmell is perceived in the procefs, and a blackifh-grey mafs is left, which is to be again mixed with charcoal and nitre and deflagrated as before: then throw in the crucible 2 oz. of black flux, and heat it intenfely for an hour. This gives a tolerably pure regulus of cobalt, weighing 6 drams. Powder it, and mix it with 1 dram of nitre, and as much manganefe; put it into a luted double crucible, and heat it for an hour in a forge-furnace. The metal, by this operation, lofes all its iron and is nearly pure.

Tromfdorf's procefs is the following: The zaffre, or fmalt, is to be twice detonated with nitre, then wafhed in hot water, which carries off the arfenic now united with the potafh of the nitre, and the refidue is to be digefted in dilute nitric acid, which will only touch the cobalt and leave the iron. The nitrous folution may then be decompofed by an

alkali,

alkali, and the purified oxyd of cobalt, thence resulting, may be afterwards reduced if required.

§ 3. *Preparation of Zaffre and Smalt, or Azure.*

All the zaffre and smalt of commerce are prepared in some parts of Germany, and particularly at Schneeburg in Misnia, which affords a very lucrative trade to Saxony. The following is the method of preparation as given by Kunckel. (See *Neri's Art de la Verrerie.*) The cobalt ore, broken in small pieces, is spread on the hearth of a furnace, like a baker's oven, so constructed that the flame of the wood is reverberated on all sides over the surface; which soon heats it red-hot. A very dense arsenical vapour then arises, which is conveyed from the furnace into a horizontal wooden square trough, or chimney, sometimes of the enormous length of a hundred fathoms, where most of the arsenic is condensed and collected for sale. The cobalt ore is calcined for some hours, till it scarcely emits any more vapours, after which it is taken out, ground to fine powder, replaced in the oven, and calcined a second time, and then again ground and passed through a very fine sieve. This powder is then mixed with about twice its weight of powdered flint or quartz, wetted to the consistence of stiff mortar, and rammed into small barrels, where the mass soon acquires a stony hardness, and is then the *zaffre* of commerce. The reason of using the flints appears to be partly to dilute the cobalt ore, and partly for some purpose of concealment; the exportation of the simple calcined ore being forbidden under heavy penalties.

Smalt, sometimes also called *azure blue*, when finely powdered, (which must not be confounded with the true *azure*, or *lapis lazuli*) is an intensely deep blue glass, made of the calcined cobalt ore and the common vitrifiable fluxes, which is used as a colouring matter for a variety of purposes. The intensity of colour of course depends on the proportion of roasted cobalt ore which it contains, regard being had to its quality, and the proportion of oxyd of cobalt which it is estimated to contain. On an average about equal parts of the roasted ore of potash, and of ground flints are used. This mixture is first *fritted*, and then melted in pots similar to those of glass-houses, and about ten or twelve hours of fusion are required. When the glass is thoroughly fused, it is laded out and dropped into cold water to crack it in every direction, and then ground in a mill made of a very hard stone. At the bottom of the glass-pots a quantity of regulus of bismuth is always found, lying under a mixed alloy of arsenic, iron, and copper.

The grinding of the blue glass is a work of much difficulty, and different degrees of fineness of the powder are obtained by subsequent washing and sifting.

Smalt is a valuable colour, on account of the fine body which it possesses; and being indestructible in any heat, it is useful for all enamel colours, but it will not mix with oil colours, and therefore can only be partially used. Starch is slightly coloured with it to give a small degree of blueness, which corrects the yellow hue which linen and cotton acquires by being worn.

Zaffre is also prepared in Bohemia, Wirtemberg, Silesia, and Lorraine, but the Saxon is preferred.

The oxyd of cobalt contained in the zaffre is still intimately mixed with a small portion of arsenic, partly as arsenic acid, and partly as oxyd of arsenic. If zaffre is digested in liquid caustic ammonia, a red solution is formed, which, on evaporation, deposits a yellow powder, which is a mixture of the oxyds of cobalt and arsenic. If zaffre is boiled in water, a solution is also obtained, which is sensibly acid, and was thought by Brugnatelli to indicate the existence of a cobaltic acid, but Darracq has shewn it to be an arseniat of cobalt.

§ 4. *Chemical Properties of Cobalt.*

Cobalt, when perfectly pure, has a steel-grey colour, not very resplendent, and when slowly cooled, has somewhat of a reticulated texture. It melts at about the fusing point of cast iron.

Cobalt, when heated strongly in contact with air, is converted into a black oxyd, with an increase of about 18 parts on 100; hence 100 parts of the oxyd contain 84.75 of metal, and 15.25 of oxygen. When it retains any arsenic, the colour is reddish.

This metal burns in oxymuriatic acid gas, with a bright white flame.

The sulphuric acid dissolves cobalt with difficulty, but its oxyds more readily. If zaffre, or which is better, the wet precipitate from nitrat of cobalt by carbonat of potash, is digested with sulphuric acid; and the mixture evaporated nearly to dryness, the residue digested with hot water, gives a solution of sulphat of cobalt, which, by slow evaporation, affords the salt in crystals, that are of a fine red when the metal is pure, but greenish when it contains nickel. This salt is soluble in 15 parts of boiling, and 24 parts of cold water.

Nitric acid dissolves cobalt or its oxyd copiously and with great ease by digestion in a moderate heat. The solution is red, or claret-coloured, or yellow, if it holds iron. It scarcely can be brought to crystallize, but by evaporation to dryness and calcination, it leaves a dark red or violet oxyd.

Muriatic acid acts with great difficulty on cobalt, and can scarcely be made to dissolve it, unless by repeated evaporations to dryness and affusion of fresh acid. But it dissolves the oxyds of this metal with much more ease when assisted by heat. The solution is of a rose-red, but when evaporated to dryness and warmed, it acquires a beautiful blue-green, which more approaches to blue in proportion as the solution is free from iron. This singular property of the muriat of cobalt was first discovered by Hellot, and used in making a beautiful *sympathetic ink*, the properties of which have engaged much of the attention of chemists. If the solution be considerably diluted, characters traced by it on paper are scarcely visible when cold, but when held near the fire, they very speedily assume a beautiful blue green, which colour again totally disappears when cold, and may be made to re-appear at pleasure by the same means. The paper, however, should not be heated more or longer than is necessary to produce the full effect. It is found, that not only the pure muriat of cobalt, but any solution of this metal into which muriatic acid, or a muriatic salt, enters, will have the same effect. Hence the commonest method of making this sympathetic ink, and that employed by the inventor, is, to digest zaffre in a moderate heat, with a mixture of about three parts of nitric and one of muriatic acid, diluted with as much water, till a high claret-coloured solution is formed, which should then be diluted with as much water as possible, to prevent the paper from being corroded by the acid. But a much more concentrated solution may be made, which shall not injure the paper, in the following way: Boil some moderately dilute nitric acid or zaffre, till much of the cobalt is dissolved out of it, then add to it any alkali as long as any precipitate takes place; pour off the clear liquor after standing some time, wash the sediment with hot water, and throw it on a filter. Take the sediment which is left on the filter, and put it, while still wet, into a glass flask, and boil it it with diftilled vinegar, which will readily diffolve it, and make a rofe-coloured folution, which may then be made into a fine fympathetic ink, by diffolving in it fome common falt or fal-ammoniac.

It has been mentioned that the colour of the common cobaltic fympathetic ink is green, and when made fimply by diffolving the foluble part of zaffre in nitro-muriatic acid, it is generally a pale grafs green, but in proportion as the cobalt becomes purer, the colour approaches to a bright blue green. This is probably owing to the feparation of iron which the common zaffre contains in abundance, and which may be effected more or lefs perfectly in various methods. The fimpleft (though not the moft economical) is to add to the folution very gradually carbonat of potafh as long as the precipitated oxyd is rofe-coloured, and to ceafe when it begins to have a yellow ochery hue; for the former confifts chiefly of the cobalt, and the latter chiefly of the iron. Then by collecting, wafhing, filtering, and re-diffolving the rofe-coloured precipitate in the nitric or acetous acid, a much purer folution is obtained, which contains very little iron, and gives a blue-green fympathetic ink, when any muriatic falt is added. Another way of feparating moft of the oxyd of iron is to evaporate the nitrous folution nearly to drynefs, and to expofe it for fome time in a fhallow veffel to the air, by which much of the iron will be rendered infoluble, and fubfide as a red ochre, whilft the cobalt will remain in folution. Or elfe the acetited folution of both metals may be alternately evaporated to drynefs, and the foluble part re-diffolved by frefh acetous acid, for two or three times fucceffively, by which the iron will gradually feparate, and the cobalt alone be left.

But to obtain perfectly pure cobalt, feparate from arfenic, bifmuth, iron, and other impurities, is more difficult, for in the above-mentioned proceffes the arfenic acid and oxyd contained in the cobalt ore muft accompany the cobalt and be retained in all the folutions. We fhould therefore recommend the following method: Digeft a quantity of zaffre with nitric acid diluted with about three times its weight of water, and boil them for fome time. After ftanding for a while pour off the clear folution and evaporate it nearly to drynefs. Then dilute it pretty largely with water, which will caufe the bifmuth, if any, to fubfide. Then neutralize any excefs of acid in the filtered folution by any alkali, avoiding to precipitate any of the metal which it contains, and add, cautioufly by drops, fome of a folution of nitrated lead (made by diffolving the cryftals of this falt in water) as long as any precipitate falls down. This latter is arfeniat of lead, and by this means all the arfenic acid of the zaffre will be removed. Then entirely decompofe the clear folution by cauftic potafh, collect and wafh the precipitated oxyd put into a phial, and add to it fome cauftic ammonia, which will diffolve only the oxyd of cobalt. From this ammoniacal folution all the oxyd may be again feparated either by evaporation to drynefs, or by boiling with cauftic potafh, and a very pure black oxyd of cobalt is left, which may be reduced to the metallic ftate by being heated intenfely in a covered crucible lined with charcoal; or it may be diffolved in the feveral acids. This method, however, is expenfive, on account of the quantity of ammonia employed, but it is difficult to exclude the iron totally by any other method.

A triple falt of cobalt, nitric acid, and ammonia, is made by adding ammonia to nitrat of cobalt, which may be cryftallized.

The fixed alkalies have little or no action on cobalt or its oxyds in the moift way, but ammonia diffolves the oxyds largely, as already mentioned.

Tincture of galls give a yellowifh white, and pruffic acid a green precipitate to the folutions of cobalt when free from iron.

Sulphur unites with great difficulty to cobalt by fufion, but the hydrofulphurets and liver of fulphur readily diffolve this metal. Hydrofulphuret of potafh added to the folutions of cobalt gives a very black precipitate, which an excefs of the hydrofulphuret again diffolves. Cobalt ore fufed with liver of fulphur is diffolved thereby, and a brilliant metallic looking mafs is produced, which deliquefces totally by expofure to air, and falls into a dark liquid.

None of the poffible alloys of cobalt deferve any particular notice, for this metal has only a fingle ufe in the arts, namely, that of giving a blue colour to vitrefcent compounds when its oxyd is melted with them, and this colouring power is fo intenfe, that a fingle grain of the pure oxyd (or zaffre in proportion) will give a very deep blue to half an ounce of glafs. When the glafs contains much more than this proportion, the body of colour is fo intenfe as to render it nearly opake, and hence, too, it is of ufe in forming the black gl[illegible] and enamels.

The affinities of cobalt are ftated to be in the following order, *viz.* the gallic, oxalic, muriatic, fulphuric, tartareous, nitric, phofphoric, acetic, arfenic, and carbonic acids, and ammonia. We may add. however, that the difficulty of obtaining pure cobalt, and the variety of metals with which it is ufually alloyed, render this order of affinity fomewhat doubtful.

Cobalt is alfo ufed by fome to exprefs that fuffocative vapour or damp in mines, which often proves fatal to the miners. It is common among the Germans, to fay on this occafion, that the cobalt rofe and choaked them. See Damps.

COBAN, in *Commerce*, a piece of gold coin in Japan, worth 30*s*. fterling.

COBANDI, in *Ancient Geography*, a people of Germany, placed by Ptolemy on the eaftern coaft of the Cimbric Cherfonefus.

COBARRUBIAS, Alonzo De, in *Biography*, an architect of Toledo, who is faid to have been the firft who introduced the Greek and Roman ftyles of architecture in Spain. He was employed by Charles V. to erect the north front, as well as fome other parts of the royal palace of Toledo, in which work, however, he has adopted a mixed ftyle, partaking of the old Gothic as well as of the Greek; probably with the view of rendering the modern part of the building more conformable to the great body of that very ancient fabric. He likewife modernized the vaft and magnificent cathedral of the fame city, and built the extenfive church and monaftery of St. Michael at Valencia. Milizia, Mem. degli. Arch.

COBAYA, in *Zoology*, the Guinea pig. See Cavia *cobaya.*

COBBAN, in *Botany*, a fmall tree like a peach-tree, which grows in Sumatra, called *Perficæ affinis in Taprobana.* C. B. *Arbor Getruph, five coblan*, J. B. It bears a fmall leaf, like that of the tree which produces the *filiqua cathartica*, with fhort branches, and a yellowifh or faffron-coloured bark. The fruit is thick and round like a tennis-ball, inclofing a nut as big as a filbert, which contains a very bitter kernel, tafting like the root of angelica.

The fruit is very proper to quench thirft; but the kernel, however bitter, is far fuperior in virtue. The inhabitants of Sumatra, where the tree grows, extract an oil from the kernel, which is very efficacious in pains of the liver and fpleen, taken inwardly, or ufed by way of unction; and is alfo a fovereign remedy in the pain of the gout, to which the inhabitants of that ifland are very fubject.

From

From the same tree distils a gum, which is very serviceable in the before-mentioned disorders, if it be dissolved with a moderate quantity of oil, and applied to the affected parts by way of cataplasm.

COBBE', in *Geography*, the capital town of Dar-fûr, in Africa, situated almost on the direct road from the north to the south extremity of the country. N. lat. 14° 11'. E. long. 28° 8'. The town is more than 2 miles in length, but very narrow; and the houses, few in number, each of which occupies within its inclosure a large portion of ground, are separated by considerable waste. It is full of trees of several kinds, which give it an agreeable appearance at a small distance; for, being situated on a plain, it is not distinctly visible more than 4 or 5 miles in any direction. During the rainy season, the ground on which it stands is surrounded by a torrent. Fronting it to the east, the town itself extending from north to south, is a mountain or rock, distinguished by the same appellation, which is the resort of hyænas and jackals. The inhabitants are supplied with water from wells of small depth, some of which are dug within the inclosure of many of the houses; but the best of them are in or near the bed of the torrent. The town is surrounded by villages at small distances, in various directions, which are dependent upon it, and increase its apparent population. The inhabitants of Cobbé are, for the most part, merchants, employed in trading to Egypt, the greater number of whom come from the river, and some of them are natives of that country. Some Egyptians, chiefly from Saïd, a few Tunisines, natives of Tripoli, and others, come and go with the caravans, remaining only a sufficient time for the sale of their goods. Others have married in Dar-fûr, and are now perfectly naturalized, and recognized as subject to the sultan. The fathers being dead, the children succeed to their occupations. The other inhabitants are foreigners, from Dongola, Mahas, Sennaar, and Kordofân, who are generally indefatigable in commerce, but daring, restless, and seditious, so that the present sultan has made some efforts to banish them from his dominions; they are the offspring of those whose parents have emigrated, and who have themselves been born in Dar-fûr; the latter are often people of debauched manners, and not remarkable for the same spirit of enterprise as the actual emigrates. The people first mentioned commonly use among themselves the language of Barabra, though they also speak Arabic. The latter are generally unacquainted with any language but the Arabic. They usually intermarry with each other, or with the Arabs. Some, avoiding marriage with Furian women, merely cohabit with their slaves. Persons of both these descriptions are easily distinguishable from the natives of the country, being usually of a more olive complexion, and having a form of visage more nearly resembling the European, with short curly black hair, but not wool. They are a well-sized and well-formed people, and have often an agreeable and expressive countenance, though sometimes indicating violent passions, and a mutable temper. South-east of the town, in a large open space, a market is held on Monday and Friday, in every week, in which provisions of every kind are sold, including all the commodities which the country produces, and also those that are brought from Egypt, and other places; and from this market all the villages, six or eight miles round, derive their supplies. About the month of December grain is cheapest, and at this time the inhabitants commonly lay in their annual stock. Two, or sometimes three, pecks of millet may be had for a string of beads, worth about one penny sterling, at Cairo. Slaves, though sometimes brought to the market, are commonly sold privately, which is frequently complained of as an evil, because it facilitates the sale of such as have been stolen from other quarters. In the town they have four or five "mectebs," in which boys are taught to read, and, if they wish it, to write. The lecturer instructs gratuitously the children of the indigent; but those who are in easy circumstances make a small remuneration. Two or three lectures in the Koran, and two others in what they call "elm" theology. In this town is one small mosque, being a square room, formed by walls of clay, where the fukkara, or pretenders to extraordinary sanctity, blending with it brutal intolerance to strangers, meet thrice in the week. A large mosque, the area of which was about 64 feet square, and the walls about 3 feet thick, was begun when Mr. Brown visited this place; but though the material was merely clay, the work advanced very slowly. Browne's Travels in Africa, ch. 17.

COBBESECONTE, or COPSECOOK, signifying, in the Indian language, the land where sturgeons are taken, is a small river which rises from ponds in the town of Winthrop, in the district of Mainé, and falls into the Kennebeck within 3 miles of Nahunkeag island, and 15 from Moose island.

COBBING, in *Sea Language*, a punishment inflicted at sea on those who quit their station during the night watch. It consists of a number of strokes on the breech with a flat piece of wood, called the *cobbing-board*.

COBBS, in *Geography*, a town of America, in the state of Virginia; 20 miles S.W. of Richmond.

COBCAR-ING *Iron-works*, are situate on a branch of the Dearne and Dove canal, in Yorkshire. See CANAL.

COBELLA, in *Zoology*. See COLUBER *venosus*, called by Laurenti *aspis cobella*.

COBEQUIL, or COLCHESTER *River*, in *Geography*, a river of Nova Scotia, which rises within 20 miles of Tatamogouche, on the N.E. coast of Nova Scotia; from thence it runs southerly, then S.W. and W. into the east end of the basin of Minas. At its mouth is a bank, with a good channel on each side, so that vessels of 60 tuns burden may pass, and sail 40 miles up the river. On its banks are some scattered settlements.

COBER, a river of England, in the county of Cornwall, which runs into the English channel a little below Helston.

COBESEY, in the district of Maine, in N. America. See PITTSTON.

COBEZA, or COBIJA, an obscure port and village in the audience of Los Charcas, in Peru, South America; the place is inhabited by about 50 Indian families, and is the most barren spot on the coast. It is, however, the nearest port to Lipes, where are silver mines, and also to Potosi, which is above 100 leagues distant through a desert country.

COBHAM, a small town of America, in the state of Virginia, on the south bank of James river, opposite to Jamestown; 20 miles N.W. of Suffolk, and eight or nine S.W. of Williamsburg. N. lat. 37° 7'. W. long. 76° 55'.

COBHAM *Isle*, an island mentioned by captain Middleton in the journal of his voyage for finding a north-east passage. Its two extremes bear N. by E. and E. by N. in N. lat. 63°, and E. long. from Churchill, 3° 50', which he takes to be the "Brook Cobham" of Fox.

COBI, as it is called by the Tartars, and denominated *Chamo* by the Chinese, an immense desart of Tartary, running in a parallel direction from the east to the west, south of the Altaian ridge, and occupying almost the whole southern part of the country of the Kalkas. This desart is reckoned to be more than 100 leagues in length from east to west, and almost the same in breadth from north to south, and even more towards the western parts; and it presents nothing to view but immense plains of sand, fometimes moveable, fometimes folid. Thefe plains are here and there interrupted by fome little hills, on which are feen a few bufhes, but not a fingle tree. It is in general dry, and deftitute of pafturage and water of every kind, except a fmall number of pools in which the rain is collected, and a few bad wells that occafionally occur. Its fituation is very high, and it may be eafily perceived on leaving China, that one muft afcend confiderably to crofs it; the cold, on that account, is exceedingly fharp, and continues very long. The great quantity of falt with which the fand is impregnated greatly contributes to this temperature. On digging only a few feet below the furface, the earth may be found frozen in every feafon of the year. The fands of this region are very inconvenient to travellers, and dangerous to horfes, many of which daily perifh; and, therefore, the neighbouring Tartars, when they traverfe them, generally make ufe of camels, becaufe thefe animals require little food, and can live without water for feveral days.

COBIJA. See COBEZA.

COBILUS, in *Ancient Geography*, a river of Afia Minor in Bithynia, according to Valerius Flaccus, fuppofed to be the Cobulatus of Livy.

COBIOMACHUS, a name given by Cicero to a village of Gallia Narbonnenfis, fuppofed to be the fame with the modern *Cabaignac*, between Touloufe and Narbonne.

COBITIS, in *Ichthyology*, a genus of abdominal fifhes, diftinguifhed by the following character.

The head is fmall, oblong, and deftitute of fcales; eyes fituated in the upper part of the head; nape flat. Gill-membrane with from four to fix rays; gill-cover confifting of a fingle piece, and clofing beneath. Body covered with mucus, and fmall, thin, deciduous fcales; and nearly of equal thicknefs from the head to the tail; back ftraight, with a fingle fin; lateral line fcarcely confpicuous; vent neareft the tail.

Species.

BARBATULA. Cirri fix, head unarmed, and compreffed. Linn. *Enchelyopus*, &c. of Klein, and *Cobitis fluviatilis* of Ray.

The *Cobitis barbatula* is the bearded loche of Englifh writers. This fifh is an inhabitant of clear rivulets in many parts of Europe. The body is finely varied with pale brown, white, and black; it is a fertile fifh, and of exquifite flavour, and is on that account cultivated with much affiduity as an article of luxury for the table in fome parts of Europe. Donov. Brit. Fifhes.

TAENIA. A forked fpine under each eye. Linn. *Cobitis aculeata*, Marfd. Dan. *Taenia cornuta*, Willughby.

This alfo is a native of Europe; it inhabits frefh waters, and is obferved to lurk under ftones, whence in England it has obtained the name of groundling; it feeds on worms, aquatic infects, and fmall fifhes; when handled makes a hiffing noife. The colour is yellowifh, with four rows of brown fpots, and like the former fpecies this has fix beards or cirri to the mouth.

FOSSILIS. Cirri eight; a forked fpine over each eye. Linn. Fn. Suec. *Muftela foffilis*, Marfd. *Beyfzker*, Gefner.

This fpecies is the largeft of the genus; it inhabits boggy places, and muddy lakes, and ftreams in feveral parts of Europe, but is moft frequent in Germany. The great loche is ufually from ten to twelve, or at the utmoft fifteen inches in length, of a dull yellowifh-brown colour, marked above by feveral longitudinal ftripes of dark brown or black, and which extend the whole way from the head to the tail. This fpecies conceals itfelf during the winter, or when the marfhes it inhabits begin to grow dry, at fome diftance beneath the furface of the mud. According to Bloch this fifh is obferved to be unufually reftlefs; quitting the muddy bottom in which it generally refides, and fwimming near the furface of the water. It is a prolific fifh, very tenacious of life, and excellent food.

HETEROCLITA. Head without cirri; dorfal and anal fins fpotted with white, and the tail barred with black.

Defcribed by Dr. Garden as a native of Carolina, where, according to that writer, it is known by the name of mudfifh. The length is about four inches: the body roundifh, and covered with large fmooth fcales, and the colour beneath yellowifh. The head is flattifh, lips denticulated; dorfal and anal fin placed oppofite, and fituated at a great diftance from the head; they are blackifh and powdered with pale tranfparent fpecks. Gmelin expreffes fome doubt whether this fifh in reality appertains to the genus *cobitis*.

JAPONICA. Head without cirri, depreffed; jaws armed with teeth. Japanefe loche.

A native of Japan, and firft defcribed by Houttuyn, in the 20th volume of the Haarlem Tranfactions. The length is five inches, and the body is of a roundifh form. The dorfal fin contains twelve rays; the pectoral eleven, ventral eight, anal nine, and tail twenty.

ANABLEPS. Cirri two; head depreffed, eyes prominent. Linn. *Anableps* Arted. *Anableps, tetropthalmus*, Bloch.

Linnæus confiders this as a fpecies of cobitis, but we are clearly of opinion that notwithftanding its general refemblance to fifhes of this genus, the very extraordinary, and indeed, peculiar conftruction of its eyes at once removes it from that genus of fifhes. Thefe eyes are protuberant, and have double pupils, fo diftinctly marked, that at the firft view the fifh appears in reality to be furnifhed with a pair of eyes on each fide of the head. Bloch conftitutes a new genus of this fingular fifh under the generical appellation of *anableps*, a genus we fhould adopt could the article be readily referred to its alphabetical order in the Cyclopædia. Linnæus, however, having defcribed it as appertaining to the genus cobitis, there can be little impropriety in allowing it to remain as a fequel to that genus. This fifh was firft defcribed by Artedi, who examined fome fpecimens of it in the mufeum of A. Seba, which were received from South America, the region it inhabits. It is faid principally to live in the rivers of Surinam, near the fea-coafts.

The length of this fifh is from fix to eight inches, or fometimes rather more. It is of a very compreffed form, and is covered with moderately large rounded fcales, which are fmaller in proportion on the head than any other parts. The colour is a pale yellowifh brown, marked, like the great loche, with four or five longitudinal blackifh ftripes. In the ftructure of its eyes it differs from every other fifh known; thefe eyes are extremely protuberant, fituated on the upper part of the head, and feem each divided into two diftinct eyes, united in a fingle tubular receptacle; it appears, however, on diffection, that though the anterior half of each eye feems to be double, or furnifhed with two pupils, yet the cryftalline is fingle; the appearance of a double eye on each fide arifing merely from the deep divifion of the anterior region. It is afferted alfo by Gronovius, that the anal fin varies in its ftructure in different individuals, being in fome of a fimple or regular form, and furnifhed with nine foft rays, while in others it is formed into a tube, which is fometimes accompanied by a fmall additional fin.

COBITIS *aculeata*, called alfo *cobytis oxyrynchus*, and *dacolithus*, names given by Aldrovandus, Jonfton, Gefner, and other old writers, to the *Cobitis taenia* of modern naturalifts. See COBITIS *taenia*.

COBIUS.

COBIUS. See GOBIUS.

COBLENT, HERMAN, in *Biography*. See H. COLAERT.

COBLENTZ, in *Geography*, a city of Germany, in the circle of the lower Rhine, in the electorate of Treves, or according to the French arrangement, the principal place of a district, and capital of the department of the Rhine and Moselle, including three communes, and containing, according to the statement of Tinseau in 1803, 10,000 inhabitants; and according to Render in his "Tour through Germany," (vol. i.) about 16,000, all of whom are Roman Catholics. They are generally tall, with agreeable features, and expressive countenances.

The population of the whole district in 1803 is stated by Tinseau to have been 69,900. It comprehends 209 communes, distributed into 12 cantons, *viz.* Coblentz, Andernach, Boppard, Cochheim, Raiserfech, Luzerath, Mayen, Munstermaifield, Polch, Ruberach, Tries, and Zell. In this district there are considerable bleaching yards, and some manufactures of woollen and linen cloth, and also of leather. The soil is moderately fertile, affording excellent vineyards; and the hills are covered with trees. The canton of Mayen has three quarries of slate and lime, together with some lead and iron mines. The mineral springs of Andernach are denominated Tinitein, or Tunistein water. The canton of Luzerath has a warm bath.

Almost immediately above the city, the river Moselle unites with the Rhine, and forms a kind of triangle, from which circumstance it derives its name, in Latin *Confluentia*. Over the Moselle is a stone bridge, constructed in the 14th century, which has 14 arches, 520 feet in length, and of such a height that vessels may pass under it without lowering their sails. The flying bridge, or bridge of boats, by which passengers may cross the Rhine three times every hour, to the small town of Thal, presents a very uncommon and pleasing sight. In the time of the Romans, Coblentz was the station of the first legion; and afterwards it became the residence of the successors of Charlemagne. In 1249, it was encompassed with walls, and since that time it has been fortified. The streets of Coblentz are generally regular, the pavement tolerably good, and the city well lighted in winter.

On the eastern bank of the Rhine, the elector finding the situation of the old palace, in the vale of Ehrenbreitstein, insalubrious and inconvenient, has lately built another very elegant and sumptuous one, where he has since resided. This city contains three large churches, two of which are collegiate, several convents, and other noble buildings. It has also a Gymnasium or academical school, in which a new plan of education is adopted, with respect both to the classics and sciences, which, from the encouragement it has received, is likely to produce the best effect on the customs and manners of the inhabitants, and to promote in a very great degree the improvement of the city. Commerce, however, notwithstanding the advantageous situation of the city near the Rhine and the Moselle, does not make any great progress; one cause of which is the vicinity of Mentz and Cologne, which, by duties and tolls, impede the natural course of trade. Another cause is religious intolerance, which long prevailed here, but is now in a great degree removed by the enlightened policy of the elector. Coblentz was formerly imperial, but was taken by the French in October, 1794, and ceded to them by the treaty of Campo Formio, in 1797. The country around this city is in every respect very romantic. The hills on the right and left form an amphitheatre, and some of them are covered with bushes. The meanders of the rivers Lahn and Moselle, which join the Rhine, exhibit a pleasing prospect. Nearly opposite to this city is the ancient fortress of Ehrenbreitstein, which is seated on the summit of a stupendous rock about 800 feet above the level of the river, and when supported by a competent garrison, is deemed impregnable; it communicates with Coblentz by subterraneous passages cut in the solid rock, and is plentifully supplied with water from a well 286 feet deep. In the arsenal, belonging to this fortress, is a curious cannon, called "Der Vogel Greif," *i. e.* the bird called Griffin, 20 feet long, about two feet diameter in the bore, and four in the breech. This cannon, it is said, when discharged with a ball of 160 pounds weight, will carry it to Andernach, about 12 miles from thence. The ancient residence of the electors of Treves is situated at the foot of the castle. The view from the pinnacle of the fortress commands the country round Coblentz for about 100 miles. A considerable leather manufactory has been established at this place, under the patronage of the elector; and another at the distance of about two miles at Vallender. They receive their hides directly from Buenos Ayres in South America. The prison belonging to this fortress, and the treatment of those criminals who are confined in it, have been long a reproach to German jurisprudence. Coblentz is situated at the distance of 36 miles N.W. from Mentz, 54 N.E. from Treves, and 82 E.S.E. from Liege. N. lat. 50° 24′. E. long. 7° 40′.

COBLENZ, a town of Swisserland, in the district of Baden, at the confluence of the Aar and the Rhine, 10 miles N.N.W. of Baden.

COBLESKILL, a new town of America, in the state of New York, and county of Schoharie, incorporated in 1797.

COBOB, a name of a dish among the Moors. It is made of several pieces of mutton wrapt up in the cawl, and afterwards roasted in it; the poorer people, instead of the meat, use the heart, liver, and other parts of the entrails, and make a good dish, though not equal to the former. Phil. Transf. N°. 251.

COBOOSE, in *Sea Language*, is derived from the Dutch *kambuis*, and denotes a sort of box, resembling a centry-box, used to cover the chimneys of some merchant-ships. It generally stands against the barricade, on the fore-part of the quarter-deck. It is called in the West Indies *cobre vega*.

COBOZE, in *Geography*, a small island in the Indian sea, near the east coast of Siam. N. lat. 12° 43′. E. long. 97° 20′.

COBRA, in *Zoology*, a species of Coluber in the Gmelinian system. See COLUBER.

COBRA *Americana* of Seba, is COLUBER *subalbidus* of modern authors.

COBRA *Lachesis* of Laurenti, is COLUBER *lachesis* of Gmelin.

Besides these it is to be observed there are several distinct kinds of snakes, known under the general and indefinite title of cobra, some of which it would be difficult to reduce with any degree of certainty to the modern nomenclature. *Cobra de las cabeças* is of this description; it is an American species of serpent, whose bite is said to be very fatal: this kind lives under ground and feeds on ants. *Cobra de coral* is also a native of America, and is called by the natives *Ibiboca*. This is about two feet in length, and is much variegated with red. *Cobra de cipo* is likewise an American snake called by the natives of Brasil, *Boitjapo*.

COBRAS *de Capelio*, the Portuguese name of a kind of serpent, called by some authors, *serpens incoronatus, diademate, seu conspicillo insignis*, and also the spectacle snake, from the strange double ocellated spots on the back of the head

head and neck, which bear some resemblance to a pair of spectacles. It inhabits India, and is said to be the most poisonous of its tribe. See COLUBER NAJA.

In the second volume of the "Asiatic Researches," we have an account by John Williams, esq. of six cases of persons, in the most dangerous situations, in consequence of being bitten by the cobra de capello, who were cured by the internal and external use of volatile caustic alkali. The dose was a tea-spoonful, repeated according to the necessity of the case. The author above observes, that convulsions of the throat and fauces are a constant symptom of the bite of this serpent; but he never knew an instance of the volatile caustic alkali failing in its effect, where the patient has been able to swallow it.

COBRAS, in *Geography*, an island of South America, in the Atlantic, near the coast of Brasil, on the south side of the river Janeiro, opposite the city.

COBRE, EL, a town of the island of Cuba, ten miles W. of St. Jago.

COBRE *de verd*, Cobre verde, in *Zoology*, the name given by the Portuguese in America, to a species of serpent, called by the natives Boiobi. This is the BOA CANINA of Linnæus.

COBULATUS. See COBILUS.

COBUM, in *Ancient Geography*, a river of Asia in the territory of Colchis; the source of which, according to Pliny, was in mount Caucasus, and it had its course among the people called Suani. Arrian mentions it under the name of Chobus. It discharged itself into the Euxine sea.

COBURG, PRINCIPALITY of, in *Geography*, a district situated near the river Saal, between the territories of Bareith, Thuringia, Henneberg, and Bamberg, in the circle of Franconia, but dependent on the circle of Upper Saxony. It formerly belonged to the counts of Henneberg, but passed by marriage to the house of Saxony, and is divided among four branches, Saxe-Coburg-Saalfeld, or Saxe-Saalfeld, Saxe-Meinungen, Saxe-Gotha, and Saxe-Hildburghausen. The land is generally fertile, and the inhabitants export corn, wool, fat cattle, tiles, works in wood, pitch, and pot-ash.

COBURG, a town of Germany in the circle of Upper Saxony, but insulated in Franconia, of which it formerly made a part, when the counts of Henneberg possessed it in the 14th century. It is now the residence of the dukes of Saxe-Saalfeld, and is seated on the river Irtsch, in a valley between two mountains. The town and suburbs are surrounded by a wall. Here are four churches, and a college founded by John Casimir, duke of Saxony, in 1597, on which the emperor Leopold, in 1677, conferred such extraordinary privileges, that it might be said to rival some universities, and a public school, and also manufactures of gold, silver, china, and petrified wood, with which the country abounds. As Luther resided some months at Coburg in the year 1530, the archives may be regarded as a treasury of authentic papers, relating to the reformation. Coburg is 23 miles N. of Bamberg, and 40 S. of Weimar. N. lat. 50° 14'. E. long. 11° 1'.

COBUS, in *Ancient Geography*, a river of the Bosphorus, which flows, according to Pliny, from the Caucasus.

COBWEB. See WEB and SILK.

COBWEB, in *Ornithology*, a name given in Merton's History of Northamptonshire to the spotted fly-catcher, or *muscicapa grisola* of Linnæus and Gmelin.

COCA, in *Commerce*, a measure in Japan, equal to an English pint.

COCA, in *Geography*, a town of Spain, in Old Castile, on the Eresma; 24 miles S.S.E. of Valladolid, and 22 N.W. of Segovia.

COCABA, in *Ancient Geography*, a place of Asia, in the territory of Bashan, in the vicinity of Palestine, where the heresiarch Ebion is said to have lived.

COCALA, a place in Asia, on the Indian sea, in the country of the Oritæ. Arrian. This town of India, is supposed to be the *Cicacole* of modern times. See CICACOLE.

COCALIA, a town of Asia, placed by Ptolemy in the interior of Pontus Cappadocius.

COCALICO, in *Geography*, a township of America, in the state of Pennsylvania, and the county of Lancaster.

COCAMA, a lake of South America, which, at 5° 14' S. lat., by a narrow channel, enters the eastern side of the river Gualaga. This lake is about 1½ league in circumference; and on the bank is a dry, elevated soil, on the top of which stands a missionary settlement, where reside the president of the missions, and the lieutenant-governor. The number of Christians is 8895, with 19 curates, and a superior of the missions; each of the former having 200 dollars a-year, and the vicar 333, paid at the treasury of Quito, and chiefly remitted in effects; while the Indian servants hunt and fish, and cultivate small fields of rice and sugar-canes. Boys of 10 or 12 years of age, are trained by an useful policy to the magistracy, being annual inspectors of the conduct of their comrades, and correcting small offences, whilst rare examples of crimes are reported to the judges. Thus offences are avoided, and young persons are trained to sincere and good conduct. See MAYNES.

COCANICUS LACUS, in *Ancient Geography*, a lake situated on the southern coast of Sicily, which, according to Pliny, produced salt.

COCCAPANI, SIGISMONDO, in *Biography*, a painter and architect, born at Florence, 1583. Early in life he shewed a strong inclination towards the mathematics, and he afterwards studied painting and architecture under Lodovico Cigoli. His first work of painting was an altar-piece in the church of St. Ponziano at Lucca. In the year 1610, he assisted his master in the paintings which he was then executing in the Paoline chapel in the Vatican. Few of his pictures are in public, but many of considerable merit, and particularly some excellent portraits, are to be found in the private collections of Florence. Many years of his life were spent in composing a treatise on architecture, mechanics, hydraulics, &c. illustrated by geometrical figures; which, for its ingenuity and clearness, was honoured with the approbation of the celebrated Galileo. About the year 1630, he was employed, in competition with other artists, to make designs for the façade of St. Maria del Fiore at Florence; which fine church, however, still remains without one. This artist died, much respected, in the year 1642. Baldinucci. Orlandi.

COCCAPANI, GIOVANNI, elder brother of the above-mentioned artist, was born in Florence in 1582. He was first intended for the law, and took his doctor's degree, but he afterwards applied himself more especially to the study of the mathematics, mechanics, and civil as well as military architecture; in each of these branches of science, he soon became so eminent, that his instructions were eagerly sought by many of the young nobility of Florence, as well as foreigners, with whom he ever after kept up a literary correspondence. In 1622, he was called to Vienna, and employed by the emperor in the quality of military engineer; and he afterwards received a grant of lands for his services. Upon his return to Florence, he built the fine palace called Villa Imperiale, for the grand duke; and erected the convent of the nuns of the order of Santa Teresa, with the church in the form of an hexagon, and a well-proportioned cupola.

cupola. The grand duke of Tuſcany having ſounded a college for the ſtudy of the mathematics, Coccapani was choſen profeſſor, nor would he abandon his native city when, upon a future occaſion, he was invited to occupy a ſituation of the ſame kind in Rome, ſtill more honourable. Several extraordinary pieces of machinery were found at his death in 1649, and one in particular, which, by the help of 30 flaſks of water, placed in a box ingeniouſly formed to receive it, was enabled to grind corn, and at the ſame time print copper-plates, and perform various other functions. Baldinucci. Milizia. Mem. degli Arch.

COCCEIRA, in *Botany*, a name by which ſome authors have called the cocoa-nut tree, the *palma nucifera Indiæ* of moſt writers.

COCCEIUS, JOHN, in *Biography*, an eminent theologian, was born at Bremen in 1603, and in 1630 he was made Hebrew profeſſor in the univerſity there. In 1650 he was choſen profeſſor of theology at Leyden, and rendered himſelf diſtinguiſhed by the peculiarity of his opinions. In explaining the Scriptures, he always looked beyond the literal meaning to ſomething that ſhould wear the appearance of myſtery. He regarded the Old Teſtament as a perpetual repreſentation, or mirror of the hiſtory of Chriſt, and his church; he maintained, that all the Jewiſh prophecies have a relation to Chriſt, and that his miracles, actions, and ſufferings, and thoſe of his apoſtles, were types of future events. He was peculiarly attached to the book of Revelations, and believed in common with many divines in almoſt every age of the Chriſtian church, that there would be a viſible reign of Chriſt upon earth, which ſhould deſtroy the kingdom of Anti-chriſt. Cocceius was oppoſed in ſeveral of his darling tenets by Voet; hence in church hiſtory we have the party names of Cocceians and Voetians. Cocceius died at Leyden in 1669, and his works were collected after his death in 10 vols. fol., eight of which were publiſhed at Frankfort in 1689, and the remaining two at Amſterdam not till 1706. He was a man of great erudition, indefatigable induſtry, and the moſt ardent piety; his many virtues did not, however, ſcreen him from the attacks of his contemporaries, by ſome of whom he was branded as a heretic: a fate to which the beſt men in every age have been ſubject. Nouv. Dict. Hiſt.

COCCEIUS, HENRY, a celebrated civilian, was born at Bremen, 1644, and educated at Leyden. After having travelled in various parts of Europe, he became profeſſor of law at Heidelberg, where he was created privy counſellor of ſtate. On the capture of this city in 1688, he loſt his library, and immediately went to Utrecht. Here he ſtayed but two years, when, in conſequence of an invitation from the elector of Brandenburg, he undertook the profeſſorſhip of law at Frankfort on the Oder. By this prince he was conſulted on the moſt important ſtate affairs, and his reputation gained him the rank of baron of the empire, in the year 1718, an honour which he ſcarcely enjoyed a ſingle year. He died in 1719, leaving behind him the character of a great man, celebrated as well for his integrity and diſintereſtedneſs, as for his aſſiduity in every thing that he undertook. His principal works are "Juris Publici Prudentia compendioſe exhibita," 1695, 8vo. "Prodromus Juſtitiæ Gentium," 1719, 4to. "Deductiones, Conſilia, Reſponſa in Cauſis illuſtrium," 1725, fol. and "A collection of Theſes," in 4 vols. 4to. He left a ſon, Samuel, who was diſtinguiſhed as a ſtateſman in the court of Pruſſia, under Frederic the Great, and who drew up the Frederician code, and publiſhed an edition of Grotius "On War and Peace," in 5 vols. 4to. He died in 1755. Nouv. Dict. Hiſt. Du Freſnoy.

COCCHI, ANTHONY, a learned Italian phyſician, was born at Florence in 1695, where he received the rudiments of his education. At a proper age, he was ſent by his father to France, to various parts of Germany, to Holland, and at length to England, every where aſſociating with, and cultivating the intimacy of the moſt diſtinguiſhed philoſophers and phyſicians, among others, with Boerhaave, ſir Iſaac Newton, and Dr. Mead. It was on the ſuggeſtion of Dr. Mead, that on his return to Italy, while filling the chair of profeſſor of anatomy and ſurgery at Florence, he was induced to publiſh "Græcorum Chirurgici Libri; Sorani unus de Fracturarum ſignis, Oribaſii duo de Fractis, et Luxatis, ex Collectione Nicetæ, Florent." 1754, fol. The manuſcripts from which this curious work is publiſhed, are in the library of the Medici at Florence. "Oratio de Uſu Artis Anatomicæ, Florent." 1736, 4to. The author gives a ſhort hiſtory of anatomy and ſurgery, in which he denies that the ancient anatomiſts, Herophilus and Eraſiſtratus, were accuſtomed to diſſect the bodies of men, while living. "Medicinæ laudatio in Gymnaſio Piſis habita," 1727, 4to. Spoken on opening a courſe of lectures at Piſa, where he had been appointed profeſſor, prior to his returning to Florence. "Del vitto Pythagorico," Flor. 1743, and 1750, 8vo. It has been ſeveral times re-printed. The author thinks a vegetable diet beſt ſuited to the conſtitution of man. He wrote alſo on cold bathing, which he commends. "On the Baths at Piſa, and Sopra Aſclepiadea." This was publiſhed by his ſon, Raymond Cocchi, who ſucceeded his father as profeſſor of anatomy, and phyſician to the public hoſpital at Florence. Haller Bib. Chirurg. Eloy. Dict. Hiſt.

COCCHI, ANTHONY CELESTINE, cotemporary, and probably related to the above, practiſed medicine, with credit, at Rome, in the early part of the laſt century. He was teacher of botany there, and author of the following: "Epiſtola ad Morgagnum, de lente cryſtallina oculi, vera ſuffuſionis ſede," Rome, 1721, 4to. "Epiſtolæ Phyſico-Medicæ ad Lanciſium et Morgagnum," Rome, 1725, 4to. Some judicious obſervations are offered by the author on the gaol or hoſpital fever, on aneuriſms, and on a caſe which occurred to the author of a dilatation of the vena cava; alſo on a caſe of hyſteria; a tranſlation into Latin of "Zenophon's Ambrocoſmus et Anthia," 1726, 4to. London. "An Oration on opening the botanical garden at Rome, to which the author was appointed curator; and a relation of a caſe of ſmall-pox, preceded by a paroxyſm of convulſion, which was appeaſed, we are told, by bleeding the patient, and immerſing the extremities in warm water." "Diſſertatio Phyſico-practica continens vindicias Corticis Peruviani," Rome, 1748, 8vo. The prejudices which at that time prevailed againſt the uſe of the Peruvian bark, which are here judiciouſly combated, have long ſince ſubſided. Haller. Bib. Med. Eloy. Dict. Hiſt.

COCCHI, GIOACCHINO, a Neapolitan opera-compoſer, of conſiderable reputation in Italy, and mentioned by Rouſſeau in his Lett. ſur la Muſ. Fran. in 1750, among the eminent maſters then flouriſhing in that country. It was in the beginning of the Mattei's opera regency, 1757, that Cocchi came to London, where he compoſed a great number of operas, ſerious and comic, arranged paſticcios, and publiſhed miſcellaneous ſongs, ſymphonies, or opera overtures, in parts, and pieces adapted to the harpſichord. Coming from Naples, where good compoſers abounded, he had good taſte, and knowledge in all the mechanical parts of his profeſſion; but his invention was very limited, and even what he adopted from others, became languid in paſſing through his hands. The only drama ſet by this compoſer, during his 15 years reſidence in this country, was "Ciro Riconoſciuto," in 1759. The air "Rende mi il figlio mio," was happily ſet, and was ſtill more happily ſung

by

by Mattei. This air is full of ſpirit and paſſion, and perfectly ſuited to the ſituation of the character by which it was performed. This is one of the firſt capital opera airs without a ſecond part and *da capo*. The duet has conſiderable merit, but too many of the paſſages are *alla ſcozzeſe*. This drama was repreſented during a great part of the remainder of the ſeaſon. It was in this opera that Tenducci was firſt noticed on our ſtage; and, though a young performer, and only ſecond in rank, he had a much better voice and manner of ſinging than Potenza, to whom he gave precedence.

In 1760, Cocchi ſet "La Clemenza di Tito," but diſcovered no new reſources in its compoſition. At the end of May of this year, "Erginda," written by Apoſtolo Zeno, now ſet by Cocchi, was alſo brought out, but after three repreſentations, to very thin houſes, the ſeaſon was cloſed, June 7th, without its having afforded much rapture to the public, or profit to the *impreſaria;* who not having been able to procure a capital ſinger to perform the firſt man's part, and Cocchi's invention, which was never fertile, being now exhauſted, the ſeaſon paſſed on rather heavily; as did his "Tito Manlio" in 1760, which only ſuſtained three repreſentations. The ſeaſon cloſed this year with an occaſional "Grand Serenata," and the next began with an occaſional drama, "Le Speranze della Terra," both compoſed by Cocchi, both ſhort-lived, and little noticed. In 1762, he compoſed two comic operas, to which even the animated performance of the admirable Paganini could not give long life. Cocchi was quite exhauſted long before his comic operas were produced. His invention did not flow in torrents, it was but a rill at its greateſt ſwell; and now, with hardly a ſingle ſmile upon any one of the airs, his heavy and thread-bare paſſages were doubly weariſome. Indeed, his reſources in the ſerious ſtyle were ſo few, that he hardly produced a new paſſage after the firſt year of his arrival in England; but in attempting to clothe comic ideas in melody, or to paint ridiculous ſituations by the effects of an orcheſtra, he was quite contemptible. Without humour, gaiety, or creative powers of any kind, his comic opera was the moſt melancholy performance I ever heard, ſays Dr. Burney, in an Italian theatre.

When Cocchi firſt arrived in England, he brought over the new paſſages that were in favour at Rome and Naples, to which, however, he added ſo little from his own ſtock of ideas, that, by frequent repetition, the public was ſoon tired of them; and his publications in this country are now as much forgotten as if he had lived in the fifteenth century. Indeed, all the animation and exiſtence they had, were conferred on them by the performance of Elſi and Mattei. He remained here long enough to ſave a conſiderable ſum of money by teaching to ſing. Plutarch informs us, that Dionyſius the tyrant of Syracuſe, when he had loſt his kingdom, became a ſchoolmaſter, the common reſource of opera compoſers and ſingers, who, after being *dethroned* in the theatre, often ſubmit to the ſame drudgery.

The operas which he compoſed in England have been ſpecified till the year 1762, when his engagement as opera-compoſer ceaſed. In 1765, he compiled a ſerious paſticcio, called "La Clemenza di Tito," in which he introduced a few of the ſongs from his own former opera of that name, which had been performed in 1760; and in 1771, he compoſed an opera called "Semiramide Riconoſciuta," and this was his *finale;* but the nation had been too long accuſtomed to better muſic to liſten to it with much pleaſure.

About 1772, he retired to Venice, where he had been maeſtro of a conſervatorio before his arrival in England; and there he enjoyed in eaſe and tranquillity the fruits of his labours, ſeveral years. The patrons of the conſervatorios of Naples and Venice, with great liberality and kindneſs to other nations, grant permiſſion to the eminent compoſers whom they elect maſters of the conſervatorios, to accept of engagements in foreign countries, without diſpoſing of their places, but to deputies properly qualified for ſuperintending theſe muſical eſtabliſhments, which are reſtored to the travelling maſters on their return. This indulgence was granted to Haſſe, Galuppi, Sacchini, Bertoni, &c. during the many journeys which they took profeſſionally to Spain, Portugal, Germany, England, and differents parts of Italy.

COCCIÆ Pilulæ, in the *Materia Medica*. See Pills.

COCCIFEROUS, in *Botany*, ſuch plants or trees as bear berries. See Bacciferous.

COCCINELLA, in *Entomology*, a genus of coleopterous inſects, poſſeſſing, according to the ſyſtem of Linnæus, the following eſſential character: antennæ clavated, or ending in a club, which is ſolid and truncated; anterior feelers hatchet-ſhaped, poſterior filiform; thorax and wing-caſes margined; the body hemiſphærical, and the abdomen flat beneath. The Fabrician character of the coccinella conſiſts in having the anterior feelers hatchet-ſhaped, the poſterior filiform; lip cylindrical; and the antennæ terminating in a ſolid club.

This genus of inſects is divided into ſections according to the colour of the wing-caſes; and the ſpots, or dots with which they are marked. The firſt ſection comprehends thoſe which have the wing-caſes red or yellow, and marked with black dots; the ſecond, thoſe having the wing-caſes red or yellow, with white or whitiſh dots: the third has the wing-caſes yellow, ſpotted with red; the fourth, the wing-caſes black, with red ſpots; and the fifth, the wing-caſes black, dotted with white or yellow.

The coccinellæ are generally found on plants, and as they ſubſiſt chiefly on the aphides, or lice that infeſt vegetables, are to be numbered among thoſe inſects which are eſſentially ſerviceable to horticulture and agriculture. The larvæ of the coccinellæ, a lively race, are frequently ſeen running briſkly over plants in ſearch of the aphides, which they attack with ferocity, and devour in vaſt numbers. Theſe larvæ are of an elongated figure, becoming pointed towards the tail; the head is rather flat and protected by a ſcaly covering, but the reſt of the body is naked. This animal is furniſhed alſo with ſix legs, which, like the head, are of a ſcaly nature. The body conſiſts of twelve joints or annulations, and in ſome ſpecies is rough, with little verrucoſe, or wart-like puſtules. When in the pupa ſtate, the coccinellæ are enveloped in a thin and delicate membrane, and are attached to the under ſurface of the leaves of thoſe plants which they moſt commonly inhabit in the larva and fly ſtate. The pupæ of many ſpecies are elegantly dotted, and ſpotted with black, upon a ground of various colours. The inſects of this genus are, with few exceptions, of a ſmall ſize.

Species.

Firſt Diviſion. Thoſe with the wing-caſes red or yellow, and marked with black dots.

Cincta. Subrotund, yellowiſh, thorax with four black dots. Deſcribed by Fabricius in his Supplementum as a native of the Eaſt Indies, from a ſpecimen in the cabinet of Dald[illegible]ff.

9 Notata. Red, with nine black dots; margin of the head and thorax white. Herbſt. Inhabits North America.

Laeta. Red, with thirteen black dots; thorax black, with the margin and two dots white. Fabr. Suppl. Inhabits Mogadore.

Lineolata. Red, with five dots, and two little lines of black

black at the baſe of the wing-caſes. A new ſpecies taken by the Revd. Mr. Burrel, near Holt, in Norfolk. Marſh. Ent. Brit.

11-NOTATA. Red, with eleven black dots; margin of the wing-caſes at the baſe yellow, body black. Marſh. Ent. Brit. Diſcovered in Kenſington Gardens.

FLAVA. Wing-caſes, legs, and thorax at the ſides yellow. Marſh. Inhabits Britain.

SINUOSA. Wing-caſes fulvous, with two abbreviated ſinuous ſtripes, and a black dot each ſide. Marſh. Inhabits Britain.

MARGINATA. Wing-caſes red, with black margin; thorax with a white marginal dot each ſide. Linn. A native of South America.

LIMBATA. Black; diſk of the wing-caſes red, with two black dots. Fabr. Inhabits Hamburgh. This is of the middle ſize, and has the head and thorax black; and the wing-caſes black, with the diſk red, and marked with a large black dot each.

MARGINELLA. Wing-caſes dull teſtaceous, with yellow margin. Fabr. A native of America.

SURINAMENSIS. Wing-caſes red and immaculate; head and thorax black. Linn. *Erotylus Surinamenſis*, Olivier. Found in South America.

IMMACULATA. Wing-caſes ferruginous and immaculate; thorax black; margin and two dorſal dots white. Fabr. Inhabits American iſlands.

UNICOLOR. Thorax and wing caſes immaculate. Fabr. Deſcribed as a native of the Eaſt Indies, from the cabinet of Abildgard.

M. NIGRUM. Oblong, wing-caſes teſtaceous and immaculate; thorax white, with a black M. Fabr. Inhabits Kiel.

SANGUINEA. Wing-caſes ſanguineous and immaculate; thorax ſpotted with black. Linn. A ſpecies of ſmall ſize; found in South America.

IMPUNCTATA. Wing-caſes red, and without ſpots; thorax red, and browniſh in the middle. Deſcribed by Linnæus as a native of Sweden, where it inhabits gardens; it is found alſo in other parts of Europe, as Germany, Spain, and Britain. Paykul calls it *coccinella aptera*.

DIMIDIATA. Wing-caſes ſcarlet, with the tip black. Fabr. A native of Coromandel, in the Bankſian cabinet. This is of a large ſize, with the head and thorax rufous, and immaculate; wing-caſes with black future; body and legs yellowiſh.

MARGINE-PUNCTATA. Wing-caſes yellow, with whitiſh margin, and two black dots. Fabr.

This kind inhabits Saxony, according to Hybner; it is of a large ſize, with the head and thorax white, ſprinkled with many black dots; the wing-caſes are yellow, with pale ſpots.

LINEOLA. Wing-caſes red; ſmall line at the baſe, and the tip black. Fabr. A native of New Holland, in the Bankſian cabinet. This is of a ſmall ſize; the head is whitiſh; thorax whitiſh, with four black dots; body beneath black, and ſhanks of the legs white.

UNIFASCIATA. Wing-caſes red, with a black band in the middle. Fabr. Deſcribed as a native of Hamburgh from the collection of Dr. Schulz; it is alſo found in Britain. Marſh. This is of the middle ſize, with the head and thorax black, and without ſpots; near the ſcutel is a ſmall oblique black line; the body is black.

ANNULATA. Wing-caſes red, with ſubannular black ſpot. Linn. Inhabits Europe.

TRILINEATA. Wing-caſes yellow, with three abbreviated black lines. Fabr. An American ſpecies in the cabinet of Zſchuck. This is a ſmall inſect; the body is black; thorax deep black, with the exterior margin whitiſh; margin of the wing-caſes with a thin edge of black.

VITTATA. Wing-caſes yellow; margin, future, and two ſtripes in the middle black; thorax black, with the anterior margin white. Fabr. A native of Guinea.

STRIATA. Wing-caſes yellow, margin, future, and two abbreviated black ſtripes; thorax yellow, with two dull dots. Fabr. Inhabits the ſame country as the laſt.

OBLONGO-PUNCTATA. Wing-caſes yellow; with four abbreviated lines, and ſix dots of black. Fabr. A native of Ruſſia. A large ſpecies.

ABBREVIATA. Wing-caſes red; an abbreviated band behind, and two dots of black; thorax black, with two white lines. Fabr.

This is deſcribed from the cabinet of Dr. Blagden as a native of North America. The body is oblong and black; front with a large white ſpot.

6-LINEATA. Wing-caſes yellow, with ſix lines, and three dots of black. Fabr. A native of Ruſſia. This is of a large ſize, the colour black; head with two white dots at the baſe; exterior margin of the thorax white, with a black dot.

2-PUNCTATA. Wing-caſes red, with two black dots. Linn. A ſpecies very common in gardens in Europe.

3-PUNCTATA. Wing-caſes red, with three black dots. Linn. A native of Germany, and parts of Europe.

HIEROGLYPHICA. Wing-caſes yellow, with two longitudinal ſinuous ſpots of black. Linn. Inhabits Europe.

RIVULARIS. Wing-caſes yellow, with two ſinuous dorſal bands, and ſix dots of black; thorax black, with two yellow dots. Fabr. *Coccinella tranſverſalis*. Thunberg. Inhabits Sweden.

TRICINCTA. Ovate; wing-caſes red, with three black bands, the anterior one abbreviated and tricuſpidate. Fabr. A native of China. This is of a moderate ſize and black colour. The thorax is black and ſhining with a white marginal ſpot each ſide.

ARCUATA. Ovate; wing-caſes red, with four dots, two bands, and dot at the tip black. Fabr.

Deſcribed from the cabinet of Scheſtedt as a native of China. This is of the middle ſize. The body is black; head whitiſh; thorax black, with the anterior part of the margin, and ſides whitiſh; future of the wing-caſes black.

UNDATA. Oblong; wing-caſes pale yellow; flexuous band and two dots black; thorax dotted with yellow. Fabr. Inhabits the Cape of Good Hope. Bankſian cabinet.

The body of this ſpecies is large, oblong, and black; head with two frontal yellow ſpots; thorax with three dorſal ſpots, margin, and mark extending from the baſe of the margin yellow; future of the wing-caſes black; legs yellow; joints black.

FLEXUOSA. Ovate; wing-caſes pale yellow; flexuous band, and two dots black; margin of the thorax white. Fabr. Inhabits Europe.

CINGULATA. Wing-caſes pale yellow; with four dots at the baſe, poſterior band and dot at the tip black. Fabr. A native of Tranquebar. Hybner.

INAEQUALIS. Wing-caſes yellow, with three anterior dots, future, and band at the tip black. Fabr.

This ſpecies is deſcribed from the Bankſian cabinet; it is an inſect of the middle ſize, and inhabits New Holland. The body is black; head yellow, and thorax black, with the fore part yellow.

TRIFASCIATA. Wing caſes red, with three abbreviated black bands. Linn. Found in gardens in Europe.

INTER-

Interrupta. Wing-cases yellow, with two waved interrupted bands, and two posterior dots of black. Fabr. Native country unknown.

2-Fasciata. Wing-cases ferruginous, with two bands and four dots of black. Fabr. Described by Thunberg under the name of *coccinella flexuosa*. It is a native of the Cape of Good Hope.

4-Notata. Wing-cases red, with four black dots at the base; margin of the thorax white. Fabr.

Inhabits Europe. The head and anterior parts of the thorax with the sides whitish; legs testaceous.

4-Maculata. Wing-cases red, with four black dots; thorax black, with a marginal white spot. Hybner. A native of Saxony.

The head of this species is black with two pale dots at the base; thorax black, shining, with the marginal spot large.

5-Punctata. Wing-cases sanguineous, with five black dots. Geoffr. A very common species in Europe.

5-Maculata. Oblong; wing-cases yellowish, with five black dots; thorax black with three rays of white on the anterior margin. Hybner. Found in Saxony and other parts of Europe. The body is large and oblong; anterior parts of the head white with two black dots.

6-Punctata. Wing-cases red, with six black dots. Linn.

Inhabits gardens in Europe. An insect of small size; the head is black with two white dots; thorax black, with the margin and two dorsal dots white.

Glacialis. Wing-cases red, with six dots of black, the intermediate one sinuate, and larger. Fabr.

A native of North America. The head is black, with the frontal spot white.

6-Maculata. Wing-cases red, with six black dots, the four anterior ones sinuate and transverse. Fabr.

An inhabitant of the East Indies, described from a specimen in the Banksian cabinet. The head is whitish; anterior part of the thorax white, with black spots; body pale yellow.

7-Punctata. Wing-cases red, with seven black dots. Linn.

Common in most parts of Europe. Donov. Brit. Inf. Known in England by the name of *lady-bird*, and *lady-cow*. In its manners of life it differs in no respect from the other species of the same natural family.

7-Maculata. Oblong; wing-cases red, with seven black dots; the middle one on the suture three lobed. Fabr.

Inhabits Germany according to Dr. Schulz. The head is black; thorax black, with the anterior and lateral margin white; body white.

7-Notata. Oblong: wing-cases red, with seven black dots; margin of the thorax and two dots in the middle white. Fabr. *Coccinella mutabilis*, Paykul.

Inhabits gardens in Germany; and is found in England, but not commonly. This insect is of a small size. The head is white, with black posterior margin; thorax black, glossy, with the margin in front and at the sides white; body black.

8-Punctata. Wing-cases red, with eight black dots; thorax white, with black dots. Linn.

A native of the north of Europe. The head is whitish, with two frontal black dots.

Transversalis. Wing-cases yellow, with eight black spots, the four anterior ones sinuate. Fabr.

Inhabits Coromandel. Banksian cabinet. The thorax is black and glossy, with a white spot each side at the tip; suture of the wing-cases and body black.

8-Maculata. Wing-cases pale yellow, with eight black dots; the six anterior ones transverse and sinuate. Fabr.

Same cabinet as the preceding; the country is unknown. The body of this insect is dull yellow, the eyes black; suture of the wing-cases black; body black.

9-Maculata. Wing-cases red, with nine black dots, the posterior one common; thorax with two dots.

A native of New Holland, in the Banksian cabinet; the body is rufous; thorax rufous, with two black dorsal dots.

9-Punctata. Wing-cases red, with nine black dots. Linn.

Found in gardens in Europe; in England not frequent. Paykul describes this species under the name of *coccinella collaris*.

10-Punctata. Wing-cases fulvous, with ten black dots; thorax with four spots. Degeer, &c.

This species inhabits Europe. The head is black, with a tridentated white spot in front; thorax, with four whitish spots. It is found chiefly in gardens.

Innuba. Oblong; wing-cases testaceous, with ten black dots; thorax immaculate. Fabr. A native of India.

Dilatata. Subrotund; wing-cases margined with fulvous, and marked with ten black dots; thorax with two dots.

Inhabits America. It is of a large size, and fulvous; anterior part of the thorax emarginate; the margin of the wing-cases dilated and black.

11-Punctata. Wing cases red, with eleven black dots; body black. Linn.

Found principally in the northern parts of Europe; occurs occasionally in Britain.

12-Punctata. Wing-cases yellow, with twelve black dots; the outer one linear, and repandate. Linn.

Inhabits gardens in Europe. The thorax is yellow, with dots, and two spots of black.

Variegata. Wing-cases yellow, with twelve dots, and two bands of black in the middle.

Described from the Banksian cabinet. The head is yellow, with the eyes black; thorax yellow, with five black dots at the base. It is a native of the Cape of Good Hope.

Crysomelina. Wing-cases rufous, with twelve black dots; thorax immaculate.

An African species, found on the *cactus opuntia*, and first described by professor Thunberg. The head and thorax are red, with the margin rather paler; dots on the wing-cases disposed in pairs; legs yellowish.

Cassidea. Oblong, red; wing-cases with twelve dots of black, and on the thorax four. Inhabits Maryland.

13-Maculata. Wing-cases yellow, with thirteen black dots; body orbicular. Forster. Nov. Sp.

Described as a native of Sweden. The thorax is white, with four black dots. This species has been found in Germany, according to Panzer, and also in England. Marsham, &c.

13-Punctata. Body pale yellow, with thirteen black dots; body oblong. Linn. Inhabits gardens in Europe.

Versicolor. Wing-cases yellow, with fourteen black dots, two of which are common. Fabr.

A native of China. The body is large and orbicular; the head is yellow; thorax margined, yellow, with a black spot in the middle.

14-Maculata. Wing-cases yellow; suture, and fourteen spots black. Hybner. Inhabits Saxony.

14-Punctata. Reddish, with fourteen black dots. Linn.

A native of Europe. Found in England, not uncommon.

Donov.

Donov. Brit. Inf. &c. *Coccinella conglomerata* of Fabricius.

16-Punctata. Wing-cafes yellow, with fixteen black dots; head with four black dots.

Inhabits Italy. This fpecies is of a large fize; its figure oblong; the head is white, with four black dots; thorax white, with many approximate dots.

18-Punctata. Wing-cafes yellow, with eighteen black dots, the laft arched. Linn.

Inhabits the northern parts of Europe. This is of the middle fize, and has the fides of the thorax yellow.

19-Punctata. Wing-cafes yellow, with nineteen black dots. Linn. Found on plants in Europe.

20-Punctata. Wing-cafes yellow, with twenty black dots. Geoffr.

Defcribed by Fabricius as a native of England, on the authority of a fpecimen in the cabinet of Mr. Aiton.

22-Punctata. Wing-cafes red, with twenty-two black dots. Linn. Inhabits gardens in Europe.

22-Maculata. Ferruginous; wing-cafes yellow, with twenty-two black dots. Fabr.

A native of Guinea, in the cabinet of Ifert. This is of a large fize; the head and thorax are dull ferruginous, glabrous, and immaculate; body yellow, abdomen in the middle ferruginous.

23-Punctata. Wing-cafes red, with twenty-three diftinct black dots. Linn. Found in gardens in Germany.

24-Punctata. Wing-cafes red, with twenty-four black dots. Linn. Inhabits Europe, and is found in England.

24 Maculata. Ferruginous; wing-cafes with twenty-four black dots. Fabr.

A native of Tranquebar. This is of a large fize, and gibbous. The head is ferruginous and immaculate: thorax ferruginous, with black dots; legs ferruginous, with a black fpot on the thighs.

28-Punctata. Wing-cafes red, with twenty-eight black dots. Fabr.

Inhabits the fame country as the laft. Difcovered by Dr. Koenig.

Conglobata. Wing-cafes yellow; with numerous contiguous black dots; the tip immaculate. Linn. *Coccinella rofea*, Degeer. *Coccinella gemella*, Herbft. A native of Europe.

Lineola. Wing-cafes yellowifh, with two little lines, and fomewhat contiguous fufcous dot. Fabr.

Inhabits South America. This is of a fmall fize. The head is white, with the eyes black; body and legs white.

Tricolor. Wing-cafes yellow, with ten red dots, and ten marginal black fpots. Inhabits Amfterdam ifland. Bankfian cabinet.

Crux. Wing-cafes yellow, with two black lines and crofs. Thunberg. Inhabits the Cape of Good Hope.

Comma. Wing-cafes yellow, with black future, margin, and line. Thunberg. An African fpecies.

Second Divifion. Wing-cafes red or yellow, with white, or whitifh dots.

Biguttata. Wing-cafes rufous, with two yellow dots.

A fpecies of fmall fize found in Europe. The thorax is black, with the lateral edge yellow.

8-Guttata. Wing-cafes red, with eight yellow dots. Thunberg. A native of Japan.

Strigata. Wing-cafes rufous, with an abbreviated whitifh ftreak. Fabr. Suppl.

2-Guttata. Wing-cafes rufous, with two yellow fpots.

Defcribed by Fabricius from the Hunterian collection. It is of a fmall fize; the thorax black, glabrous, with the lateral margin yellow. A native of Europe.

10-Guttata. Wing-cafes yellow, with ten white dots. Linn.

A native of Sweden, according to Linnæus; found alfo in England. Vide Donov. Brit. Inf.

Bis-6 Guttata. Wing-cafes fulvous, with twelve white dots, and the thorax edged with white. Fabr. Inhabits Norway.

Cayennensis. Wing-cafes fulvous, with twelve white dots, and two connected white lunules on each fide. *Coccinella 12-guttata*, Fabr.

Found in Cayenne. The thorax is rufous, with a large white fpot on each fide.

14-Guttata. Wing-cafes rufous, with fourteen white dots. Linn. A native of Europe; and inhabits Britain.

Bis-7-Guttata. Wing-cafes fulvous, with fourteen white dots; margin of the thorax white. *Coccinella 14-guttata*, Schall. Act. Hall. A native of Germany.

15-Guttata. Wing-cafes yellow, with fifteen white dots. Herbft, &c. A native of Germany.

16-Guttata. Wing cafes red, with fixteen white dots. Linn.

Inhabits England, and other parts of Europe. Donov. Brit. Inf.

18-Guttata. Wing-cafes red, with eighteen white dots, the firft two lunate.

Defcribed as a native of Europe by Linnæus and Schæffer. Inhabits Germany. Panzer. Rarely found in England, once taken near Barton by Mr. Sheppard. Vide Marfh. Ent. Brit.

20-Guttata. Wing-cafes red, with twenty white fpots. Linn. Found in gardens in Europe.

Oblongo Guttata. Wing-cafes red, with lines and dots of white. Linn.

Inhabits pines in Europe, and is a rare fpecies. This is an elegant fpecies, and has been difcovered in England. Donov. Brit. Inf.

Third Divifion. Wing-cafes yellow, fpotted with red.

Obliterata. Wing-cafes yellow, with four rufous dots; the anterior pair obfolete. Thunberg. Inhabits Upfal. Act. Upf. 4. t. i. f. i.

Fourth Divifion. Wing-cafes black, with red fpots.

7-Pustulata. Wing cafes black, with feven red dots. Marfh.

The head is black, with two yellow lines between the eyes; thorax black, with the anterior margin yellow. Inhabits England.

10-Pustulata. Wing-cafes black, with ten fulvous dots. Linn.

Inhabits gardens in Europe. *Coccinella variabilis* of Paykul.

Bimaculata. Downy; wing-cafes black, with two rufous fpots. Marfh.

Found in England. The antennæ and mouth is rufous; body black; legs rufous, with black thighs.

Biliturata. Downy, head ferruginous; wing-cafes black, with two ferruginous blotches; legs teftaceous. Marfh. A native of Britain.

Fulvifrons. Deep black, front fulvous. Marfh. Inhabits England.

Rufipes. Wing-cafes black, with a large marginal fpot, and legs rufous. Fabr. Suppl.

Inhabits the South of Europe. The body is fmall and ovate; head and thorax black and immaculate; legs entirely rufous.

Impustulata. Wing cafes black and immaculate. Linn. Inhabits the woods of Germany.

Nitidula.

Nitidula. Wing-cafes braffy-black; thorax margined with rufous. Fabr.

Found in the American iflands. It is a fmall infect; the head is black and immaculate, and the body rufous.

Parvula. Wing-cafes black; head, thorax and legs rufous. Geoffr. Inhabits the environs of Paris.

Villosa. Villous and black; the margin of the wing-cafes yellow. Fabr.

A native of Cayenne, in the cabinet of Don Rohr.

Analis. Wing-cafes black, with the tip red and immaculate. Hybner.

A native of Saxony. The head is red, and without fpots; thorax rufous, and at the bafe in the middle black; abdomen and legs rufous.

Hæmorrhoidalis. Wing-cafes black; the tips red, with a black band. Fabr. Inhabits Hamburgh. Dr. Schulz.

Oculata. Wing-cafes black, with two red fpots; a large marginal white fpot on each fide the thorax. Fabr.

This is a native of North America, and is allied to *Coccinella cacti*, but is rather lefs.

Cacti. Wing-cafes black, with two rufous fpots, and the thorax immaculate. Linn. Inhabits America.

Variabilis. Wing-cafes black, with two lunate fubmarginal red fpots. Fabr. *Coccinella auftriaca*, Schrank. Found in the neighbourhood of Hamburgh.

Frontalis. Wing-cafes black, with two red fpots; front, and anterior legs black. Fabr. A native of Saxony.

4-Pustulata. Wing cafes black, with four red dots; orbits of the eyes, and edge of the thorax pale. Linn. Inhabits Europe.

4-Verrucata. Wing-cafes black, with four red fpots; tail rufous. Fabr. Inhabits Kiel.

Bis-2-Pustulata. Wing-cafes black, with four red dots; head and thorax dull black. Fabr.

An European fpecies, and is fometimes found in England.

Erythrocephala. Wing-cafes black, with fix red dots; head and margin of the thorax pale reddifh. Fabr. Found in Kiel.

6-Pustulata. Wing-cafes black, with fix red dots; body black. Linn.

Inhabits gardens in Europe, and is found in England. Vide Donov. Brit. Inf.

Lunata. Wing-cafes black, with ten red fpots, fix of which are lunated. Fabr.

Defcribed from a fpecimen in the Bankfian cabinet, that was found in St. Helens.

Fifth Divifion. Wing-cafes black, dotted with yellow or white.

10-Pustulata. Wing-cafes black, with twelve white dots; the exterior ones connected at the margin. Fabr. A native of Europe.

14-Pustulata. Wing-cafes black, with fourteen white dots. Linn. Found on plants in Europe.

Guttato-Pustulata. Wing-cafes black, with two yellow fpots and four rufous ones.

Defcribed from the Bankfian cabinet as a native of New Holland.

Felina. Wing-cafes black, with fix white dots; body globular. Fabr.

An American fpecies. This is of a fmall fize; the head is white; thorax white, with a black fpot at the bafe.

Pantherina. Wing-cafes black, with eight yellow dots. Linn. Inhabits Europe.

Pardalina. Wing-cafes black, with ten dots, and finuate margin white.

Defcribed from a fpecimen in the Bankfian cabinet. The native country unknown.

Ursina. Wing-cafes black, with ten white dots; and the head and anterior margin of the thorax white. Fabr. A native of North America, in the Hunterian collection.

Leonina. Wing-cafes black, with fixteen white dots.

An inhabitant of New Holland, defcribed by Fabricius from the Bankfian cabinet.

Tigrina. Wing-cafes black, with twenty white dots; thorax fpotted. Linn. An European fpecies.

Canina. Wing-cafes black, with twenty black dots; head and thorax villous and immaculate. Fabr. A native of the Cape.

Thunbergii. Wing-cafes black, with the margin and two dots white; head black, with white dots. Thunberg. Inhabits Upfal.

Flavipes. Wing-cafes black; thorax black, with two yellow dots; margin of the thorax with the tail yellow. Thunberg. Inhabits the Cape.

Villosa. Villous, black; margin of the fhells yellow. Thunberg. Inhabits Cayenne.

Lævis. Wing-cafes black, with fix yellow dots; anterior angles of the thorax yellow. Thunberg.

Dentata. Wing-cafes black; the outer margin, tridentated line, and fix dots yellow. Thunberg. A native of the Cape.

COCCIUM, or Coccio, in *Ancient Geography*, a place in the ifle of Albion, placed in Antonine's Itinerary on the route from Glanoventa to Mediolanum, between Bremetanacis and Mancunium; fuppofed to be Rilchefter.

COCCO, the name of a plant in the Weft Indies, and in fome of the iflands of the South Sea, called alfo *Indian kale.*

COCCOCYPSELUM, in *Botany* (from κοκκος, a *grain*, or *feed*, and κυψελη, or κυψελιον, a *cheft* or *veffel.*) Schreb. 1721. Mart. Willd. 207. Lam. Illuft. 168. Juff. 198. (Cocipfele, Encyc.) Clafs and order, *tetrandria monogynia.* Nat. Ord. *Rubiaceæ*: Juff.

Gen. Ch. *Cal.* Perianth fuperior, one-leafed, four-cleft, permanent; fegments linear-lanceolate, erect. *Cor.* Monopetalous, funnel-fhaped; tube longer than the calyx; border four-cleft, fegments egg-fhaped, half-open. *Stam.* Filaments four, fhort, inferted into the tube; anthers oblong, erect. *Pift.* Germ inferior, roundifh; ftyle the length of the corolla, bifid at the top; ftigmas oblong. *Peric.* Capfule fucculent, Juff. La Marck; Ill. (berry; Schreb. Lam. Encyc. Willd.) inflated, roundifh, crowned with the calyx, two-celled. *Seeds* numerous, fmall, compreffed, affixed to the partition.

Eff. Ch. Calyx fuperior, four-cleft. Corolla funnel-fhaped. Capfule (or berry) inflated, crowned, two-celled, many-feeded.

Sp. 1. C. *repens*, Mart. Willd. Swartz. Prod. 31. C. herbaceum; Lam. Ill. Pl. 64.—Herbaceum repens; Browne Jam. 144. tab. 6. fig. 1. " Stem creeping at the bafe; leaves egg-fhaped; cymes axillary, nearly feffile." Lam. *Stems* growing in tufts; each of them creeping eighteen or twenty inches from the root, and fhooting out a few lateral branches as it runs. *Leaves* oppofite. *Flowers* and *fruit* on fhort, divided peduncles from alternate axils. Browne. A native of Jamaica. 2. C. *virgatum*, Lam. Ill. (Naciboea alba; Aubl. tab. 37. fig. 2.) " Stems rod-like; leaves acuminate; cymes lateral, peduncled; peduncles longer than the petiole." Lam. A native of South America, communicated by M. Richard.

C. *uniflorum*, and *biflorum*; Willd. See Fernelia *buxifolia*.

We confefs that we are rather inclined to think with Willdenow, that there is no folid generic diftinction between coccocyp-

coccocypſelum and fernelia. For it appears to us that a ſucculent capſule, without valves, would be better called a dryiſh berry (bacca vix carnoſa), the character attributed to the fruit of fernelia. But as the two genera are kept diſtinct by Juſſieu, who muſt have had both of them in immediate contemplation, when he drew up the third ſection of his natural order, *rubiaceæ*, we have not choſen to diſſent from ſuch high authority. The only remaining differences are, that in fernelia the partition is perforated in the middle, and the ſeeds are attached to a central receptacle which ſupplies the defect. Willdenow, however, is wrong in his appropriation of La Marck's figures; for on the authority of La Marck himſelf, in his Illuſtrations, fig. 1 is not buxifolia, but his own obovata, and fig. 2. is his lygiſtum axillare, copied from Browne's tab. 3, fig. 2, and engraved by miſtake as a fernelia. The new genera coccocypſelum, lygiſtum, and fernelia, as well as the petesia of Linnæus, ſeem to need a more accurate inveſtigation; and it will probably be found, that no violence would be done to nature if they were all united into one.

COCCODES, in *Natural Hiſtory*, a name given by Mercatus to thoſe ſtones of the AMMITES kind, whoſe grains are very large.

COCCOLOBA, in *Botany*, (ſo called from the kernel being lobed at the bottom.) Linn. Gen. 496. Schreb. 678. Willd. 786. Gært. 261. Juſſ. 82. Vent. 2. 249. (Coccolobis; Brown. Raiſinier: Encyc.) Claſs and order, *octandria trigynia*. Nat. Ord. *Holoraceæ*, Linn. *Polygoneæ*, Juſſ. Vent.

Gen. Ch. *Cal.* Perianth one-leafed, five-cleft; ſegments oblong, obtuſe, concave, coloured, ſpreading widely, permanent. *Cor.* none. *Stam.* Filaments eight, awl-ſhaped, ſhorter than the calyx: anthers roundiſh, didymous. *Piſt.* Germ egg-ſhaped, three-ſided; ſtyles three, ſhort, ſpreading; ſtigmas ſimple. *Peric.* the permanent calyx, thickened into a berry, involving the ſeed. (Drupe; Gært.) *Seed*; nut, egg-ſhaped, acute, one-celled.

Eſſ. Ch. Calyx five-cleft, coloured, corolla none. Nut covered by the calyx, which is converted into a berry.

Sp. 1. C. *uvifera*. Linn. Sp. Plant. 1. Mart. 1. Poir. 1. Willd. 1. Lam. Ill. tab. 316. fig. 2. Gært. tab. 45. Jacq. Amer. 112. tab. 73. Brown. Jam. 208. (Polygonum caule arboreo. fructibus baccatis; Linn. Sp. Pl. Ed. 1. Uvifera; Hort. Cliff. Pluk. Alm. tab. 236, fig. 7. Guajabera; Plum. ic. 145. Populus americana rotundifololia; Bauh. Pin. 430. Prunus; Sloan. Jam. 183. Hiſt. 2. tab. 220, fig. 3. Cates. Car. 2. tab. 96.) Round-leaved ſea-ſide grape, or mangrove grape tree. "Leaves heart-ſhaped, roundiſh, ſhining." A large tree. *Branches* irregularly ſpreading, not forming a handſome head, but rendered beautiful by the leaves and fruit; bark cinereous, thin; in the young trees ſmooth; in the old ones full of chinks; wood hard, ponderous, red; but of little uſe, except for burning, on account of its fibrous texture. *Leaves* large, alternate, entire, generally ending in a ſhort blunt point, but often quite round, thick, coriaceous, deep green, with alternate prominent nerves, connected by ſmall ſcarlet veins; petioles hard, ſhort, thick; ſtipules ſheathing the branches. *Flowers* whitiſh, very ſmall; racemes about a foot long, ſimple, terminal, ſolitary, thick, upright at the time of flowering, pendulous with the ripe fruit; pedicels one-flowered, thick, ſhort. *Berries*, the ſize of a ſmall cherry, roundiſh, umbilicated, conſiſting of a purpliſh membrane, which covers a ſoft, thin, not unpleaſantly aſtringent, pulp, and a large three lobed nut. Linn. *Drupe* formed of the berried calyx, becoming black and wrinkled when ripe; pulp ſoft, drying into a thin cruſt; ſhell thin, like paper, intimately united with the pulp, half three-celled; partitions membranous, narrow, to be found only at the bottom of the drupe. *Receptacle* a ſmall fungous tubercle, formed at the baſe of the fruit by the concurrence of the partitions. *Seed* ſingle, ſomewhat globular, acuminate at the top, deeply umbilicated at the bottom, ſtriated with wrinkles, ferruginous brown. Gært. A native of South America and the Weſt Indies, on a ſandy ſoil, generally near the ſea. The fruit is ſold in the market, and forms part of the deſert in its native countries. 2. C. *latifolia*. Poir. 2. Lam. Ill. Pl. 316. fig. 4, a leaf. "Leaves entire, very broad, contracted at the baſe." In habit reſembling the preceding, but differing remarkably in its leaves. Young branches ſmooth, finely ſtriated, a little compreſſed. *Leaves* thin, rather membranous than coriaceous, ſmooth, quite entire, at leaſt as broad as long, narrowed, not heart-ſhaped at the baſe; with lateral ſimple yellowiſh nerves, which are connected by capillary reticulated veins. A native of South America, cultivated in the botanic garden at Paris, where it has not yet flowered. 3. C. *auſtralis*. Mart. 12. Poir. 16. Willd. 2. Forſt. Prod. n. 176. "Leaves cordate-ovate, acute; flowers polygamous." A native of Zealand. From the drawing in ſir Joſeph Banks's collection, it ſeems to be a polygonum. 4. C. *pubeſcens*. Linn. Sp. Pl. 2. Mart. 2. Poir. 3. Willd. 3. Brown. Jam. 210. (C. grandifolia; Jacq. Amer. 113. Scortea; Pluk. Phyt. 222. fig. 8.) "Leaves orbicular, pubeſcent." A tree ſixty or eighty feet high. *Trunk* rough. *Branches* only two or three principal ones, but little ſubdivided, thick, ſpreading. *Leaves* alternate, very large, ſometimes two feet in diameter, quite entire, ſlightly heart-ſhaped, much veined and wrinkled, ſmooth when old; petioles hard, thick, very ſhort, ſheathing at the baſe. *Flower* and *fruit* unknown in Europe. A native of the Weſt Indies. The wood, according to Jacquin, is of a deep red colour, very hard, heavy, brittle, but almoſt incorruptible: when uſed for poſts or paliſades, the part under ground becomes as hard as ſtone. The fruit is ſaid to be good to eat. 5. C. *diverſifolia*. Poir. 4. Willd. 4. Jacq. Amer. 114. tab. 76. "Leaves of the branchlets ovate; of the branches ovate-heart-ſhaped." A ſhrub, ten or twelve feet high. *Leaves* alternate, petioled, a little coriaceous, quite entire, ſlightly wrinkled, ſhining, veined, ending in an obtuſe point. *Racemes* about three inches long, terminal, upright, ſimple, ſolitary. *Fruit*, about the ſize of a ſmall cherry, nearly round, almoſt umbilicated at the ſummit by the union of the thick fleſhy leaves of the calyx; pulp ſoft, of a beautiful purple colour, a little more acid than that of C. uvifera, but eaten by peaſants and children. A native of St. Domingo. 6. C. *flaveſcens*. Mart. 7. Poir. 5. Willd. 5. Jacq. Amer. 114. tab. 75. "Leaves elliptical, obtuſe, mucronate, heart-ſhaped at the baſe." Willd. A ſmall branching tree or ſhrub, about twelve feet high. *Leaves* alternate, coriaceous, ſhining, quite entire, on very ſhort petioles. *Racemes* ſcarcely an inch and a half long, terminal, ſimple, erect. *Fruit* roundiſh, purple, a little larger than a pea; pulp reddiſh, ſweet and eatable, but not much eſteemed. A native of St. Domingo. 7. C. *excoriata* Linn. Sp Pl. 4. Mart. 3. Poir. 6. Willd. 6. (C. cortice lævi; Brown. Jam. 210. Guajabara; Plum. Ic. 146. fig. 1. Arbor indica; Pluk. Amath. tab. 353. fig. 4. ?) "Leaves egg-ſhaped; branches appearing as if ſtripped of their bark." Linn. "Leaves oblong-egg-ſhaped, rather acute, heart-ſhaped at the baſe; racemes pendulous." Willd. A lofty tree. *Branches* with a very thin, even-ſurfaced bark. *Leaves* alternate, on ſhort petioles, coriaceous, entire, ſmooth, green above, yellowiſh underneath, finely nerved and veined; ſtipules embracing the ſtem. *Racemes* long. A native of America and the Weſt Indies. 8. C. *nivea*. Mart. 4. Poir. 7. Willd. 7. Swartz, Prod. 64. Flor. ind. occid. vol. ii. p. 693. Jacq. Amer. 115. tab. 78. "Leaves oblong, acuminate, veined, ſhining above;

 racemes

racemes almost erect." A tree about twenty feet high, erect, branched. *Leaves* alternate, half a foot long, entire, petioled, wrinkled, thin, membranous. *Flowers* small, yellowish; racemes terminal, solitary, simple, calyx finally thick, succulent, of a snow-white colour, covering to the middle a three-sided, black, shining nut. *Fruit* sweet and pleasant. A native of the West Indies. 9. C. *leoganensis*. Mart. 5. Jacq. Amer. 113. tab. 178. fig. 33. (C. uvifera. β. Poir. Willd.) "Leaves roundish, quite entire, shining, flat; racemes erect." A shrub ten feet high. *Leaves* resembling those of C. uvifera, but only half the size. A native of Port-au-Prince and Leogane in St. Domingo. 10. C. *punctata*. Linn. Sp. Pl. 3. Mart. 8. Poir. 8. Willd. 8. (C. coronata; Jacq. Amer. 114. tab. 77. uvifera arbor; Pluk. Almag. 394. tab. 237. fig. 4.) "Leaves lanceolate, egg-shaped." A shrub, twelve or fifteen feet high, erect, branched. *Leaves* half a foot long, petioled, flat, quite entire, a little coriaceous, alternate, veined, shining, commonly two or three on each flowering branchlet; stipules sheathing. *Flowers* white; racemes scarcely an inch and a half long, erect, simple, terminal, solitary. Almost the whole receptacle, with a small part only of the calyx, becomes a roundish, dotted drupe, of a dark red colonr, and a sweetish, but rather austere taste. A native of South America, about Carthagena. 11. C. *obtusifolia*. Mart. 6. Poir. 12. Willd. 9. Jacq. Amer. 114. tab. 74. "Leaves oblong, very obtuse." A shrub, ten or twelve feet high, much and diffusely branched. *Branches* smooth, cinereous. *Leaves* narrow, elliptical, alternate, petioled, numerous, quite entire, shining, coriaceous, rounded at both ends, handsomely veined. *Flowers* white, small; racemes terminal, often alternate on the young branches, solitary, simple; calyx-leaves finally succulent, enveloping almost to the summit a shining nut, and leaving the upper part naked. *Fruit* astringent. A native of South America about Carthagena, in hedges and woods. 12. C. *microstachya*, Willd. 10. Poir. 13. "Leaves egg-shaped, obtuse, quite smooth; racemes nodding." *Branches* cylindrical, smooth, cinereous. *Leaves* at least an inch and a half long, alternate, petioled, broadest on one side, quite entire. *Flowers* small, in very short terminal racemes. A native of the West Indies. 13. C. *emarginata*. Murray Syst. Veg. 314. Mart. 9. Poir. 11. Willd. 11. Jacq. Amer. 314. Obs. vol. i. p. 18. tab. 9. "Leaves coriaceous, roundish, deeply emarginated." *Branches* somewhat zig-zag. *Leaves* alternate, petioled, entire, heart-shaped at the base, emarginate commonly with an acute angle, nerved and veined. *Fructification* unknown. A native of the West Indies. 14. C. *barbadensis*. Mur. Syst. Veg. 379. Mart. 10. Poir. 10. Willd. 12. Jacq. Amer. 37. Obs. 1. 18. tab. 8. "Leaves cordate, ovate, undulated." A tree. *Leaves* very large, petioled, simple, entire, acuminate, smooth on both sides, nerved, veined. *Fructification* unknown. A native of Barbadoes and Jamaica. 15. C. *tenuifolia*. Linn. Sp. Pl. 5. Mart. 11. Poir. 9. Willd. 13. Lam. Ill. tab. 316. fig. 1 and 3. Brown. Jam. 210. tab. 14 fig. 3. "Leaves egg-shaped, membranous." A shrub of humbler growth than any of the former. *Leaves* alternate, petioled, smooth, entire, obtuse, sometimes a little acute, thin; petioles, according to Linnæus, surrounded with a membrane instead of a stipule; but the specimens in La Marck's herbarium have sheathing stipules. *Flowers* scattered, pedicelled, in simple terminal racemes. A native of the West Indies. 16. C. *Asiatica*. Mart. 13. Lour. Coch. 239. "Climbing; leaves oblong, egg-shaped, veined; racemes terminal." *Stem* somewhat shrubby, branched. *Leaves* alternate, rather acuminate, quite entire, coriaceous. *Flowers* white, in loose racemes; calyx bell-shaped; style cloven half way down; stigmas roundish. *Fruit* a roundish five-lobed berry, formed from the five segments of the calyx, blackish, pellucid, small. A native of Cochin-china in hedges and woods. 17. C. *cymosa*. Mart. 14. Lour. Cochin. 240. "Climbing; flowers axillary and terminal, in sessile cymes." Exactly similar to the preceding, excepting the inflorescence; and like it, a native of Cochin-china.

Propagation and Culture. None of these species have produced either fruit or flowers in England: but are easily propagated by seeds imported in a perfect state. These should be sown in small pots filled with earth from the kitchen-garden, and plunged into a hot-bed. The plants will appear in five or six weeks, and in about a month after will be fit to transplant into separate pots; after which they must be constantly kept in the bark stove, and treated like other tropical plants.

COCCONAGÆ, in *Ancient Geography*, a people of India, on this side of the Ganges, according to Ptolemy.

COCCONAGARA, or COCCORANAGARA, a town of the Sines, according to Ptolemy, who were placed by the ancients in the southern parts of China.

COCCONAGI, islands situated at the entrance of the Red sea, towards the south of Arabia, according to Ptolemy.

COCCONILEA, in *Botany*, Bauh. Pin. Clus. See RHUS *cotinus*.

COCCOS, Gært. See COCOS.

COCCOTHRAUSTES, formed from κοκκος, a grain or kernel, and θραυω, to break, in *Ornithology*, the name of a very remarkable bird, considerably larger than the chaffinch, very short-bodied, and large beaked, whence it is called in English, the *gross-beak*, or *hawfinch*, the LOXIA *Coccothraustes* of Linnæus and Gmelin; the specific character of which is, that it has a white line on the wings, that the middle quills of the wings are rhomboid-shaped at the tips, and that the quills of the tail are black on the thinner side of the base. It is the *Gros-bec* of Buffon. Its head is very large in proportion to its body, and its great beak tapers from a very thick base to a sharp point, resembling the shape of a funnel. The upper mandible is cinereous, but of a lighter tint near the base; the lower mandible is cinereous at the edges, which close into the upper; its under side is flesh-coloured, with a cinereous cast. The tongue is fleshy, small, and pointed; the gizzard is very muscular, preceded by a pouch, containing in summer bruised hemp seeds, green caterpillars, almost entire, and very small stones. It is an inhabitant of the temperate climates from Spain and Italy as far as Sweden, and lives generally in the woods and mountains all summer; in winter it comes into the flat country, and resorts near the hamlets and farms. It is never seen in England, except in the winter months; it feeds on the kernels in the stones of fruit, as cherry-stones, and the like, and breaks these with great dexterity, whence its name; it will also eat the seeds of many different plants. This bird is solitary, shy, and silent; its ear is insensible, and its prolific powers are inferior to those of most other birds, so that the species is not numerous. The male and female are of the same size, and much resemble each other.

COCCOTHRAUSTES *cristata*, the name by which naturalists call the bird usually known among us by the name of the *Virginian nightingale*, it being truly a coccothraustes, though called by the improper name nightingale. Ray. See LOXIA *cardinalis*.

COCCULÆ, in *Botany*, *officinales*, Bauh. Pin. See CISSAMPELOS *cocculus*.

COCCULUS *indicus*. See CISSAMPELOS *cocculus*, and MENISPERMUM.

COCCUS, in the *Writings of the Ancients*, a name given by by ſome authors to that fine ſhining red colour uſed to illuminate the capital letters in manuſcripts, and more generally known by the name of *encauſtum ſacrum*, from its being uſed in ornamenting the manuſcript bibles, and its reſembling the fine red glow of the enamel of that colour.

COCCUS, in *Entomology*, a genus of the hemipterous order. The inſects of this tribe have the ſnout ſeated in the breaſt, the antennæ filiform, and the poſterior part of the abdomen furniſhed with briſtles; the male has two erect wings, and is deſtitute of poiſers, and the female is apterous, or without wings.

The cocci are a prolific race, and, like the aphides and the chermes, are the peſt of plants. They are remarkably diſcriminate in their choice of food, almoſt every ſpecies being peculiar to ſome particular plant, and this ſo conſtantly, that the far greater number of the cocci bear the name of the individual vegetable on which they reſpectively ſubſiſt. The diſſimilarity prevailing between the two ſexes is very ſtriking, not only in their form, but manners of life. The male is furniſhed with wings, and is naturally very active; the female is without wings, and has ſcarcely the appearance of animation. The females fix themſelves to the branches, leaves, and ſometimes roots of plants, where they remain immoveable, and are viſited by the males; in this ſtate of apparent torpor, they produce their young, and periſh. As the cocci live on the juices of plants, which they obtain by perforating the cortex, or cuticle, with their proboſcis, they are very injurious to plants, more particularly the tender exotic kinds raiſed in ſtoves and green-houſes. The females, when affixed to plants, oftentimes loſe the very form and appearance of inſects; their bodies ſwell, their ſkin ſtretches, and becomes ſmooth, and the ſegments, or annulations of the abdomen, entirely diſappear. In this ſtate they ſo much reſemble certain kinds of excreſcences or galls found on the leaves and branches of plants, as to be in general miſtaken for ſuch. When the inſect aſſumes this laſt appearance, its diſſolution is faſt approaching; and after its death, the abdomen ſtill ſerves as a covering, under which the eggs of the future brood are concealed and protected. Others of the coccus genus, though they adhere in the ſame manner to the leaves or branches of plants, retain the true form of the inſect till the young are produced from the egg. The females of moſt ſpecies have a quantity of fine cotton, in which the lower part of the abdomen is concealed, and which ſerves as a neſt for the eggs when depoſited by the parent inſect.

Species.

HESPERIDUM. Found generally on the orange, citron, and other plants of the ſame family, and on various evergreens reared in green-houſes. The French call it *Cochenille de l'oranger*, as it ſeems to prefer the former of thoſe trees.

The female of this ſpecies is a ſmall oval inſect, about the ſixth part of an inch in length; the back ſlightly convex, of a ſhining brown colour, with a ſmooth ſurface, and a notch in the poſterior part. It has ſix legs, and when young runs upon trees. The full-grown inſect does not envelope itſelf in a cotton-like or downy ſubſtance, like many others of the coccus tribe, but adheres, and afterwards remains attached firmly to the bark, under the form of an oval convex ſhell, or huſk, of a ſemi-tranſparent browniſh colour, with a gloſſy aſpect, as if covered with a coat of varniſh. In this ſtate the inſect dies, and ſhortly afterwards the numerous eggs concealed within the abdomen are hatched, and produce another brood. The male is a very ſmall winged inſect, and leſs frequently obſerved than the female, which latter is extremely abundant, and oftentimes proves very injurious to the plants they infeſt. The ſpecies is originally a native of the warmer regions, and has been introduced into Europe with exotic plants. An account of this inſect occurs in the Memoirs of the French Academy by De la Hire, under the title of "Deſcription d'un Inſecte, qui ſ'attache à quelques plantes etrangeres, et principalement aux orangers." t. 10. p. 10.

AONIDUM. Body purpliſh-black; crown of the head tuberculate. Fabr. Modeer Act. Gothenb. i. 30.

Inhabits various ever-green trees of Aſia; it is ſmaller than coccus heſperidum, without wings, and yellowiſh; oblong, or ſomewhat orbicular, and with antennæ nearly the length of the thorax.

CAPENSIS. Ovate, ſomewhat downy, conic-gibbous, and operculate at the tip. Modeer Act. Gothenb.

A native of the Cape of Good Hope, and infeſts the gnaphalium muricatum.

ADONIDUM. Rufous, mealy and hairy. Fabr. *Cochenille des ſerres*, Latreille. *Coccus adonidum, corpore roſeo farinaceo, alis ſetiſque niveis*, Geoffroy. *Pediculus adonidum*, Linn. Fn. Suec. *Pediculus coffeæ*, Lederm.

The moſt common inſect of the coccus tribe, and is ſuppoſed to have been originally peculiar to Senegal, from whence it was long ſince tranſported to America and Europe. The female is of an oblong-ovate form, ſlightly convex above, with the body divided into many tranſverſe ſegments, which project on the ſides, and are furniſhed with ſmall proceſſes or points; theſe proceſſes are longer on the two laſt diviſions of the body than the reſt, and form a kind of bifid tail. The whole inſect is of a pale roſe colour, and appears more or leſs covered with a fine white farinaceous ſubſtance; the legs ſhort, and ſix in number. The male is very ſmall, alſo of a roſe colour, and partially covered with a white powder, with ſemi-tranſparent milk-white wings, and four long filaments at the tail. Theſe inſects wander about the plants they infeſt, and nouriſh themſelves by ſucking the juices. When the female is full grown, and pregnant with eggs, ſhe ceaſes to feed, and remaining fixed to one ſpot, envelops herſelf in a fine white fibrous cotton-like ſubſtance, and lives but a ſhort time afterwards; the young, which hatch under the huſk or body of the parent inſect, proceeding from it in great numbers, and diſperſing in queſt of food.

QUERCUS. Found on the oak, *Quercus robur*. This is ſomewhat kidney-ſhaped, and of a brown colour.

CACTI. Found on the *cactus opuntia*, or prickly pear tree.

The coccus cacti is a native of South America, and conſidered as an article of commerce and manufactory, is of far greater importance to mankind than any other of the inſect race;—it is the true cochineal, the drug ſo well known for its valuable properties in the art of dyeing, and other uſeful purpoſes of life. The body is depreſſed, downy, and tranſverſely wrinkled; the abdomen is purpliſh, the legs ſhort and black, the antennæ ſubulate, and about one third the length of the body.

The diſcovery of this valuable inſect has contributed more efficiently to enrich the poſterity of the Spaniſh adventurers in the New World, than the wealthy mines of Peru and Mexico. The cultivation of the inſect proves a ſource of employment to the induſtry of the country; and while it improves the eſtates of the land-proprietors, conſtitutes to the benefit of the revenue a branch of commerce of the firſt importance and conſideration. This is no matter of aſtoniſhment; the properties of the cochineal of South America are ſo incomparably ſuperior to thoſe of any other dye for the

the brilliancy at leaſt, and in no ordinary degree for its durability, that its diſcovery may be conſidered as an ineſtimable advantage to the civilized world.

The coccus dye of Portugal, Sardinia, Aſia Minor, and Africa, was in the moſt general uſe in ancient times. This was univerſally imagined to be the berry, or an excreſcence of ſome vegetable, an opinion which the common appearance it aſſumes in a dried ſtate would, in a certain meaſure, juſtify. That Pliny was of this opinion, is evident from ſeveral paſſages in his writings; it was the idea of the vulgar, and he adopted it. The ſame notion, preciſely, was entertained of the Mexican cochineal; and it was only of late years, long after its valuable properties, were known in Europe, that the true origin and nature of this inſect were clearly demonſtrated.

The cochineal of Mexico is brought into Europe in the form of little grains of an irregular figure, which are roundiſh on one ſide, and wrinkled tranſverſely; the other ſomewhat flat. That in moſt eſteem is of a ſlaty grey colour, mixed with reddiſh, and covered with a fine white powder. In trade the merchant diſtinguiſhes four ſorts, the Meſtique, Campeſchane, Tetraſchale, and Sylveſtre, of which the three firſt are conſidered the beſt; thoſe are named from the places where they are produced; the laſt ſort, ſylveſtre, from being found wild without any culture. The firſt three are ſuppoſed to be of the ſame ſpecies; but we are yet ignorant whether the C. ſylveſtre, or wild cochineal, and the other are of two different ſpecies; we only know that the laſt furniſhes leſs of the tincture than the other. This M. Thierry attributes not to the inferiority of the grain, but to the cottony matter with which it is covered, this augmenting its weight and abſorbing part of the colour. The proceſs employed by the dyers for extracting the colour is ſufficiently known, neither is it ſcarcely requiſite to add that carmine, the fineſt and moſt beautiful crimſon we poſſeſs, is obtained from the cochineal See Cochineal.

The female of the cochineal inſect, in its full-grown or torpid ſtate of pregnancy, ſwells to ſuch a ſize in proportion to that of its infant ſtate, that the legs, antennæ, and proboſcis, are ſcarcely to be diſcovered, except with a good eye, or the aſſiſtance of the microſcope. It is the female only that is valuable for its dye. The male is a ſmall, and rather ſlender, two-winged fly, about the ſize of a flea, or ſtill ſmaller, with jointed antennæ, and large white wings in proportion to the body, which is of a red colour, with two long filaments proceeding from the tail. It is an active and lively animal, and is diſperſed in ſmall numbers among the females, in the proportion, according to Mr. Ellis, in the Philoſophical Tranſactions, of one male to a hundred, or a hundred and fifty, or two hundred females: ſome writers ſay even three hundred.

The plants upon which theſe inſects are raiſed by the cultivators of cochineal is the nopal, or nopalleca of the Indians, called by ſome the Indian fig-tree, and by botaniſts the *cactus opuntia*, or prickly pear-tree. The culture of this plant for the purpoſe conſiſts merely in lopping the rotten or decayed branches, and removing other plants and weeds away that might injure them. Thoſe they plant in an argillaceous earth intermixed with gravel and ſtones. The Indians of the provinces of Guaxaca and Oxaca, who attend particularly to the culture of the nopals, plant them near their habitations, and call them nopaleries.

The juice of the plant on which theſe inſects breed is their ſole ſubſiſtence. About the 15th of October, which, in Mexico, is the commencement of the fine ſeaſon, they diſtribute the cochineals upon the nopals. This operation conſiſts merely in placing the females, while they are yet young and active, in a number of ſmall neſts among the leaves, from whence they wander about over various parts of the plant, in ſearch of the particular branches to which they afterwards attach themſelves, and are viſited by the males.

The breeding of the cochineal is attended with precarious circumſtances; the cochineal is expoſed to a variety of dangers from the violence of the winds, the rains, fogs, froſts, and other cauſes, and alſo from the depredations of birds, who are very fond of theſe inſects.

When the inſects are at their full growth they are gathered and put into pots of earthen-ware, but much attention is requiſite to prevent them from getting out, as in that caſe great numbers of them would be loſt; though there is no danger of this when they are at liberty on the nopal leaves, theſe being their natural reſort, and where they enjoy abundance of delicious food; for though they often remove from one leaf to another, they never quit the plant; nor is it uncommon to ſee the leaves entirely covered with them, eſpecially when they are arrived at maturity. When they are confined ſome time in theſe pots they are killed, and put into bags.

The Indians have three different methods of killing theſe inſects; one by immerſing them in hot water, another by fire, and the third by expoſing them to the burning rays of the ſun; and it is owing to theſe different proceſſes, that the cochineals are ſometimes of a deep, and at others, of a bright red. Thoſe who uſe hot water are very careful to give it the requiſite heat, and that the quantity of water be proportioned to the number of inſects. The method of killing the creatures by fire is to put them on ſhovels, into an oven moderately heated for the purpoſe, the fine quality of the cochineal depending on its not being over dried at the time of killing the inſects. Some alſo are killed by the fumes of heated vinegar, and others by ſmoke. Thoſe killed and dried in the ſun ſeem, however, to have the preference. When the female inſect has diſcharged all its eggs it becomes a mere huſk and dies, ſo that the greateſt care is taken to kill the inſects before that time, to prevent the young from eſcaping, and thus diſappointing the hopes of the proprietor.

As this inſect attains to maturity, performs the ordinary functions of life, depoſits eggs, and dies within the ſhort ſpace of two months, according to M. Thierry, there are no leſs than ſix ſucceſſive generations of this inſect in the ſpace of a year. After being excluded from the egg, both the male and female remain ten days in the larva form, and five under that of the nymph or pupa, and are then become perfect inſects. Some writers, however, ſay, that there are only three broods of the cochineal annually, the firſt of which appears about the middle of December, and the laſt in May. It appears pretty certain that the female, after coupling, ſurvives for about a month, and that the males die immediately. Beſides the depredations committed amongſt theſe inſects by birds, the larvæ of the ſmall ſpecies of lady-bird, called by Fabricius *coccinella cacti*, is highly injurious to them, deſtroying the females while in a ſtate of torpidity with perfect impunity.

The principal countries where the cochineal inſects are bred, are Oaxaca, Tlaſcala, Chulula, Nueva Galicia, and Chiapa, in the kingdom of New Spain; and Honduras, Loja, and Tucuman in Peru: but it is ſaid to be princip in Guaxaca and Oaxaca that they are gathered in large quantities, and form a branch of commerce, the cultivation of them being there the chief employment of the natives.

Notwithſtanding ſo much has been already written on this ſubject, we are perſuaded no ſmall degree of uncer-

 tainty

tainty prevails with regard to the true hiſtory of this inſect, and time alone can develope it; we are even yet ignorant, as before obſerved, whether the kind found wild in South America is of the ſame ſpecies with that cultivated for the purpoſes of commerce; we are yet to be informed whether our own colonial poſſeſſions may not produce the ſame kind of inſects, or inſects capable of ſupplying us with the ſame kind of dye; and even whether the ſpecies of cocci indigenous, or naturalized in our own country, may not be rendered of conſiderable utility in the ſame point of view. It appears, ſtill further, from what we have ſeen, that the Eaſt Indies affords one, two, or, perhaps, more ſpecies of the cochineal tribe, which, with due attention and culture, might prove equally valuable with that of Mexico, and which, conſidering the vaſt extent of our poſſeſſions in India, might one day become the ſource of unexpected wealth. Latreille, with a degree of patriotiſm that does infinite credit to his memory, invites the particular attention of his countrymen to the ſubject; he recommends them earneſtly to attend to the indigenous products of France, ſatisfied as he is that the French need no longer remain tributary to Spain for this branch of commerce. And he addreſſes himſelf in particular to the inhabitants of the Eaſt Indies, to ſeek after, and inveſtigate another ſort of cochineal peculiar to thoſe countries, which is infinitely ſuperior in ſize to that of Mexico, as he judges by a ſpecimen brought by Maſſé, a zealous naturaliſt, to the Muſeum of Natural Hiſtory. "Le gouvernement (ſays Latreille) a le plus grand intérêt á favoriſer ces tentatives. Il me paroit aſſez démontré que nous pouvons ceſſer d'ètre tributaires d'l'Eſpagne pour cette branche du commerce. La cochenille ſylveſtre ſe perpétue dans les ſerres du Jardin des Plantes de Paris; pourquoi ne porteroit-on pas ſes regards ſur ce genre de culture, auquel d'heureuſes circonſtances ſemblent nous inviter? J'engagerois encore les naturaliſtes, ou hommes éclairés, qui habitent les Indes orientales, à ètudier une autre ſorte de cochenille qui eſt infiniment ſupérieure pour la grandeur à celle de Mexique. J'en juge par un individu que Maſſé, zélé naturaliſte, a envoyé au Muſéum d'Hiſtoire Naturelle."

It is but juſtice to ſome enlightened individuals of our own country to ſtate that the cocci of the Eaſt Indies, which produce the cochineal tincture, have not been entirely diſregarded. A ſeries of no leſs than fourteen letters on the ſubject of cochineal inſects diſcovered at Madras by Dr. Anderſon, and addreſſed to ſir Joſeph Banks, were printed and publiſhed at Madras in the year 1788, and two others in concluſion of this ſubject in 1789 and 1790; and alſo an account of the importation of American cochineal inſects into Hindooſtan. An intereſting paper on the lacſha, or lac inſect of that country, (coccus lacca), occurs alſo in the Tranſactions of the Bengal Society, vol. ii. p. 361, and in the Philoſophical Tranſactions, vol. 81.

Polonicus. On the roots of ſcleranthus perennis. Linn. Faun. Suec. *Chermes radicum purpureus*, Geoffr. *Coccus tinctorius radicum*, Breynnius Act. Phyſ. Med. p. i. p. 504. *Graine d'eſcarlate de pologne*, Latreille.

The body of this ſpecies is of an oblong ovate form, and of a purple or cheſnut colour. It inhabits Poland.

This is denominated the cochineal of the north, is found only in cold climates, and ſeems in a great meaſure peculiar to Poland, though not entirely confined to that country. It was one of the principal kinds of ſcarlet dyes in uſe before the diſcovery of South America; but as it is an article collected with difficulty, and is ſufficiently verified by experience to be in every reſpect inferior, as a dye, to the coccus cacti, or Mexican cochineal, its cultivation is leſs aſſiduouſly regarded than formerly.

Theſe inſects are affixed chiefly to the roots of plants, the principal of which is the ſcleranthus perennis; they occur alſo on the pimpernel, the pellitory, mouſe-ear, and ſome others, that grow in ſandy ſituations. Towards the end of June theſe cocci are in a fit ſtate for being gathered; they are then nearly of a ſpherical form, and of a fine violet colour. Some of them are not larger than poppy ſeeds, and others the ſize of a pepper corn, and each of them is lodged in a ſort of cup like that of an acorn, and in which more than half the body is contained. The outſide of the covering is rough and of a blackiſh brown, the inſide ſmooth, poliſhed, and ſhining. On ſome plants they find only one or two of theſe, and on others more than forty. Theſe are the females; the males are ſmaller, and have wings. About the end of June theſe inſects are quite full of purple juice, and it is at that ſeaſon they are gathered. Thoſe who gather them have a hollow ſpade with a ſhort handle; then taking hold of the plant with one hand, they raiſe it out of the ground with the tool held in the other; after which they very quickly and dexterouſly detach the inſects and replace the plant in the ground, where it again takes root. The coccus is then ſeparated from the earth by means of a ſieve; and ſprinkled with very cold water or vinegar. And, laſtly, they are killed by expoſure to the ſun, or keeping them for ſome time in a warm place; but this muſt be done with caution, as too haſty drying would ſpoil the colour. Sometimes they ſeparate the inſects from the veſicles with their fingers, and form them into balls, and by this operation increaſe the value of the article. The Turks and Armenians buy this cochineal for dyeing not only their wool and ſilk, but the tails and manes of their horſes. The women of Turkey alſo employ an infuſion of this drug in the juice of the citron or grape to ſtain the tips of their fingers, and feet, of a beautiful carnation colour. The Levantines, after the manner of the Dutch, ſometimes intermix the Poliſh cochineal in equal portion with the cochineal of Mexico, and extract from it the dye with which they ſtain their ſcarlet cloths, by means of citron-juice, or a ſolution of alum. In the preparation of colours for the artiſt, the Poliſh cochineal is of little ſervice. M. Macquer, who tried many experiments on it, could never produce with it any other than lilac, fleſh colour, or crimſon; and he found it far more expenſive than the Mexican cochineal, becauſe, although it bears an inferior price, it does not yield more than one-fifth part of the colour in proportion.

Fragariæ. On the fragaria and potentilla. *Coccus fragariæ veſcae*, S. G. Gmelin It. i. p. 205. *Coccus potentillæ*, Mayer.

A ſpecies indigenous to ſome parts of northern Europe, Pruſſia, and Siberia. This kind is diſtinguiſhed by having the ſnout black, the thorax marked with three ridges, and the tail ſurrounded by blackiſh hairs. The Ruſſians extract a ſcarlet dye from this inſect.

Hypericornis. On the hypericum perforatum. Pallas. Inhabits Ruſſia.

Ilicis. On the quercus coccifera. Fabr. Modeer Act. Gothenb. Geoffr. Mat. Med. ii. p. 782.

This is the kermes of the *Materia Medica*, and when immerſed in vinegar and dried, produces a colouring matter of a ſimilar nature and tint, but in an inferior quantity, to that of the coccus cacti. Theſe inſects are found adhering to the ſhoots of the quercus coccifera, under the form of ſmooth, reddiſh brown, or blackiſh grains, about the ſize of peas, and covered with a white down. According to M. Hellot, of the French Academy, they are found in the woods of Vauvert, Vendeman, and Narbonne; but more abundantly in Spain towards Alicant and Valencia, and in Murcia,

Murcia, Jaen, Cordova, Seville, Eftremadura, La Mancha, and Serranias de Cuenca. The infect occurs alfo in Greece, and the iflands of the Archipelago.

Before the difcovery of America, the coccus ilicis, or kermes, as it was then termed, was the moft valuable for dyeing fcarlet. Its utility was known to the ancients, but neither the ancients nor the moderns, till of late years, feem to have underftood its origin and nature. Pliny fpeaks of it as the berry of a plant; others, after him, confidered it in the fame light, or as an excrefcence formed by the puncture of a particular kind of fly, fimilar to the gall-nuts on the oak, and other plants. Tournefort was of this opinion. Marfigli, and Dr. Nifole, a phyfician at Montpellier, made experiments and obfervations, with a view to further difcoveries, but did not perfectly fucceed. Two other phyficians at Aix in Provence, Dr. Emeric and Dr. Garidel, applied themfelves about the fame time, and with more fuccefs, having finally difcovered that the kermes is, in reality, nothing elfe than an infect, affuming the appearance of a berry in the procefs of drying.

It is related in Dillon's "Travels through Spain," that in Xixona and Terra de Rellen, there is a diftrict called De la Grana, where the people of Valencia firft began to gather it, and their example was followed all over Spain. In fome years, this article has produced 30,000 dollars to the inhabitants of Xixona.

The culture of the kermes is ftill an object of confideration, though infinitely lefs fo than formerly. The people of Hinojos, Bonares, Villalba, and other parts of the kingdom of Seville, dry it on mats in the fun, ftirring it about, and feparating the red duft, which is the fineft part; this they mix with vinegar, and denominate "paftel." In other parts, the infects are gathered from the trees as carefully as poffible, without lopping the branches of the trees to which they adhere, and are fteeped in vinegar, in order to kill the parent, to prevent the exclufion of the young in drying. The kermes are then fpread or thrown on linen, and as long as they retain any moifture, are turned twice or thrice a day, till they are thoroughly dried, when they are put up for fale. The kermes of Spain is faid to be preferred on the coaft of Barbary, on account of its goodnefs. The people of Tunis mix it with that of Tetuan for dyeing fcarlet caps, fo much in ufe in the Levant. The Tunifians, according to the fame accounts, export every year above 150,000 dozen of thofe caps, which yield to the dey a revenue of 150,000 dollars.

The woollen cloths dyed with this fpecies of coccus, are of a deep red colour, much inferior in brilliancy to the fcarlet cloths dyed with the true, or Mexican cochineal, but of a more durable nature, and lefs liable to ftain. M. Hellot, to whom the world is indebted for feveral ufeful obfervations on this fubject, obferves, that the figured cloths to be feen in the old tapeftries of Bruffels, and the other manufactures of Flanders, which have fcarcely loft any thing of their livelinefs by ftanding for two hundred years, were all dyed with the kermes.

Ficus. On the ficus religiofa and indica. Fabr. *Coccus lacca kerr*, Phil. Tranf. 1781.

This is the infect which produces the gum lac, and is a native of the Eaft Indies. It is of an oval compreffed form, inferior in fize to the head of a moderately large pin; the back is carinated, the abdomen flat, the antennæ half the length of the body, and ramofe, or fending forth two or three long delicate hairs; and the tail furnifhed with two briftles.

The natural hiftory and transformations of this infect have not, hitherto, been attended to by any accurate and well-informed obferver, upon whom we may implicitly rely. The following general remarks feem more entitled to attention. Thefe infects are faid to inhabit, befides the trees abovementioned, the *plafo* of the Hortus Malabaricus, and *rhamnus jujuba* of Linnæus. They commonly fix themfelves fo clofe together, and in fuch numbers, that fcarcely one in fix can have room to complete her cell; the others die, and are eat up by various infects. The extreme branches appear as if they were covered with a red duft, and their fap is fo much exhaufted, that they wither, and produce no fruit, the leaves drop off, or become of a dirty black colour. Thefe infects are tranfplanted by birds; for if they perch only upon thefe branches, they muft carry off a number of the infects upon their feet to the next tree they reft upon. It is worth obferving, that thefe fig-trees, when wounded, drop a milky juice, which inftantly coagulates into a vifcid ropy fubftance, which, hardened in the open air, is fimilar to the cell of the coccus lacca. The natives boil this milk with oils into a birdlime, which will catch peacocks, or the largeft birds. A red medicinal gum is procured by incifion from the plafo-tree, fo fimilar to the gum lacca, that it may readily be miftaken for the fame fubftance. And hence it is fuppofed, thefe infects have little trouble in animalizing the fap of thefe trees in the formation of their cells. The gum lacca is rarely feen upon the rhamnus jujuba, and it is inferior to what is found upon the uncultivated mountains on both fides of the Ganges, where nature has produced it in fuch abundance, that were the confumption ten times greater, the markets might be fupplied. The only trouble in procuring the lac, is in breaking down the branches, and carrying them to market. The price in Dacca, a few years ago, was about 12*s*. the hundred weight, though brought thither from the diftant country of Affam. The beft lac is of a deep red colour. This infect and its cells have gone under the various names of gum lacca, lack, and loc tree; in commerce, they diftinguifh four kinds of this fort of gum.

Caricæ. On the ficus carica. *La cochenille du figuier commun*, Olivier. The body is ferruginous, with the margin elevated and pale. Its general figure is oval, and convex. This defcription applies only to the female, as the male is yet unknown.

This kind is found in the fouth of Europe, and throughout the Levant, where they commit vaft depredations on the fig trees, to which they are peculiar. Thefe infects are fo numerous, that it is impoffible to deftroy them, and in fome feafons in particular, they appear in fuch immenfe fwarms, as to defpoil the trees of their foliage, and rob them of their moifture, till they occafion the fruit to drop off before it can ripen. Some cultivators of the fig fprinkle their trees with a mixture of vinegar and the dregs of oil, and which, in a partial degree, may prove efficacious in deftroying them.

Uvæ Ursi. On the roots of arbutus uva urfi. Fabr. The body of this infect is a chefnut colour, and produces a tincture. Modeer Act. Gothenb.

Characias. *Cochenille du characias.*

This curious infect was firft defcribed by Bofc in the "Journal de Phyfique," February, 1784, under the name of *Dorthefia characias*, in memory of his friend Dorthes de Montpellier, who had previoufly obferved it. The male is about a line and a half in length exclufive of the wings, which are very large, femi-tranfparent, and of a leaden-grey colour. The antennæ are fetaceous, and much longer than the body, and the extremity and upper part of the abdomen are tufted with white hairs or filets, which extend beyond the end of the wings. The female is larger than the male, meafuring

meafuring two or three lines in length, the antennæ are fhort, filiform, and of a reddifh brown, and entirely covered with a whitifh matter, which forms appendages or tufts on the fides and on the back. The abdomen terminates in a folid friable mafs of long filets, upon removing which the body appears reddifh; with nine tranfverfe ftriæ. The trunk is fhort and fituated in the fpace between the anterior legs. The legs are of a reddifh brown. Preparatory to the fe-male beginning to lay her eggs, which fhe does at the commencement of the fpring feafon, fhe forms a little elongated receptacle fomewhat in form of a fack, and fills it with a white cotton-like fubftance, in which the eggs are depofited. Thefe infects prefer the *euphorbia characias*, and *euphorbia pilofella*, two plants on which they thrive, and are rarely found on any other. The young fhed their fkins feveral times before they acquire their full fize. The wings of the male appear, when they have caft their fkins the third time, in the month of September; the latter are rare, compared with the females, not more than one or two males being found to two or three hundred females. Their amours and habits refemble thofe of the other cocci. A circumftance apparently new in the hiftory of the cocci was obferved by Dorothes relative to this infect. He found that the females furvive after laying their eggs; in the winter they conceal themfelves under ftones, or among the bark and moffes, and re-appear in fpring, when the young are hatched, and the parent lives at leaft a month afterwards. It is faid that the larva of a particular kind of coccinella infinuates itfelf in the receptacle of eggs, and eats them without attacking the parent. Olivier appears to have found the fame fpecies of coccus on the bramble in the neighbourhood of Paris.

The coccus characias emits from the pofterior part globules of a vifcous matter, refembling the faccharine moifture difcharged by the aphides. Some attempts have been made to difcover whether thefe infects might be rendered of any utility to the dyer, but without fuccefs; an infufion of them in boiling water produces only a weak tincture of a pale yellow colour.

Cataphractus. Milk-white; eyes, antennæ, roftrum, and legs ferruginous.

This curious infect was defcribed by Dr. Shaw, in the fifth volume of the "Naturalifts' Mifcellany," from a fpecimen communicated by Mr. Dickfon, gardener to the Britifh Mufeum. Dr. Shaw confiders it as a fpecies of coccus, an opinion that feems to admit of fome doubt, but as the infect is unknown to us, except from the defcription, we fhall retain it in this genus, and only repeat the account given of it by that writer in his own words.

"The natural fize of the infect (of which the female alone appears to be at prefent known), is that of the coccinella tigrina, or fmall yellow-fpotted lady-bird, and at firft view has an appearance fo little allied to the generality of the cocci, as to make it doubtful whether it really belongs to that tribe of infects. The whole animal (except the eyes, legs, antennæ, and roftrum,) being coated, in the moft curious manner, in a complete fuit of milk-white armour, as if cafed with ivory. The divifions or annuli of the back are eight in number, of which the three fuperior ones are each furnifhed with a fmall fcutellum or appendicular piece, which is wanting in the other. The fides are furrounded by projecting laminæ, fomewhat in the manner of tortoifes or millepedes; the lower furface is compofed of angular pieces, difpofed nearly as in the former of the abovementioned animals; the eyes which are fituated juft below or on the underfide of the antennæ, are bright, and fomewhat elevated, not unlike thofe of a lobfter; the colour of the projecting parts, *viz.* the legs, eyes, antennæ, and roftrum, is a fine bright ferruginous or reddifh brown." The eggs were fmall in proportion to the animal and of a brown colour. This infect is found among fphagnum and other moffes in boggy and turfy ground, and is moft frequent in Scotland, Ireland, and the north of England, particularly in fome parts of Cumberland.

Oleæ. Feeds on the olive, myrtle, and phyllyrea. Oliv.

Olivier defcribes this fpecies under the name of *Coccus oleæ*, and *Cochenille de l'Olivier*. The female is oval, and of a red-brown colour, paler or deeper in different individuals, and with the nerves, raifed and irregular. The male is unknown. This is found in the fouthern parts of France and in Italy: it chiefly infefts the olive, and, though common on the leaves of that plant, is obferved never to touch the fruit. The young, foon after being hatched, difperfe, and refort to the under fide of the leaves and buds. They multiply prodigioufly faft, and are, of courfe, injurious to the olive which they particularly prefer.

Rusci. Shell furrounded by eight fmaller pieces. Modeer Act. Gothenb.

Inhabits Italy; on the Myrtus and Rufcus. The fhell is truncated, octagonal, and perforated, and has the fmaller lateral pieces granulated in the middle.

Myricæ. Feeds on the *myrica quercifolia*, Fabr. Modeer Act. Gothenb.

A native of the Cape of Good Hope. This is the fize of a fmall pea, and of a femi-oval form, and pale flefh colour: the crown is obtufely pointed, and furnifhed with a very fmall pore, and another above the thicker cartilaginous membrane.

Capreæ. Feeds on the willow. Modeer Act. Gothenb. *Coccus fubrotundus fufcus, linea dorfali nigra*, Degeer.

Size of a fmall pea, and of an ovate form, with the anterior part obtufe and bifid; the colour teftaceous or fufcous, with a gloffy furface, and marked down the middle with a line of black. An European fpecies.

Phalaridis. On the roots of graffes, particularly the *phalaris canarienfis*, or canary grafs.

This kind is defcribed by Linnæus in his "Fauna Suecica," under the name of *Coccus phalaridis*. Geoffroy calls it *Coccus graminis, corpore rofeo*. The female forms little nefts along the ftalks, and at the roots of grafs, which are compofed of a white cotton-like fubftance, in which fhe depofits her eggs. The body of the female is pale-red, or whitifh, and mealy; the male is of the fame colour, with two wings, and four threads at the extremity of the tail, two of which are longer than the reft.

Cratægi. Feeds on the hawthorn, *Cratægus oxyacantha*, Modeer Act. Gothenb.

Inhabits Europe; is of an oblong form, and chefnut colour.

Serratulæ. Feeds on the faw-wort, *ferratula arvenfis*, Fabr. Found in England.

Zosteræ. Feeds on the *zoftera marina*. Fabr.

This is about the fize of a pea; the fhields are brown, and paler at the edges. Found chiefly on the *zoftera marina* in the Baltic.

Vitis. On the branches of *vitis vinifera*. Fabr. *Chermes vitis oblongus*, Geoffroy.

The body of this fpecies is oblong, and of a cinnamon colour.

Liriodendri. Feeds on the *liriodendrum tulipifera*. Hamburgh Mag.

Farinosus. Ovate, downy, pale fufcous, powdered with white. Modeer Act. Gothenb.

Infefts the *betulus alnus*. The body of this fpecies is depreffed.

Clematidis. Feeds on plants of the *clematis genus*. Geoffr.

Persicae. Feeds on the *amygdalus persica*. Modeer Act. Gothenb.

The body of this species is glossy, and either of a reddish colour, tawny, or black.

Abietis. On the *pinus abies*. Modeer. *Le kermès du sapin* of Geoffroy.

This is of a round and spherical form, and of a deep maroon colour: it is found on pines near the bifurcations of the branches.

Fuscus. On the oak, *quercus robur*. Modeer. Body brown and mealy, and of a rotundate form.

Variegatus. Round, variegated with white, yellowish, and black.

The general colour is a yellowish-white, marked with three black transverse rays, and the intermediate spaces dotted with black.

Lanatus. Oblong, silky white; on the *quercus robur*. Geoffroy.

This is of a brown colour, and assumes a white appearance from the silky down with which the body is covered.

Mespili. Body silky-white; on the *mespilus*. Called by Geoffroy *Le kermès cotonneux du néflier*.

Concholiformis. Body linear, and fuscous; on the elm. Modeer.

Aceris. Body ovate; on the maple. Modeer.

Laniger. Brown, silky-white; on the *ulmus campestris*. Reaum.

Diosmatis. On the *diosma crenata* and *pulchella*. Modeer.

Alni. In the divisions of the branches of *betula alni*. Modeer. The body is of an oblong-ovate form, and reddish.

Uva. Fuscous, inclining to yellowish, and sphærico-gibbous. Modeer. Inhabits Sweden, and is found under stones.

Spurius. Ovate, with a few hairs, chesnut; beneath pale yellow. Modeer. Found on the ulmus, or elm.

Coccus *Maldivia*, the Maldivia nut, in the *Materia Medica*, the name of the fruit of the *palma Maldiviensis* of Johnston, an oval-figured fruit, of a sweet taste, and famous for its virtues in nervous disorders.

COCCYGÆUS Musculus, in *Anatomy*, is a thin and flat muscle, of a triangular figure, arising by its apex from the point of the spinous process of the sacrum, and inserted by its basis into the inferior lateral part of the sacrum, and into the side of the os coccygis. It is strongly connected to the lesser sacro-ischiatic, or spinoso-sacral ligament. It will restore the os coccygis, when that bone has been carried backwards; and it may bend this bone forwards. This muscle is the *levator coccygis* of Morgagni; *triangularis coccygis* of Santorini; and *sacro-coccygeus* of Winslow.

COCCYGIS *curvatora*, is a thin and slender muscle, derived from the inferior lateral portion of the inner surface of the sacrum, and from the upper part of the os coccygis; it is fixed into the lower bones of the coccyx. It is often, mostly or entirely, tendinous. It will bend the coccyx forwards.

Coccygis *ossis musculi*. These are small, thin, radiated muscles, lying on the inner, or concave side of the os sacrum, and neighbouring parts of the pelvis. They are four in number, two on each side, one placed more forward, the other more backward; for which reason the first may be termed *coccygæus anterior*, sive *ischio coccygæus*, and the other *coccygæus posterior*, sive *sacro coccygæus*.

COCCYGIUS, in *Ancient Geography*, a hill of the Peloponnesus, in the Argolide territory. The way from Troezené to Halicé, passed by the foot of this hill, on which was a temple, dedicated to Jupiter; and an old temple at the bottom of the hill is said to have been consecrated to Apollo. This hill was near the river Inachus, according to Plutarch and Pausanias, the latter of whom calls it *Coccyx*.

COCCYGRIA, in *Botany*, Bauh. Pin. See Rhus *cotinus*.

COCCYNUM Promontorium, in *Geography*, a promontory of Italy, in Magna Græcia, opposite to Sicily. Appian.

COCCYX, or Ossa Coccygis, in *Anatomy*, three or four small portions of bone, connected with each other, and joined to the inferior extremity of the sacrum. See Skeleton.

Coccyx, in *Ichthyology*, a name given by Aristotle, and other old Greek writers, to the fish called *cuculus*, and *lyra*, by other authors. It is a species of the *trigla*, distinguished by Artedi by the name of the *trigla*, all over red, with a bifid snout, and the coverings of the gills striated.

COCETUM, among the *Ancients*, a kind of drink made of honey and poppies.

COCHA, in *Ancient Geography*, a town of Arabia Deserta. Ptolemy.

COCHABAMBA, in *Geography*, a province and jurisdiction of Peru, the new vice-royalty of La Plata, or Buenos Ayres, situated in a fertile valley between mountains, and watered by a river of the same name. The adjacent provinces are Sicasica to the N.W.; La Paz and Cruso to the W. and S.W.; Chayanta to the S.; and to the E. Plata and Santa Cruz de la Sierra, in S. lat. about 18°, and W. long. about 67°. The capital town is Oropesa, and it was formerly denominated the granary of Peru. It has one gold mine.

COCHE, in *Ancient Geography*, a village of Babylonia, near Seleucia, to the S. E.

Coche, in *Geography*, a small island in the Caribbean sea, between the island of Margarita and the continent of South America. N. lat. 10° 57′. W. long. 63° 10′.

COCHECO, a north-west branch of Piscataqua river, in the state of New-Hampshire, in America. It rises in the Blue hills in Strafford county, and its mouth is 5 miles above Hilton's Point.

COCHER, a river of Germany, which runs into the Neckar near Wimpfen, in the circle of Swabia.

COCHEREL, a town of France, in the department of the Eure, famous for a victory gained by Guesclin over the king of Navarre in 1364; 7 miles E. of Evreux.

COCHHEIM, or Kocheim, a town of Germany, in the circle of the Lower Rhine, and electorate of Treves, now belonging to the French, and chief place of a canton in the department of the Rhine and Moselle, and district of Coblentz, seated on the Moselle, formerly imperial, but engaged to the electorate of Treves in 1240 by the emperor Adolphus de Nassau; 30 miles N.E. of Treves, and 46 N.E. of Luxemburg. The place contains 1527, and canton 5647 inhabitants. The territory includes 18 communes.

COCHIA, in the *Materia Medica*, the name of officinal pills, which are distinguished into the greater and lesser: the former is a composition of hiera picra, troches of Alhandal turpeth, diagrydium, and syrup of buckthorn, taken from Rhases, but seldom used in the present practice. The latter is compounded of equal quantities of bright aloes, the purest scammony, and the pulp of colocynth, made into a mass with syrup of buckthorn; two drams of the distilled oil of cloves are added to an ounce of each of the former ingredients. These pills are prescribed to discuss viscidities, watry humours, and flatulencies.

COCHICAT, abridged from the Mexican name *Cochitenacatl*,

nacatl, in *Ornithology*, the *Psittacus torquatus* of Gmelin, the *Ramphastos torquatus* of Latham. Ind., the *Tucana Mexicana torquata* of Brisson, and the *Coloured Toucan* of Lath. Syn.; has the following specific character: Above it is black, below whitish, its belly green, its hind part red, and its collar of the same colour. It frequents the sea-shore, and lives on fish.

COCHILE, or Coscile, in *Geography*, a river of Naples, which runs into the gulf of Tarento, between Cassano and Rossano, in the province of Calabria Citra.

COCHIN, a sea-port town of Hindoostan, on the coast of Malabar, formerly occupied by the Portuguese, afterwards the chief settlement of the Dutch, but now in possession of the English; it is situated in a country N. of Travancore, to which it gives name, and which has been chiefly resorted to for pepper. Cochin stands at the N.W. of an island, which is about 18 Dutch miles in length, and two in breadth; to the south the island is formed by the mouth of the river of Cali Coylang, and to the N. by that which runs from Cranganore, and separates it from the island of Baypin. The form of the city is nearly semicircular, and it is about $1\frac{1}{2}$ mile in circumference. Cochin, besides the bastions, cavalier and wall by which it is fortified, has three gates, to the W. to the E. and to the N. Its principal buildings are the church and the government-house. Its streets are generally wide, but there are few handsome houses. The whole country in the vicinity of Cochin abounds with lakes, which are the repositories of the waters that spring from the west side of the Gauts, and is very flat, marshy, and insalubrious. At Cochin there were, at the beginning of the last century, about 4000 Jews, descendants, probably, of those who fled through Persia to the coast of Malabar, from the persecution of Titus. They had a synagogue, in which were carefully kept their records, engraven on copper-plates; so that they could show their history from Nebuchadnezzar to the present time. Wolfius, cited by Kennicott (State of the printed Heb. Text, vol. ii. 532.), is of opinion, that the Hebrew MSS. of Malabar claim a considerable degree of confidence. N. lat. 9° 58′. E. long. 76° 2′.

Cochin, Nicholas, in *Biography*, an engraver of considerable merit; he was born at Troyes, in Champagne, but settled in Paris, where he engraved a great number of plates, not unfrequently in the style of Callot, whose disciple he probably was; and, like that great master, he most excelled in small figures. Many of his prints are from his own compositions. Amongst his other works are, part of the plates for the entry of Lewis XIV., with his queen, into Paris. This work, consisting of 22 prints, was published 1622. Part of the plates for a large volume in folio, of battles, plans, views of towns, &c. relative to the conquests of the French army under the same monarch, published 1645. Various sets of small prints from the Old and New Testament, &c. described by Strutt and Heinecken.

Cochin, Noel, or Natales R., an engraver, born at Troyes, and in all probability of the same family with the preceding artist. He worked at Paris about 1670, and afterwards went to Italy, and died, as it is supposed, at Venice. We have by him many bold, but coarse, etchings from the works of Titian, Tintorett, the Caracches, and other Italian artists, and, among others, several of the plates for a work, entitled, "Tabellæ, selectæ ac explicatæ à Carola Catherina Patina, Parisina Academica Batavii, 1691." This work was also published at Venice in the same year, with an Italian translation of the descriptions. The prints, however, owe their chief value to the merit of the compositions from which they are engraved. Strutt. Heinecken.

Cochin, Charles Nicholas, in his youth applied himself to painting, but afterwards quitted the palette for the graver.

He was received into the Royal Academy of Paris in 1731, and died in 1754. His numerous prints, though somewhat mannered, are executed in an agreeable and spirited style. Amongst his best works are: "The meeting of Jacob and Esau," from Le Moine; and "Jacob and Laban," its companion, from Restout; both upright plates of a middle size. He likewise engraved the two studies of Raffaele, for the "Alexander and Roxana," in the Crozat cabinet. Strutt. Heinecken.

Cochin, Charles Nicholas, son of the preceding artist, was born at Paris in 1715, and, assisted by the instructions of his father, and his mother Louise Madeleine Hortemels, became an engraver of considerable celebrity. In 1749, he travelled to Italy with the marquis de Marigny, and after his return, was, in 1752, made a member of the Royal Academy of Paris, and, in the sequel, appointed secretary and historian to that society.

In addition to these honours, he was made a knight of the order of St. Michael, and keeper of the king's drawings. Of his works, then extremely numerous, Mr. Jombent published a catalogue in 1770. He was living, according to Mr. Strutt, in 1785, when that gentleman published his dictionary. Heinecken. Strutt.

COCHIN-CHINA, in *History* and *Geography*. The extensive empire of China terminates on the south of the 22d degree of latitude; but a tongue of land continued with it extends on its western side as far as the ninth parallel of north latitude. This prolongation of 13 degrees in extent, has a ridge of high mountains, which, running from north to south, divides the Birman empire on the west, from the kingdoms of Tung-quin, or Tong-quin, Cochin-china, Tsiampa, or Siampa, and Cambodia, on the east. These names, though usually marked on our charts, are unknown to the natives, except Tung-quin. The other three, collectively, are called An-nan, and are distinguished by three great divisions. The first, contained between the southernmost point, which forms the extremity in the gulf of Siam, and which lies in about the ninth degree of latitude, as far as to the twelfth degree, is called Don-nai; the second, extending from hence to the fifteenth degree, Chang; and the third, between this and the seventeenth degree, where the kingdom of Tung-quin commences, is called Hué. On the sea-coast of all these divisions, are safe and commodious bays and harbours. The great river of Don-nai (Cambodia on the chart) is described as navigable by ships of the largest size to the distance of forty miles, where the city Sai-gong is situated, having a capacious and a commodious port, and an extensive naval arsenal. In the division of Chang, in latitude 13° 50′ N., is Chin-chen bay and harbour; the latter spacious and completely sheltered from all winds, but only accessible by large vessels at high water, on account of a bar that runs across the narrow entrance between it and the outer bay. At the head of this harbour is situated the city of Quin-nong. The principal city in the division of Hué, which bears the same name, is situated on the banks of a large river, navigable by ships of a considerable burden; but a bar of sand runs across the mouth. A little to the southward of this river is the bay of Han-sare, or, as it is usually marked in the charts, Turon, which, for the security and conveniences it affords, is equalled by few in the eastern world. It is situated in N. lat. 16° 7′.

Cochin-china, properly so called, extends from about the 20th degree of north latitude to Pulo Condore, which lies in 8° 40′. It is bounded by the kingdom of Tong-quin on the N., from which it is separated by the river Sungen, by the kingdom of Laos, and by a range of mountains, which divides

vides it from Cambodia on the W.; and by that part of the eastern ocean, called the Chinese sea, on the S. and E. The kingdom is divided into 12 provinces, lying upon the sea-coast, and succeeding each other from north to south. Its breadth bears no proportion to its length; as few of the provinces extend further than a degree from east to west, and some less than 20 miles. The whole country is intersected by rivers, which, though not large, are favourable to inland commerce. The climate is healthy, as the violent heat of the summer-months is tempered by regular breezes from the sea. The rainy seasons are September, October, and November; when the low lands are liable to be suddenly overflowed by immense torrents of water that flow from the mountains. These inundations, which happen generally once a fortnight, last three or four days. The frequent rains which are brought in December, January, and February, by cold northerly winds, distinguish this country by a winter different from any other in the East. The inundations, like the overflowings of the Nile in Egypt, contribute very much to fertilize this country; so that in many parts the land produces three crops of grain in the year. All the fruits of India are found here in the greatest perfection, with many of those of China. Asiatic Register. iii. 84.

History of Cochin-china. This country had a share in all the early revolutions of Tung-quin; it was subject originally to the Chinese government, and of course liable to the same changes which China itself experienced. In many periods of its history, Cochin-china seems to have stood high in the estimation of the parties contending for rule. When the Ming had expelled the Mogul Tartars from China, the new emperor, chief of that dynasty, sent notice to the king of Cochin-china of his accession to the throne, and caused sacrifices to be offered up in honour of the spirits of mountains, forests, and rivers. Itataha, who was then sovereign, sent his tribute to the new monarch, from whom, in return, he received magnificent presents. In 1373, this same prince made so many naval captures from the pirates who infested the seas, that he was enabled to present the emperor with seventy thousand pounds weight of precious woods.

In the next century, after a long and very bloody war, the kings of Tung-quin became absolute masters of Cochin-china, as far as cape Aurilla, in N. lat. 12° 34′. The aborigines, called Moys, retired to the mountains that separate Cochin-china from Cambodia, where they have ever since remained. They are said to be a savage race of people, very black, and in their features resembling the Caffres.

After this revolution, the Chinese historians speak but little of Cochin-china. It, however, recovered its independence, and continued to be governed, as it is at present, by its own kings. There is, notwithstanding this, but little come down to us of its history, till what is given us by Mr. Barrow, which commences in the year 1774, and of which the following is a brief outline.

In the year 1774, and in the 35th year of the reign of Caung-shung, king of Cochin-china, an insurrection broke out in the city Quin-nong, the capital of his kingdom. This rebellion was headed by three brothers, of whom the eldest, named Yin-yac, was a wealthy merchant, who carried on an extensive commerce with China and Japan: the name of the second was Long-niang, a general officer of high rank, and great command; and the third was a priest. Such a dangerous combination of wealth, of military power, and of influence over the minds of the people, was but feebly resisted on the part of the king, who had for many years surrendered, in a great degree, the reins of government into the hands of his generals, who were mostly eunuchs. Other circumstances tended to forward the views of the rebel chiefs. The imposition of a poll-tax had created general discontent among the people. They seized upon the king, whom, with as many of his family as they could get into their hands, they put to death. The city of Sai-gong was supposed to be favourable to the cause of the deposed sovereign: an army was therefore marched against it, the city was taken, and 20,000 of its inhabitants put to the sword. The usurpers left no measures untried, nor suffered any occasion to pass by, which might be the means of giving them popularity. The merchant gave sumptuous entertainments, fetes and fire-works: the general encouraged and flattered his army, and the priest prevailed on the clergy to announce to the multitude the decree of Tien, which had ordained these three worthies to be their future rulers. According to a plan laid down for the government of this extensive country, it was determined that Yin-yac should possess the two divisions of Chang and Don-nai: Long-niang that of Hué, bordering on Tung-quin; and that the youngest brother should be high priest of all Cochin-china. Thus Yin-yac placed his brother between himself and the Tung-quinese, who were regarded as a very powerful people; with these Long-niang took occasion to quarrel, but they were unable to cope with him. Their king, after the first engagement, abandoned his army, and fled to Pekin to implore the assistance of the emperor. Kien-Lung, who, from his successes in every part of Tartary, and on the great island of Formosa, had been led to believe that his troops were invincible, conceived there would be but little difficulty in driving the usurper from Tung-quin, and in restoring the lawful sovereign to his throne. For this purpose he ordered the viceroy of Canton to march immediately at the head of 100,000 men. Long-niang, apprized of the movements of this immense army, and having ascertained their line of march, sent out detachments to plunder and destroy the towns and villages, through which it must pass: the country being thus laid waste, the Chinese army, long before it had reached the frontier of Tung-quin, was so distressed by the want of provisions as to be obliged to fall back; but in their retreat they were harrassed by the enemy to such a degree, that by fatigue, famine, and sword, half the Chinese army was destroyed without a general battle being fought. The viceroy, when he was within 100 miles of Canton, offered to negociate with the usurper, but Long-niang assuming the character and tone of a conqueror declared, that having been called to the throne of Tung-quin by the will of heaven and the voice of the people, he was determined to maintain his right to the last extremity: that he had 200,000 men in Tung-quin, and as many in Cochin-china, ready to die in his cause: and that he was no longer an usurper, for he had been crowned Quang-tung, king of the united kingdoms of Tung-quin and Cochin-china. The viceroy was but ill prepared for this decided tone: yet no time must be lost in deliberation. He dispatched a courier to Pekin, giving an account of victories gained, and enemies subdued, although himself had been driven before the enemy without once daring to hazard an engagement. At the same time he spoke in high terms of commendation of his antagonist, and of his right to the crown for which he had been contending, and gave it as his opinion that Quang-tung should be invited to the court of Pekin to do the usual homage, and to receive the sanction of the emperor for holding the throne of Tung-quin; suggesting, also, that a degree of mandarinate in one of the provinces of China, conferred on the late sovereign of that country, would be an ample indemnification for the loss he had sustained in Tung-quin. The court approved the viceroy's propofal. The fugitive king of Tung-quin relinquifhed his pretenfions to a crown, and accepted the degraded title of a Chinefe Mandarin: after which an invitation was difpatched to Quang-tung to proceed to Pekin. The wary general fent an officer as his reprefentative, who was to act the part of the new king of Tung-quin and Cochin-china. He was received at the court of Pekin with all due honours, loaded with prefents, and confirmed in his title to the united kingdoms, which were to be regarded as tributary to the emperor of China. On the return of this mock king to Hué, Quang-tung knew not how to act; but perceiving that the affair could not remain a fecret, he caufed his friend and the whole fuite to be put to death, as the only means of preventing the trick which had been fuccefsfully played on the emperor of China, from being difcovered. This event happened in the year 1779. At the time of the rebellion in Cochin-china, there refided at court a French miffionary of the name of Adran, who was ftrongly attached to the royal family, and who effected the efcape of the queen and her fon. By favour of the night they fled to a confiderable diftance from the capital, and took refuge in a foreft. Here for feveral months the young king of Cochin concealed himfelf, and the remnant of his unfortunate family, in the fhady branches of a banana-tree, where they received their daily fuftenance from the hands of a Chriftian prieft, who carried them fupplies at the hazard of his life, till all farther fearch was given up. As foon as the enemy had retired, the unfortunate fugitives made the beft of their way to Sai gong, where the people flocked to the ftandard of their legitimate fovereign, whom they crowned as king of Cochin-china, under the name of his late father, Caung-fhung. At this time there were in the port of Sai-gong an armed veffel commanded by a Frenchman, feven Portuguefe merchantmen, and a confiderable number of junks and row-boats. Thefe the king purchafed for the purpofe of making an attack on the ufurper's fleet, in the harbour of Quin-nong. The monfoon was favourable for the project, but the refult was not crowned with fuccefs, and the young monarch was glad to make a hafty retreat. Though a confiderable part of Yin-yac's fleet was difabled or deftroyed, it anfwered no other purpofe than to roufe his attention towards the fouthern parts of the country. Caung-fhung had fcarcely returned to Don-nai, which he reached with difficulty, on account of the monfoon being adverfe to his return, when intelligence was received that a large army was on its march againft him. Refiftance on his part being in vain, he determined to feek for fafety in flight. Having collected the remains of his family, and a few faithful followers, he embarked in the river of Sai-gong, and after a fhort voyage, arrived fafely on a fmall uninhabited ifland in the gulf of Siam, called Pulo Wai. Here he was joined in a fhort time by about 1200 of his fubjects fit to carry arms. The ufurper having difcovered the place of his retreat was upon the point of fending out an expedition againft him, but Caung-fhung, apprized of his intention, deemed it more prudent to embark for Siam, and to throw himfelf on the protection of the king of that country. He had not been long landed before he offered his affiftance, and that of his people, to join his Siamefe majefty againft the Birmans: thefe he foon reduced to the neceffity of fuing for peace on any terms. Caung-fhung returned to the capital of Siam, where he was received with univerfal joy, and every demonftration of kindnefs, on the part of the king, who loaded him with prefents of gold, filver, and precious ftones. He did not remain long in favour, but was obliged with his adherent to feek refuge again in their folitary ifland. Here he fortified himfelf fecurely againft his enemies, and in a fhort time, learnt through his friend Adran, that the greater part of his fubjects were ftill attached to him, and diffatisfied with the ufurper. He committed his fon to the care of Adran, who embarked with his charge for Pondicherry, and from thence they failed to Paris, where they arrived in the year 1787. The young prince was prefented at court, and treated with every mark of refpect. In the courfe of a few months Adran concluded a treaty between Louis XVI. and the king of Cochin, in which the former engaged to lend Caung-fhung effectual affiftance to reftore him to his own throne. The fcheme was, however, fufpended firft by the devices of an artful woman, and afterwards completely abandoned by the French Revolution in 1789. The bifhop neverthelefs did not defpair of the caufe; he, with the young prince and fome volunteers from France, went in fearch of the king. At the mouth of the river leading to Sai-gong they learned that the monarch had remained two years, living, like the reft of his adherents, on the roots which they dug from the ground, but that he had at length raifed his ftandard in Don-nai. In the year 1790, the bifhop and his fon joined him at Sai-gong; they were followed by a fmall veffel which had been taken up to convey arms and ammunition. The greater part of the firft year was occupied in fortifying the place, in recruiting and difciplining the army, and in collecting and equipping a fleet. In the year 1791, the rebel Quang-tung died at Hué, leaving behind him a fon of about 12 years of age to fucceed in the government of Tung-quin, and the northern part of Cochin-china. Caung-fhung immediately commenced operations againft Yin-yac; the attack was fo wholly unexpected on the part of Yin-yac, that he and his court had gone thirty miles up the country to enjoy the pleafure of hunting. On fuch occafions the fovereign is not only attended by a few courtiers, but with numbers fufficient to compofe a fmall army. They are chiefly foldiers, who furround the thickets, and having fprung the game, which is ufually an elephant, or tyger, or buffalo, they diminifh the diameter of the circle, till fixing the animal on a fpot, they either kill him with their fpears or take him prifoner. The alarm of the enemy was quickly communicated to the hunting party, and the beach was prefently lined with troops: but they were of little affiftance, and the ufurper had the mortification of witneffing the deftruction of his fleet by that of Caung-fhung. In the year 1793, when the Britifh fquadron, in its way to China, came to anchor in Turon-bay, it was known that the whole of Donnai was in poffeffion of the lawful fovereign. Chang, the middle part of the country, was held by the ufurper Yin-yac; and Hué, including the country and iflands adjacent to Turon-bay, was governed by the fon of Quang-tung. At firft it was fuppofed that our fleet had come in aid of the legitimate fovereign, and under this idea, his opponents affembled a confiderable body of troops and elephants in the vicinity of Turon, and it was not till after many days had expired, that this impreffion was done away. The rebel, Yin-yac, did not long furvive the deftruction of his fleet: he died a few months after the Britifh left Turon bay of a difeafe brought on by rage and defpair at the fuccefs of the lawful king: by fome, however, his death has been imputed to poifon adminiftered by his fubjects already wearied with his government. He was fucceeded by his fon, who poffeffed all the vices without the talents of the father. Cruel, deceitful, and vindictive, he was univerfally hated. In the year 1796, Caung-fhung refolved to attack his capital

tal by land. The young usurper brought against him an army of 100,000 men; but the king completely routed it with a much inferior force, and took possession of Quinnong. On this occasion an extraordinary instance of magnanimity is related of Caung-shung. When the garrison had surrendered, the king, having been engaged in person the whole day, and worn out with fatigue, was conveyed into the citadel in a sedan-chair; but, on passing the inner gate, he was fired at by a person on the rampart: the culprit was seized and brought before the king, when it was discovered that he was a general officer, and a relation to the usurper. The king, according to the custom of the Chinese, when it is intended to mitigate the sentence of death passed on a criminal, told him, that instead of ordering his head to be struck off, he would allow him his choice of poison, a cord of silk, or a dagger. "If you are not afraid of me," said the rebel chief, "you will instantly order my release; and as I have sworn never to live under your protection, or to be obedient to your laws, if you dare comply with what I ask, I shall immediately repair to Hue, where my rank and character will procure me the command of an army, at the head of which I shall be proud to meet you." The king ordered his release, and caused him to be escorted to the northern frontier; and the following year this very man was second in command at the siege of Quin-nong where he lost his life. The son of Yin-yac was completely subdued, and the whole country, as far as Turon-bay, submitted to the arms of the lawful sovereign. The other usurper still kept possession of the kingdom of Tung-quin, against which Caung-shung was preparing a formidable armament in the year 1800, since which there have been no authentic accounts, though, according to Mr. Barrow, there are grounds for believing that he has re-conquered the whole of that country. From the year 1790, in which Caung-shung returned to Cochin-china, to 1800, he was allowed to enjoy only two years peace; these, however, were probably the most important in his hitherto troublesome reign. Under the auspices of the bishop Adran, who, in every undertaking of consequence, was to him as an oracle, he turned his attention to the improvement of his country. He established a manufactory of salt petre, opened roads of communication between important posts and considerable towns, and planted them on each side with trees for the sake of shade. He encouraged the cultivation of the areca nut and the betel pepper, the plantations of which had been destroyed by the army of the usurper. He held out rewards for the propagation of the silk worm; caused large tracts of land to be prepared for the culture of the sugar-cane; and established manufactures for the preparation of pitch, tar, and resin. He caused several thousand match-locks to be fabricated; he opened a mine of iron ore, and constructed smelting-furnaces. He distributed his land forces into regular regiments; established military schools, where officers were instructed in the doctrine of projectiles and gunnery by European masters; and Adran translated into the Chinese language a system of military tactics for the use of his army. In the course of these two years he constructed three hundred large gun-boats, five luggers, and a frigate built upon the French plan. He caused a system of naval tactics to be introduced, and had his naval officers instructed in the use of signals. An English gentleman, in the year 1800, saw a fleet of 1200 sail, under the immediate command of this prince, weigh their anchors, and drop down the river in the highest order, in three separate divisions, forming into lines of battle, and going through a variety of manœuvres by signals as they proceeded. During this interval of peace he undertook to reform the system of jurisprudence: he abolished several species of torture, and he mitigated punishments that appeared to be disproportionate to the crimes of which they were the consequence. He established public schools, to which parents were compelled to send their children at the age of four years, under certain pains and penalties. He drew up regulations for the commercial interests of his kingdom; caused bridges to be built over rivers; buoys and sea-marks to be laid down in all the dangerous parts of the coasts; and surveys to be made of the principal bays and harbours. He sent missions into the mountainous districts on the west of his kingdom, inhabited by the Laos and the Miaotse, barbarous nations whom he wished to bring into a state of civilization and good government. In short, this monarch, by his own indefatigable application to the arts and manufactures, roused, by his example, the energies of his people, and spared no pains to regenerate his country. In less than ten years, from a single vessel he accumulated a fleet of 1200 ships, of which three were of European construction. Caung-shung is, in the strictest sense of the word, a soldier, and holds the name of general in far greater estimation than that of sovereign: he is described as being brave without rashness; and fertile in expedients, when difficulties are to be surmounted. He is neither discouraged by difficulties, nor turned aside by obstacles. Cautious in deciding, but, when once resolved, prompt and vigorous to execute. In battle he is always eminently distinguished; attentive to all the officers under his command, he studiously avoids to mark out any individual as a favourite. He knows the name of almost every soldier, and delights in talking over with them of their adventures and exploits; he makes particular inquiries after their wives and children; and even enters with a degree of interest into a minute detail of their domestic concerns. To foreigners he is affable and condescending; he professes a veneration for the doctrines of Christianity, and tolerates all religions in his dominions. He observes a most scrupulous regard to the maxims of filial piety, as laid down in the works of Confucius, and humbles himself in the presence of his mother, who is still living, as a child before its master. With the works of the most eminent Chinese authors he is well acquainted; for the energy of his mind is not less vigorous than the activity of his corporeal faculties. He is represented as the main-spring of every movement that takes place in his extensive kingdom. To enable him the better to attend to the concerns of his government, his mode of life is regulated by a fixed plan. At six in the morning he rises and goes into the cold bath; at seven he has a levee with his mandarins, when the letters received on the preceding day are read, on which his orders are minuted by the respective secretaries. He then proceeds to the naval arsenal, examines the works that had been performed in his absence, and rows in his barge round the harbour, inspecting his ships of war. About twelve or one he takes his breakfast in the dock-yard, which consists of boiled rice and dried fish. At two he retires and sleeps till five, when he gives audience to the naval and military officers, the heads of tribunals or public departments, and examines what they may have to propose. These affairs generally employ his attention till midnight, when he retires to his private apartments, makes notes of the occurrences of the day, takes a light supper, passes an hour with his family, and retires to bed between two and three in the morning. We have been thus particular in drawing the character of this prince, on account of the ascendancy which he is likely to gain in that part of the East. The strength of the forces of the king in Cochin-china was, in the year 1800, as follows:

ARMY.	Men.
24 Squadrons of buffalo cavalry -	6,000
16 Battalions of elephants (200 beafts) -	8,000
30 Battalions of artillery - - -	15,000
25 Regiments of 1200 each, trained in the European manner - - -	30,000
Infantry with match-locks, &c. - -	42,000
Guards trained in European tactics -	12,000
Land forces -	113,000

MARINE.	
Artificers in the naval arfenal - -	8,000
Sailors regiftered on the fhips in the harbour	8,000
Attached to the European built veffels -	1,200
Attached to the junks - - - -	1,600
Attached to a hundred row-galleys -	8,000
Marine forces -	26,800

Making in the whole, for the land and fea-fervice, one hundred and thirty-nine thoufand eight hundred men.

Thefe military men are active and vigorous, and not encumbered with drefs; they wear pafte-board helmets, with taffels of cow-tails, dyed fcarlet; their quilted jackets and petticoats are completely Chinefe. In general, a handkerchief, tied about the head, fomewhat in the fhape of a turban, a loofe fmock-frock, with a pair of drawers, conftitute the drefs of a foldier.

Manners and Cuftoms of the Cochin-Chinefe. "As none of the houfes," fays Mr. Barrow, "were large enough for the accommodation of our party, the governor of Turon directed a fhed to be built, which was finifhed in the courfe of a few hours; the roof and fides were covered with thick clofe mats. Within this fhed was placed a row of little tables, with forms on each fide. In China it is the cuftom to cover their tables fo completely with difhes, or bowls, that no part of their furfaces can be feen; but the Cochin-Chinefe feem to have improved on the liberality of their neighbours, by not merely covering the table, but by piling the bowls in rows on each other, three or four high. Of table-linen, knives, bottles, and glaffes, they make no ufe; but before each perfon is laid a fpoon of potter's ware, and a pair of porcupine quills, or fmall fticks, like thofe ufed by the Chinefe. The contents of the bowls are preparations of beef, pork, fowls, and fifh, cut into fmall pieces, mixed with vegetables, and dreffed in foups and gravies, compofed of various materials. Neither wine, nor fpirits, nor fermented liquors of any kind, nor even water, are ferved round during the time of eating; but when dinner is over, the Chinefe *feau-choo* is handed about in porcelain cups. The governor does not fit down with ftrangers, but ufually when he entertains fuch, lies ftretched on a mattrafs at the end of a room, fmoking tobacco, or eating his areca nut, while two tall fellows agitate the air the whole time with large fans, made of the winged feathers of the Argus pheafant. The drefs of the Cochin-Chinefe is thus defcribed: they go bare-legged, and generally bare-footed; their long black hair, like that of the Malays, is ufually twifted in a knot, and fixed on the crown of the head. This, indeed, is the ancient mode in which the Chinefe wore their hair, until the Tartars, on the conqueft of the country, compelled them to fubmit to the ignominy of fhaving the whole head, except a little lock of hair behind. The houfes in general confift only of four mud walls, covered with thatch; and fuch as are fituated on low ground, or in the neighbourhood of rivers, are ufually raifed on four pofts of wood, or pillars of ftone, to keep out vermin, as well as inundations. The Cochin-Chinefe are, like the French, always gay and forever talking; the Chinefe always grave, and affect to be thinking; the former are open and familiar; the latter clofe and referved. A Chinefe would confider it as difgraceful to commit any affair of importance to a woman. Women, in the eftimation of the Cochin-Chinefe, are beft fuited for, and are accordingly entrufted with the chief concerns of the family. In Cochin-china the women are quite as gay and unreftrained as the men; but it appears to be their fate to be doomed to thofe occupations which require, if not the greateft exertions of bodily ftrength, at leaft the moft perfevering induftry. They may be feen, day after day, and from morning till night, ftanding in the midft of pools of water, occupied in the tranfplanting of rice; all the labours of tillage, and the various employments connected with agriculture, fall to the fhare of the female peafantry; while thofe in Turon, to the management of domeftic concerns, add the fuperintendence of all the details of commerce. They even affift in conftructing and keeping in repair their mud-built cottages. They conduct the manufacture of coarfe earthen-ware veffels; they manage the boats on rivers and in harbours; they carry their articles of produce to market; they draw the cotton-wool from the pod, fpin it into thread, weave it into cloth, dye it of its proper colour, and make it up into dreffes for themfelves and their families. The young men in general are compelled to enrol themfelves in the army, and fuch as are exempt from military fervice, employ themfelves occafionally in fifhing, in collecting fwallows nefts, and the *biches de mer*, among the neighbouring iflands, as luxuries for the ufe of their great men, but more particularly as articles of export for the China market; in felling timber, building and repairing fhips and boats, and fome other occupations, which however they take care fhall not engrofs their whole time, but contrive to leave a confiderable portion of it unemployed, or employed only in the purfuit of fome favourite amufement. But the activity and induftry of the women are fo unabating, their purfuits fo various, and the fatigue they undergo fo haraffing, that the Cochin-Chinefe apply to them the fame proverbial expreffion which we apply to a cat, obferving, that a woman, having nine lives, bears a great deal of killing. The men in this country, even in the common ranks of life, confider the other fex as deftined for their ufe; and thofe in the higher ftations as fubfervient to their pleafures. The number of wives, or concubines, which a man may find it expedient to take, is not limited by any law; but here, as in China, the firft in point of date claims precedence, and takes the lead in all domeftic concerns. The terms on which the parties are united are not more eafy, than thofe by which they may be feparated; the breaking of one of their copper coins, or a pair of fticks with which they eat their food, before proper witneffes, is confidered as a diffolution of their former compact, and their act of feparation. In China, as we have feen, the men have fedulously and fuccefsfully inculcated the doctrine, that a well-bred woman fhould never be feen abroad; and fo craftily have they contrived their precepts to operate, that the filly women have been prevailed on to confider a phyfical defect, which confines them to the houfe, as a fafhionable accomplifhment. In this refpect there is a total difference with regard to the Cochin-Chinefe women; they have the free ufe of their limbs and their liberty, and, by their buftling about with naked feet, they become unufually large and fpreading. The fame caufe, which in China has effected this total feclufion of the fex from fociety, and the abridgement of their phyfical powers, has produced in Cochin-china a dia-a diametrically oppofite effect, by permitting them to revel uncontrouled in every fpecies of licentioufnefs; hence they are degraded in public opinion, and confidered as beings of an inferior nature to men. Thus fituated, character becomes of little value either to themfelves or others; the confequence of which is, that women of lefs delicacy, or men of more accommodating difpofitions, are not to be met with in any part of the world than thofe in the environs of Turon bay; perhaps, however, the general character of the nation is not to be afcertained from that which prevails at a fea-port. The fingular indulgence granted by the laws of Solon, of permitting young men to difpofe of their perfonal favours, for the purpofe of enabling them to procure the articles of the firft neceffity for themfelves or their families, is fanctioned by the Cochin-Chinefe, without any limitation as to age, condition, or object. Neither the hufband nor the father feems to have any fcruples in abandoning the wife or the daughter to her gallant. This profligacy of character is not confined to the common people; it applies indeed more forcibly to the firft ranks of fociety. There is, however, but little that is prepoffeffing in the general appearance of the Cochin-Chinefe. The women have but flender pretenfions to beauty; yet the want of perfonal charms is in fome degree compenfated by a lively and cheerful temper. Both fexes are coarfely featured, and their colour is very dark; they have the univerfal cuftom of chewing areca and betel, which, by reddening the lips, and blackening the teeth, gives them an appearance ftill more unfeemly than nature intended. The drefs of the women is by no means fafcinating. A loofe cotton frock, of a brown or blue colour, reaching down to the middle of the thigh, and a pair of black nankeen trowfers, made very wide, conftitute in general their common clothing. With the ufe of ftockings and fhoes they are wholly unacquainted; but the upper ranks wear a kind of fandals, or loofe flippers. As a holiday drefs, on particular occafions, a lady puts on three or four frocks at once, of different colours and lengths, the fhorteft being uppermoft. Their long black hair is fometimes twifted into a knot, and fixed on the crown of the head, and fometimes hangs loofe in flowing treffes down the back, frequently reaching to the very ground. Short hair is not only confidered as a mark of vulgarity, but an indication of degeneracy; the drefs of the men has little, if any thing, to diftinguifh it from that of the other fex, being chiefly confined to a jacket and a pair of trowfers. Some wear handkerchiefs tied round the head, others have hats or caps, formed for protecting their face againft the rays of the fun; for which purpofe they alfo make ufe of umbrellas of ftrong China paper, or fcreens of leaves, or fans made of feathers. Confonant with the appearance of their mean and fcanty clothing, are their lowly cabins of bamboo. There is, however, fuch a vaft difference in the circumftances under which an European and an inhabitant of a tropical climate are fituated, that the former, who for the firft time finds himfelf among the latter, will be very apt to fall into error in attempting to form a comparative eftimate of their refpective conditions. To the one, fuel and clothing, and clofe and compact lodging, are effential, not only to his comfort, but to his exiftence; to the other, fire is of no father ufe than a few embers to boil his rice, or to prepare an offering for his god. Clofe, thick clothing, fo far from being a comfort, would be to him the moft inconvenient of all incumbrances. Even the little which he occafionally finds it expedient to ufe, he frequently throws afide; for where nakednefs is no difgrace, he can at all times, and in all places, accommodate his drefs to his feelings and his circumftances. In the vicinity of Turon bay, there are only a few villages, in the largeft of which the number of houfes do not exceed 100, and thefe chiefly thatched. The cottages of Turon are in general fnug and clean, and fufficiently compact to protect the inhabitants from the heat of the fun at one feafon, and the heavy rains at the other. There feems to be no want in the market of either cotton or filk ftuffs for clothing; and the country produces a great variety and abundance of articles, which contribute to the fuftenance of the multitude, as well as to the luxuries of the higher orders of the people. Almoft every kind of domeftic animal, except fheep, appears to be very plentiful. In Cochin-china they have bullocks, goats, fwine, buffaloes, elephants, camels, and horfes. In the woods are found the wild boar, tiger, and rhinoceros, with plenty of deer; they account the flefh of the elephant a great dainty, and their poultry is excellent. They pay little attention to the breeding of bullocks, as the tillage of their land is performed by buffaloes, and their flefh is not efteemed as food. The fea, as well as the land, is a never-failing fource of fuftenance to thofe who dwell on the coaft. Moft of the general marine worms, diftinguifhed by the name of *mollufca*, are ufed as articles of food by the Cochin-Chinefe. All the gelatinous fubftances derived from the fea, whether animal or vegetable, are confidered by them the moft nutritious of all aliments; and, on this principle, various kinds of fea-weeds, particularly the *fuci* and *ulvæ*, are included in their lift of edible plants. The Cochin-Chinefe collect likewife many of the fmall fucculent, or flefhy plants, which are ufually produced on falt and fandy marfhes, which they either boil in their foups, or eat in a raw ftate, to give fapidity to their rice, which with them is the grand fupport of exiftence. In Cochin-china they are almoft certain of two plentiful crops of rice every year, one of which is reaped in April, the other in October. Fruits of various kinds, as oranges, bananas, figs, pine-apples, pomegranates, and others of inferior note, are abundantly produced in all parts of the country. They have very fine yams, and plenty of fweet potatoes. Their fmall breed of cattle does not appear to furnifh them with much milk, but of this article they make a fparing ufe, even with regard to their young children. Children, till the age of feven or eight years, go entirely naked, and their food feems to confift chiefly of rice, fugar-cane, and water-melons. The mafs of the people in Cochin-china, like the common Chinefe, have but two meals in the day, one about nine or ten in the morning, and the other about fun-fet; and thefe are ufually taken in the dry feafon, before the doors of their cottages, upon mats fpread in the open air.

Amufements. The Cochin-Chinefe are very fond of theatrical amufements; the actors are bufily engaged in their performances the whole day, proceeding, apparently, with as much ardour when there are few or even no fpectators prefent, as when there are many. Being hired for the day, a crowded or a thin audience makes but little difference to the performers, all their concern being the receit of their pay on the finifhing of their labour. One of thefe exhibitions has been defcribed by Mr. Barrow. "In the farther divifion of the buildings," fays he, "a party of comedians was engaged in the midft of an hiftorical drama when we entered; but on our being feated they broke off, and coming forward made before us an obeifance of nine genuflexions and proftrations, after which they returned to their labours, keeping up an inceffant noife and buftle during our ftay. The horrible crafh of the gongs, kettle-drums, rattles, trumpets and fqualling flutes, were fo ftunning and oppreffive, that nothing but the novelty of the fcene could have detained us for a moment. The moft entertaining part of the exhibition was a fort of interlude, performed by three young women, for the amufement as it fhould feem of the principal actrefs, who ſat as a ſpectator in the character of ſome ancient queen; whilſt an old eunuch, very whimſically dreſſed, played his antic tricks, like a buffoon, in an harlequin entertainment. The dialogue was light and comic, and occaſionally interrupted by cheerful airs, which concluded with a common chorus. Theſe airs, rude and unpoliſhed as they were, appeared to be regular compoſitions, and were ſung in exactly meaſured time. The voices of the women were ſhrill and warbling, but ſome of their cadences were not without melody, and the inſtruments at each pauſe gave a few ſhort flouriſhes, till overpowered by the deafening gong. At each repetition of the chorus, the three Cochin-Chineſe graces diſplayed their fine ſlender ſhapes in the mazy dance, in which, however, the feet were the leaſt concerned. By different geſtures of the head, body, and arms, they aſſumed a variety of figures, and all their motions were exactly adapted to the meaſure of the muſic. No entrance money is ever expected in the theatre of China, or Cochin-china. The actors are either hired to play at private entertainments, at a fixed ſum for the day; or they exhibit before the public in a temporary ſhed entirely expoſed in front. On ſuch occaſions, inſtead of cheering the performers with empty plaudits, the audience throw among them pieces of copper money." At Cochin-china football with a bladder; leaping over an horizontal pole, and other acts of agility are practiſed. The men amuſe themſelves in fighting cocks, and young boys, in imitation of their elders, train quails, ſmall birds, and even graſshoppers to tear each other in pieces; and in every corner of the ſtreets gameſters may be ſeen playing at cards, or throwing of dice. But what will moſt aſtoniſh an European, is the ſight of a party of young men keeping up a ſhuttlecock in the air, by ſtriking it with the ſoles of the feet. Nothing indeed can exceed the activity and energy of the men in Cochin-china; but, active as they are, in the uſe of their feet, their manual dexterity is not leſs remarkable. Jugglers and conjurors, and poſture-makers, are continually exerciſing their reſpective arts for the amuſement of the crowd, and for their own advantage; and thoſe who do not openly practiſe juggling as a profeſſion, are equally as expert in the art of picking pockets. They are all, from the higheſt to the loweſt, moſt importunate beggars, craving without the leaſt ceremony, for every thing that may ſuit their fancy; they are neither ſatisfied with a ſimple denial, nor even with obtaining what they aſk, but generally become more urgent in their demands, in proportion to the liberality of the giver, and what they cannot obtain by begging, they uſually endeavour to procure by ſtealing.

Arts, Manufactures, &c. That particular branch of the arts in which the Cochin-Chineſe may be ſaid to excel at the preſent day, is naval architecture, for which they are not a little indebted to the ſize and quality of their timber. Their row-gallies for pleaſure are remarkably fine veſſels, from 50 to 80 feet in length, and they are ſometimes compoſed of five ſingle planks, each extending from one extremity to the other. The edge is mortiſed, kept tight by wooden pins, and bound firm by twiſted fibres of bamboo, without either ribs or any kind of timbers. At the ſtem and ſtern they are raiſed to a conſiderable height, and are curiouſly carved into monſtrous figures of dragons and ſerpents, ornamented with gilding and painting. A number of poles, bearing flags and ſtreamers, pikes ornamented with tufts of cows' tails painted red, lanterns and umbrellas, and other inſignia, denoting the rank of the paſſenger, are erected at each end of the boat. The veſſels that are employed in the coaſting trade, the fiſhing craft, and thoſe which collect ſwallows-neſts among the iſlands, are of various deſcriptions: many of them covered with ſheds of matting, under which whole families conſtantly reſide. Their foreign traders are built on the ſame plan as the Chineſe junks; the form and conſtruction of which are entitled to but little reſpect, except from the antiquity of the invention. As theſe veſſels were never intended for ſhips of war, ſecurity rather than ſpeed has always been the object of the owner. And as no great capitals are employed in trade, and the merchant is both owner and navigator, a limited tonnage is ſufficient for his own merchandize; the veſſel is therefore divided into diſtinct compartments, ſo that one ſhip may ſeparately accommodate many merchants. The bulk heads, by which the diviſions are formed, conſiſt of planks two inches thick, and ſo well caulked and ſecured as to be completely water tight. A ſhip thus fortified with croſs-bulk heads, may ſtrike on a rock, and yet ſuſtain no ſerious injury; a leak ſpringing in one diviſion of the whole will not be attended with any damage to the articles placed in another; and by the ſhip being ſo well bound together, ſhe is firm and ſtrong enough to ſuſtain a more than ordinary ſhock. In the neighbourhood of Turon are ſeveral plantations of ſugar and tobacco. The juice of the former having undergone a partial refinement, is exported to China in cakes, which in colour, thickneſs, and poroſity, reſemble the honeycomb; the latter is conſumed in the country, as all degrees, of every age and ſex, indulge in the habit of ſmoaking. The face of the country exhibits but feeble marks of tillage, and arts and manufactures are evidently in a languiſhing ſtate. The cottages contain little furniture, and that little is of rude conſtruction, as if intended only for temporary uſe. The matting that covers the floor is ingeniouſly woven in different colours. Their domeſtic utenſils conſiſt chiefly of an earthen ſtove, an iron pot to boil rice, a pan ſomewhat in the ſhape of a watch-glaſs, to fry their vegetables in oil, and a few porcelain cups or bowls. Their veſſels of caſt iron are equal in quality to thoſe of the Chineſe, but their earthen ware is very inferior. They work in metal with a tolerable degree of neatneſs, and their articles of fillagree are equal to thoſe of the Chineſe. In fact both the one and the other poſſeſs quick and comprehenſive talents, and under proper encouragement are already in that advanced ſtage to make a very rapid progreſs in the arts, ſciences, and manufactures. Theſe, however, do not appear to be in a ſtate of progreſſive improvement: but under every diſadvantage their ingenuity occaſionally breaks forth in a ſurpriſing manner. There is in all oriental governments a radical defect, which no advantages of ſoil or climate, or other favourable circumſtances can compenſate, and which muſt for ever operate againſt their attaining the character and condition of a great and happy people. This defect ariſes from the want of a permanent ſecurity to property.

The ſituation of Cochin-china is well adapted to commerce; its vicinity to China, Tunquin, Japan, Cambodia, Siam, the Malay coaſt, the Philippines, Borneo, the Moluccas, &c. renders the intercourſe with all theſe countries eaſy and expeditious, the commodious harbours formed on the coaſt, particularly that of Turon, afford a ſafe retreat for ſhips of any burthen, during the moſt tempeſtuous ſeaſons of the year. No country in the Eaſt produces richer, or a greater variety of articles proper for carrying on an advantageous commerce; ſuch as cinnamon, pepper, cardamoms, ſilk, cotton, ſugar, Agula-wood, Japan-wood, ivory, &c. Gold is obtained almoſt pure from the mines; and gold in duſt has been brought at different periods from the mountains, and bartered by the rude inhabitants for rice, cloths, and iron. From them alſo the Agula and Calamboe woods are procured, together with quantities of wax, honey, and ivory. Silver mines have been alſo lately diſcovered; and both gold and ſilver are uſed in ingots, as in China. The commodities, for

which

which there is the greateſt demand at Cochin-china, are ſaltpetre, ſulphur, lead, fine cloths, and barred or flowered chints. Pearls, amber, and coral were formerly in great requeſt. The principal exports of this country are ſilks, ſugar, which is excellently purified by a proceſs deſcribed by Sir George Staunton, ebony, and Calamboe wood, edible birds' neſts, which are found in great plenty on the iſlands that are ſituated near the coaſts of Cochin-china, and which are eſteemed a luxury in China, gold in duſt or bars, and copper, and porcelain, tranſported thither from China and Japan. It has been ſuggeſted that a commercial connection with Cochin-china might prove very beneficial to this country. The drain of ſpecie from the company's ſettlements in India, is become a matter of ſuch ſerious import, that any plan for reſtraining and counteracting this growing evil demands attention; and it has been thought that a ſettlement in Cochin-china would conduce to this important and deſirable purpoſe, as well as be productive of many other advantages; the productions of Cochin-china, which are in great demand among the Chineſe, might with eaſe be brought to centre with us, if we had a ſettlement and a confirmed influence in the country. Purchaſed with the ſtaples of India and of Europe, Turon would become the emporium for them, where our ſhips bound to Canton, from which it is only five days ſail, might call and receive them. It would prove a ſaving of ſo much ſpecie to Great Britain or India, as the value of the commodities amounted to in China. In a few years, there is reaſon to believe, a very conſiderable inveſtment might be provided. A ſettlement in Cochin-china would give us a ſuperior advantage both to the Dutch and the Spaniards, not only as its ſituation is nearer, but as the Chineſe are more accuſtomed to reſort thither. Colonies of Chineſe have, from time to time, emigrated from the parent country, and fixed their abode in different parts of Cochin-china. Theſe have a correſpondence in every ſea-port of the empire; and by their means, teas, china-ware, and various other articles, that are the objects of our commerce with China, might be imported in junks to our own ſettlements, equally good in quality, and cheaper, as the Chineſe are exempted from the exorbitant duties levied on foreigners. Some of the beſt workmen might be encouraged to ſettle in Cochin-china, and under proper direction, manufactures might be carried on to as great a degree of perfection as in China itſelf. The intercourſe between Japan and Cochin-china might be renewed, and we might participate in a trade for many years monopolized by the Dutch. An advantageous trade might be carried on with the Philippine iſlands, and goods for Madras and Bengal, introduced among them by means of the junks, for the conſumption of Spaniſh America. The Siameſe and Cambodians would bring the produce of their reſpective countries, and barter or ſell it for ſuch articles as they wanted from Cochin-china, and among them a ſale might probably be found for quantities of Bengal cloths. The gold mines of this country, of which we have already taken notice, would promote and enrich ſuch an eſtabliſhment in Cochin-china, the expediency and utility of which have now been ſuggeſted. Beſides the commercial advantages likely to reſult from ſuch a ſettlement, it would be attended with others of a political nature. Turon-bay would not only afford a ſecure retreat to our Indiamen, in caſe of loſing their paſſage to China, but from thence we might intercept the fleets of any hoſtile power, either going to, or returning from that country. We ſhould thus become formidable neighbours to the Dutch, and to the Spaniards, and in the event of a war with either of them, attack, with advantage, their moſt valuable ſettlements.

The Japaneſe is the only current money in Cochin-china: it is paid or received by weight; the money of the country, which is of copper, is as large as our common counters, of a round figure, and has a hole in the middle, by which it may be ſtrung in the ſame manner as beads. Three hundred pieces are put on one ſide, and 300 on another, which paſs in Cochin-china for a thouſand; becauſe in 600 there are found 10 times 60, which make a century among almoſt all the people of the Eaſt. In this country merchants are liable to be much deceived with regard to the value of money; becauſe the pieces are unequal in figure and quality, and their value is regulated by a few characters that are ſtamped upon them, which are not eaſily aſcertained; accordingly merchants, without the aſſiſtance of honeſt and ſkilful people, are liable to great impoſition, more eſpecially as the traders of Cochin-china value themſelves on being able to cheat an European.

The Language and Religion of the Cochin-Chineſe. The Cochin-Chineſe have effectually preſerved the written characters of the Chineſe language, but the ſpoken language has undergone a very conſiderable change, which is not ſurpriſing, ſince the inhabitants of the northern and ſouthern provinces of China are unintelligible to each other; though it has been altered, it does not appear to have received any improvement. By a compariſon of a ſhort catalogue of Chineſe words, taken from Mr. Barrow's excellent work on Cochin-china, with their ſynonyms, in the Cochin-chineſe language, an idea may be formed how far the two ſpoken languages reſemble or differ from each other.

Engliſh.	Chineſe.	Cochin Chineſe.
The earth,	tee,	dia.
The air,	kee,	bloci.
Fire,	ho,	whoa.
The ſea,	hai,	bœ.
A river,	ho,	jeang.
A mountain,	ſhan,	noui.
The ſun,	jee-to,	mat bloci, eye of heaven.
The moon,	yue,	blang.
The ſtars,	ſing,	ſao.
The clouds,	yun,	moo.
Thunder,	luie,	no-ſang.
Lightning,	ſhan-tein,	choap.
The wind,	fung,	jeo.
The day,	jee, or tien,	ngai.
The night,	ye, or van-ſhang,	teng.
The ſky, or heaven,	tien,	tien.
The eaſt,	tung,	doo.
Weſt,	ſee,	tai.
North,	pee,	pak.
South,	nan,	nang.
Man,	jin,	dan-ou.
Woman,	foo-gin,	dan-ba.
A quadruped,	ſhoo,	kang.
A bird,	kin,	ching.
A fiſh,	eu,	ka.
A tree,	ſhoo,	kai.
One,	ye,	mot.
Two,	ul,	hai.
Three,	ſan,	teng.
Four,	ſoo,	bon.
Five,	ou,	lang.
Six,	leu,	lak.
Seven,	tchee,	bai.
Eight,	pa,	tang.
Nine,	tcheu,	chin.
Ten,	ſhee,	taap.
Eleven,	ſhee-ye,	moei-mot.

Engliſh.

English.	Chineſe.	Cochin Chineſe.
Twelve,	ſhee-ul,	moci-hai.
Twenty,	ul-ſhee,	hai-moci.
Thirty,	ſan-ſhee,	teng-moci.
Thirty-one,	ſan-ſhee-ye,	teng-moci-mot.
Thirty-two,	ſan-ſhee-ul,	teng-moci-hai.
One hundred,	pe,	klang.
One thouſand,	tſien,	ngkin.
Ten thouſand,	van,	muon.

The Cochin-Chineſe have introduced the conſonants *b, d, r,* which they pronounce without the leaſt difficulty, though a Chineſe cannot by any exertion articulate a ſyllable into which one of theſe enters. In the conſtruction of phraſes, there is alſo a conſiderable difference between the two languages. In forming the plural of the perſonal pronouns, the Chineſe make uſe of the ſyllable muen, *many*, as,

ngo,	ne,	ta,
I,	thou,	he,
ngo-muen,	ne-muen,	ta-muen,
we,	ye,	they,

But the Cochin-Chineſe employ the ſyllable chung, *all*, as,

tooi,	bai,	no,
I,	thou,	he,
chung-tooi,	chung-bai,	chung-no,
we,	ye,	they.

To the Cochin-Chineſe, "we found leſs difficulties," ſays Mr. Barrow, "in making ourſelves intelligible, than we had to encounter with the grave and ſolemn Chineſe, whoſe dignity would be thought to ſuffer debaſement by their condeſcending to employ the pencil in delineating objects, notwithſtanding its alliance with their mode of writing; or by attempting to indicate, by ſigns and geſtures, ſuch ideas as are capable of being interchanged without the aid of language. This was by no means the caſe with the Cochin-Chineſe, who always ſeemed anxious to enter into our views, and to facilitate a mutual underſtanding."

The *religion* of the Cochin-Chineſe, like that of almoſt all the oriental nations, is a modification of the doctrine of Budha, but more ſimple, and leſs diſguiſed with the myſteries and machinery of oracular worſhip, than that which is practiſed popularly in China. From a ſentiment of gratitude to the benevolent and bountiful ſpirit, the Cochin-Chineſe manifeſt their piety, by offering to the image of the protecting deity the firſtlings of their living flocks, and of the fruits of the earth. The firſt ears of rice, the firſt cup of ſugar, or whatever the nature of the produce may be, is taken to the ſhrine which contains the ſacred image, and is there depoſited with becoming reverence, as an humble acknowledgment of the divine goodneſs. Mr. Barrow was preſent at an offering of this kind, which he thus deſcribes: "I obſerved a perſon in a long coloured robe reaching to the ground, his head bare and cloſely ſhaved, marching with a kind of meaſured ſtep, and followed by a few of the peaſantry. On arriving at the foot of the tree, they all halted, juſt at the head of the main trunk (for it was a ſpecies of banian tree, called *dea* in Cochin-china, whoſe branches take root and become ſtems). I obſerved a large cage of latticed work, with a pair of folding doors, fixed within two boughs, and partly hidden by the foliage. Within was a wooden figure of Budha, of the ſame corpulent ſhape, and in the uſual ſitting poſture as he is repreſented in the temples of China. A little boy, attending on the prieſt, ſtood cloſe before him, with a burning coal on a brazen diſh. One of the peaſants carried a ladder of bamboo, which he placed againſt the tree, and another mounting it, depoſited in the cage before the idol, two baſons of rice, a cup of ſugar, and one of ſalt. The prieſt in the meantime, with arms extended, and eyes turned towards heaven, muttering ſomething in a low tone of voice, when the man who had carried the ladder fell on his knees, and nine times proſtrated his body to the ground, according to the cuſtom of the Chineſe. Several women and children remained at a diſtance, as if forbidden to approach too near; though as prieſteſſes are ſaid to be common in this country, it is not probable there was any reſtriction on account of the ſex." The Cochin-Chineſe are extremely ſuperſtitious, and their devotional exerciſes, like thoſe of the Chineſe, are more frequently performed with a view of averting an ideal evil, than with the hope of acquiring a poſitive good; or, in other words, the evil ſpirit is more dreaded than the good one is revered. In various parts of the country are erected large wooden pillars, not only for the purpoſe of marking the ſpot where ſome great calamity may have happened, but as a propitiation to the evil ſpirit, by whoſe influence it is ſuppoſed to have been occaſioned. So, when an infant dies, the parents are ſuppoſed to have incurred the diſpleaſure of ſome malignant ſpirit, which they endeavour to appeaſe by offerings that they imagine to be moſt acceptable to the angry divinity. Beſides the ſpontaneous offering, which individuals conceive it neceſſary to make on various occaſions, there is a yearly contribution levied by government, for the purpoſe of ſupporting a number of monaſteries, in which the prieſts invoke the deity for the public welfare. This contribution conſiſts of produce in kind, as rice, fruits, ſugar, &c.; in lieu of which, in towns, are collected money, metals, and clothing. The prieſts here, as in China, are reckoned the beſt phyſicians, but their art lies more in charms and facinations, than in the judicious application of ſanative drugs.

COCHINEAL, *Coccus cacti*, Linn. See Coccus *Cacti*. The ſubſtance known in commerce by the name of cochineal, which is the moſt precious of all our dyeing drugs, affording the ſcarlet crimſon, and many other valuable dyes, and from which the fineſt carmine is generally prepared, is in the form of hemiſpherical ſhrivelled grains, about an eighth of an inch long, of a deep reddiſh-purple colour, and covered more or leſs with a white down: they are very light, and eaſily rubbed to powder between the fingers. The Spaniſh merchants diſtinguiſh at leaſt two kinds, the beſt, or domeſticated, called *grana fina*, or fine grain, and the wild, or *grana ſylveſtra*; of theſe, the latter is not more than half the ſize of the former, and is covered with a much longer down; on which account it always bears a much lower price in the market.

The cochineal inſect is a native of Mexico, and was in common uſe among the inhabitants as a dyeing drug when the Spaniards firſt came into the country; ſince that period its uſe has become more and more general, not only in Europe, but in various parts of Aſia, and, as almoſt the whole of this valuable commodity is ſtill raiſed in Mexico, Peru, and the adjoining Spaniſh ſettlements, it becomes every year an object of more ſedulous cultivation than before.

The beſt and fineſt cochineal, and, indeed, by far the greateſt proportion of that conſumed in Europe, is brought to us from Mexico. The principal diſtricts where it is bred are Oaxaca, Tlaſcala, Chulula, Neuva Gallicia, and Chiapa, in New Spain, but it is in Oaxaca that the greateſt quantities are produced, where the cultivation of this little inſect has long given employment and been an object of commerce to the native Mexicans. According to Ulloa it is likewiſe produced at Hambatia, Loja, and Tucuman in Peru. It has been introduced into St. Domingo, and the Braſils alſo.

The wild cochineal (grana ſylveſtra) feeds upon moſt of the ſpecies of cacti that are natives of Mexico, requires no particular care or attendance, and may be gathered ſix times in in the year, there being fo many generations of this infect in a twelvemonth: the time of collecting the cochineal is juft before the female produces its young, as the animal perifhes immediately afterwards. The cultivated cochineal (grana fina), called alfo *Meftique* from a Mexican province of that name, is the product of flow and progreffive improvement in the breed of the wild cochineal, and is found only in the gardens and plantations of Mexico, where, provided with its choiceft food and fheltered from the inclemencies of the feafons, it attains nearly double its original fize. This feeds only on one fpecies of cactus, the cochenilifer or nopal, and produces only three broods in the year. Its management is fimple, but requires inceffant attention. At the third annual gathering of cochineal, a certain number of females are left adhering to branches of the nopal, which are then broken off and kept carefully under cover during the rainy feafon; when this is over, the ftock of cochineal, thus preferved by each cultivator, is diftributed over the whole plantation of nopals, where they foon multiply with great rapidity. In the fpace of two months. the firft crop is gathered by detaching the infects with a blunt knife, after which they are put into bags, and dipped in hot water to kill them, and finally dried in the fun, by which they lofe about two-thirds of their weight. This kind is alfo much more abundant in colouring matter, in which, indeed, its fuperiority over all other kinds confifts; fince, from the experiments of the French academicians, the grana fylveftra of Mexico, and the cochineal of St. Domingo, afforded colours equal in brilliancy, though not in quantity, to the meftique or grana fina. The cochineal of Brafil alfo, according to Bancroft, is not inferior in quality to the fine grain of Mexico, though it contains only half the quantity of colouring matter. The proportion of colouring matter contained in equal portions of the cultivated cochineal, of the wild cochineal of Mexico, and of an inferior kind from St. Domingo, is, according to Berthollet, as eighteen, eleven, and eight.

In time of peace, the cochineal of Mexico is almoft exclufively fent from Vera Cruz to Cadiz, whence it is diffufed all over Europe; but in time of war a contraband trade is carried on to various parts of America and the Weft Indies, whence this country is chiefly fupplied.

The quantities of fine cochineal imported into Spain in the years 1788, 1789, and 1790, amounted to 11,000 bags, weighing 200lb. each, and making together 2,200,000lb. weight; and between the 1ft of January, 1791, and the 1ft of October in the fame year, the importations had exceeded 2000 bags. From accurate calculations it appears that the average quantity of fine cochineal, annually confumed in Europe, amounts to about 3000 bags, or 600,000lb. weight, of which 1200 bags, or 240,000lb. may be confidered as the prefent annual confumption of Great Britain: a greater quantity comes, indeed, into the kingdom, but the furplus is again exported to other countries. The attention of the Eaft India company has been lately directed to the production of this infect, though hitherto with but partial fuccefs. It is very fmall, not very abundant in colouring matter, and inferior in quality to that of New Spain. It is ufed only for the coarfeft goods, and fold from 3*s*. 6*d*. to 5*s*. per pound. From 8 to 10,000 lb. are annually brought to this country. See Coccus Cacti.

Cochineal retains fome traces of its original form, even in its dried ftate; and though Europe for a long time confidered it as the feeds of an Indian plant, it is eafy to felect from a parcel fome infects in which the round or convex back, with fmall tranfverfal furrows and flat belly, are readily difcovered. Its external or commercial characters differ confiderably; it is diftinguifhed by the dealers chiefly by its colour and fize. 1. The large black, or deep purple, of bright hue, is preferred to all others. Its value decreafes with its fize and luftre. 2. The large filver grey, though held in lefs eftimation here, is, in general, equal to the former. It is preferred by the German buyers, to whom it is fold fomewhat lower than the preceding, and from which it differs only in the lefs removal of that white farinaceous powder with which the infects, in their natural ftate, are covered. 3. The fmall white or filvery cochineal is held in little eftimation, and fold at very inferior prices. Cochineal duft is fometimes found in the market, and alfo the fmall, or mutilated grains, feparated by the fieve from the larger, and known by the name of *Granilla*. All thefe kinds are liable to adulteration with various fubftances, but more efpecially with a pafte, which is fometimes managed fo dexteroufly as to deceive the beft judges, without very particular examination.

The ufe of cochineal was known to the Mexicans before the invafion of the Spaniards. It was the beauty of its colour, as difplayed in their furniture, ornaments, and cotton cloth, which firft directed the attention of their conquerors towards this precious infect. From the reports made to the Spanifh miniftry on this fubject, orders were iffued to Cortes, in the year 1523, to take meafures for multiplying this valuable commodity, and confiderable quantities, raifed by the induftry of the natives, were foon afterwards fent to Spain. Although it was for fome time fuppofed to be the berry or feed of a vegetable; it was at length, however, afcertained that thefe grains were the females of a particular fpecies of infect, called by naturalifts "Coccus cacti," and of the fame genus as the "kermes" (Coccus ilicis, Linn.). See Coccus.

It is probable that alum was the only mordant ufed for fixing the cochineal dye for fome time after its introduction into Europe. The Mexicans alfo employed the fame fubftance, as appears from the teftimony of the Spanifh hiftorian, Herrara. The colour afforded by cochineal with the aluminous mordants is crimfon, and, indeed, previous to the difcovery of the ufe of tin, this feems to have been the only colour analogous to fcarlet that was known. Drebbel, or, as fome fay, Kufter, or Keffler, a German chemift, firft difcovered the effect of the folution of tin in exalting the cochineal dye. He brought his fecret to London about the year 1643; and the firft eftablifhment for dyeing fcarlet in this country appears to have been at Bow, whence it obtained, for a long time, the name of the Bow-dye. The procefs was known in Holland foon after the difcovery was made, and in France alfo, where it was practifed by the famous Gobelins, who received information from a Flemifh painter, to whom it had been communicated by Kufter himfelf. For the details of this operation, and the fucceffive improvements down to the prefent time, we refer our readers to the article Scarlet-*Dye*.

Cochineal, when thoroughly dry, if kept in a dry place, and in clofe packages, may be preferved many years without alteration. Hellot tried fome 130 years old, and found it equal in quality to the frefh infects.

The colouring matter of cochineal may be extricated either by water or alcohol. The alcoholic folution is of a deep crimfon colour, and, on evaporation, leaves a tranfparent refiduum of a deep red, which has the appearance of a refin, and which affords by diftillation the products of animal fubftances. The aqueous folution or decoction of cochineal is of a crimfon colour, bordering on purple, when viewed by tranfmitted lights; and this, if evaporated flowly to the confiftence of an extract, and then digefted in alcohol, communicates

municates to this menſtruum a colour ſimilar to the preceding ſpirituous ſolution, a reſiduum of the colour of wine-lees being left behind. This affords, by deſtructive diſtillation, the products of animal ſubſtances.

The aqueous decoction of cochineal, if mixed with a little ſulphuric acid, aſſumes a red colour, inclining to yellowiſh, or orange hue, and a ſmall quantity of a fine red precipitate is thrown down. Muriatic acid produces nearly the ſame change of colour, but occaſions no precipitate. A ſolution of tartar, and, indeed, all acids, change the cochineal decoction to a yellowiſh red, and a ſmall quantity of a pale red precipitate is ſlowly depoſited: the ſupernatant liquor is yellow, but on the addition of a little alkali it becomes purple, the precipitate being at the ſame time re-diſſolved. Alum brightens the colour of the infuſion and gives it a redder hue; a crimſon precipitate is depoſited, and the ſupernatant liquor retains a ſimilar tinge. A mixture of alum and tartar produces a brighter and more lively colour, inclining to yellow; and a precipitate is thrown down, but much paler, and leſs in quantity than where alum alone is uſed. Nitro-muriate of tin throws down a crimſon ſediment in conſiderable abundance, not a particle of colouring matter remaining in the liquor.

On adding a ſolution of tartar, and afterwards of tin, to the infuſion of cochineal, a roſe-coloured precipitate is formed more quickly than in the preceding experiment. The ſupernatant liquor retains a tinge of yellow.

Cochineal, boiled with half its weight of tartar, affords a decoction more inclining to red, and not ſo deep as when boiled with water only. With the ſolution of tin, however, it affords a more abundant precipitate, and of a more intenſe colour. The extraction of the colouring particles of cochineal, therefore, is favoured by the action of tartar, though the liquor appears much paler than the ſimple aqueous ſolution.

The ſulphate of iron forms a brown coloured purple, or browniſh violet precipitate; and the ſupernatant liquor is of a dilute yellowiſh brown. The ſulphate of zinc forms a deep purple, or deep violet; and the acetate of lead a purple-violet precipitate, leſs deep than the preceding; the liquor in both caſes being perfectly colourleſs.

The ſulphate of copper changes the colour of the decoction to violet, and a ſmall ſediment of the ſame colour ſlowly ſubſides.

Berthollet remarks a diſtinctive character in the colouring matter of cochineal, compared with that of madder, treated with the ſame re-agents. Both ſpecies of colouring matter acquire a yellow colour from acids; but if the particles of cochineal be ſeparated by a ſubſtance, which precipitates them from the acid liquor they are diſſolved in, they reappear with their natural colour little changed, whilſt thoſe of madder retain a yellow or fawn-coloured hue. On this account the ſolutions of tin, which retain a great exceſs of acid, and are ſo eminently uſeful in exalting the colour of cochineal, are uſed with little ſucceſs with madder; probably as Mr. Berthollet ſuppoſes, becauſe the combination of the oxide of tin with the colouring matter of madder, retains a larger portion of acid than it does when combined with the colouring matter of cochineal.

We have before obſerved, that the natural colour of cochineal is crimſon, and that, till the diſcovery of the uſe of the ſolution of tin, the colour now called ſcarlet was unknown. The production of this colour was aſcribed to the nitro-muriate of tin only, and more eſpecially to the action of the nitrous acid of that ſolution, with little or no reference to the agency of the tartar, which was always employed in the operation. We are indebted to Bancroft for the correction of this error, and for a ſeries of experiments on the action of other metallic and earthy ſolutions, with the colouring matter of cochineal on woollen.

From theſe experiments it appears, that cochineal, with the nitro-muriate of tin, or common dyers' ſpirits, produced a crimſon only, but with the addition of tartar a good ſcarlet.

Cochineal, with a ſolution of tin in muriatic acid, dyed a beautiful crimſon, and with a ſolution of that metal, by a mixture of tartar and muriatic acid, a beautiful ſcarlet.

Cochineal, with tin calcined by the long continued action of ſulphuric acid, dyed a ſalmon colour, and, with a recent ſolution of tin, a reddiſh ſalmon colour, inclining a little to the crimſon. A ſolution of tin, in equal parts of nitric and ſulphuric acids mixed, afforded a ſimilar colour.

Tin, diſſolved by the pure acid of tartar, dyed with cochineal a very beautiful ſcarlet, inclining a little to the aurora.

Tin very readily diſſolves by pure citric acid, and even by lemon juice; and the ſolution, newly made, dyes with cochineal a moſt beautiful ſcarlet, inclining, like the preceding, a little to the aurora. The citric acid with tin acts, at leaſt as efficaciouſly as that of tartar, in yellowing the cochineal crimſon; nothing, ſays Dr. Bancroft, can exceed the beauty of ſcarlet dyed with the citrate of tin.

The ſolution of tin in vinegar afforded a ſcarlet inclining a little to the crimſon.

The phoſphate of tin produced an aurora, and the fluate of tin a very good ſcarlet.

With other baſes cochineal gave the following colours to woollen:

With nitro-muriate of platina, a red, and of gold a reddiſh brown.

With nitrate of ſilver a dull red, and with muriate of ſilver a lively reddiſh-orange.

With the acetate of lead, a purple, inclining to violet; and with nitrate of lead, a delicate lively colour, between the red and cinnamon, but inclining moſt to the former.

With the ſulphate, nitrate, muriate, and acetate of iron, cochineal produces a dark-violet, and even a full black, when employed in ſufficient quantity.

All the preparations of copper appear to debaſe the colouring matter of cochineal, as do thoſe of mercury in a ſtill greater degree; moſt of theſe, whilſt they degrade the colour, ſeem to annihilate a portion of it.

With the nitrate and muriate of zinc, and various ſolutions of biſmuth, cochineal produces different ſhades of lilac. Cobalt and nickel alſo afford various ſhades of lilac and purple. The ſulphate of mangan eſe an orange, and the nitrate of mangan eſe a colour reſembling a madder red.

It has been before obſerved, that, with the aluminous mordants, cochineal affords its natural colour, or crimſon. Dr. Bancroft has alſo examined the effects of other earthy ſolutions.

Lime water, with cochineal, dyes a purple, which took but ſlowly, and required long boiling.

Sulphate of lime a full dark red, and nitrate of lime a lively red, approaching to ſcarlet, and muriate of lime a purple.

The ſolutions of barytes and of magneſia, afforded various ſhades of lilac, and even the ſolution of ſilex in cauſtic alkali, precipitated by the addition of an acid, affords a full rich pleaſing purple, which proved ſufficiently durable.

The foregoing experiments repeated on ſilk gave leſs advantageous reſults. Cochineal, indeed, with the aluminous baſis, dyes the crimſon colour as well and as durably on ſilk as on wool. The modes of producing this are well known,

known, and will be treated of hereafter; but in general, with the other earthy and metallic bases, cochineal produced similar but much paler colours than on wool.

The little disposition manifested by the colouring matter of cochineal to unite with cotton, and the celebrated experiment of Mr. Dufay to illustrate this, are well known. He caused a piece of cloth to be manufactured with a woollen web and cotton woof, and having subjected it to the ordinary process of dyeing scarlet, found that the wool had taken a most beautiful scarlet, whilst the cotton remained perfectly white. Subsequent experiments have shown that this effect arises not from the total want of affinity between the colouring particles of cochineal united to tin, and the fibres of cotton, but from a striking and powerful difference in the force with which the colouring matter is attracted by the two substances. When cotton *alone* is subjected to the same process, it takes a scarlet colour more slowly indeed, and paler than that imbibed by woollen, yet sufficient to prove its disposition to such union, when not counteracted by more powerful affinities. When cotton and wool, however, are *jointly* subjected to the operation of scarlet dyeing, the latter, by its strong attraction, draws, and exclusively appropriates to itself, all the colouring matter in the vessel before the cotton has had time to engage any part of it. It is owing to this weaker attraction between the fibres of cotton and the scarlet dye, that this latter is so much less permanent on cotton than on wool; and it is also from this want of sufficient attraction that the cochineal colour is found to take most beneficially on cotton, when the basis has first been applied separately.

Cochineal is sometimes used by calico printers in topical dyeing, but more frequently in the preparation of those colours for the pencil, which are described under the article Colour-*making*.

The mordants used for cochineal are those employed with madder. The acetate of iron, or iron liquor for black, diluted solutions for various shades of purple or lilac, and mixtures of the acetates of iron and alumine for chocolates, blooms, &c. &c.

With the common aluminous mordant, printed and rinsed off the same as for madder red, cochineal affords a bright and beautiful crimson. It is, however, much less fixed than madder, and cannot support repeated washing and exposure. It is applied chiefly on fine cloth and delicate muslins, when the solidity of the colour is oftentimes an object of less consideration than its beauty. An addition of one-tenth, or fifteenth, of galls to the cochineal, gives it greater stability, but this permanency is gained at the expence of its lustre. The fine crimson disappears, and the colour approaches more to the red or middle hue. An advantage attending the use of cochineal, is its little effect on the white or unprinted part of the cloth, which acquires no stain in the dyeing, but what is completely removed by simple washing, or, in some particular cases, by very gentle branning. From two to three ounces of cochineal, according to the fulness of the pattern, are sufficient for a piece of light ground. The pale delicate crimson grounds, with white objects, require from four to five ounces. It must be finely ground, and inclosed in a linen or cotton bag, suspended in the dye-copper, from whence it can be occasionally taken and squeezed or wrung, for the more complete extraction of the colour.

In dyeing with cochineal, the value of this drug renders every precaution for economizing its use indispensably necessary, and a considerable saving is made by diminishing as much as possible the quantity of the dye liquor. It is well known, that colouring matter of any kind, held in solution in the dye-copper, can only be exhausted to a certain degree, even by fresh and undyed goods; there is a certain point at which the affinity of the water for colouring matter becomes equal to that of the strongest mordants, and all that is thus retained may be considered as totally lost, except when fresh portions of colouring matter are added to the already exhausted liquor, and the operation of dyeing again renewed, in which case the loss is inversely as the number of successive operations performed in the same liquor. In dyeing with cochineal, therefore, no more water should be used than is barely sufficient to cover the goods when pressed down close into the copper, with a stick as they come over the winch, and three successive dyeings, at least, should be passed through the same liquor before it is let off, and the copper replenished with fresh water. Long continued heat has a tendency to injure the cochineal crimson, and incline it too much to the purple hue; each dyeing, therefore, should be withdrawn shortly after it has attained the boiling point. The first sets may be boiled three minutes; the second, one; the third set may be kept five or six minutes at the boil, if it consists of darker colours, such as chocolates, dark purples, &c.; but if crimsons, the colour, without boiling, will incline very much to the purple hue, and be much inferior to the first, and even to the second sets. On this account it is proper, when the work will admit of it, to dye the pale crimson grounds first, follow after with the stronger light grounds, and, lastly, with the darker colours above-mentioned.

The use of tin vessels in dyeing scarlet or woollen, (where the acid solutions used in that operation render them indispensably necessary) has induced many calico printers to employ them in dyeing cotton, where no acid solution is present, and where the good effects of tin may be supposed not to apply. It is certain, however, that the hue of the pale and delicate crimson grounds produced in a tin vessel is much superior to that produced in copper, and the cause of this difference is satisfactorily explained by the experiments of Mr. Thomson. From these experiments, which will be more fully detailed in another part of this work, it appears that the colouring matter of cochineal possesses very distinct acid properties.

Turnings of pure soft iron digested in a strong decoction of cochineal were dissolved, with disengagement of hydrogen gas. The solution, at first purple, gradually acquired a more intense colour, approaching to black. Exposed to the atmosphere, it gradually absorbed oxigen, and let fall a black precipitate. It communicated to cloth a dark grey or purple colour, which was not removed by washing. With tin the decoction of cochineal formed a beautiful crimson solution, and, with copper, a dull crimson inclining to purple; both these solutions imparted their colour to cloth, which rinsing did not remove. Hence it appears that the difference in the colours, produced in a tin and in a copper vessel, arise from the action of the colouring matter on the substance of the vessel itself.

The colouring matter of cochineal also acts powerfully on the earths and metallic oxides, or on its own combinations with them or cloth. A piece of calico impregnated with a weak aluminous mordant, and dyed in a strong decoction of cochineal, takes at first a dye which is, however, speedily removed, and the mordant itself soon after carried off the cloth. The same takes place with the dilute solutions of iron. In dyeing with cochineal, therefore, in the way prescribed above, some care is necessary in the management of those goods, on which weak as well as strong mordants are applied, lest with the treatment necessary to bring up the latter to their proper strength and fulness, the former be totally destroyed.

The beautiful pigment carmine, used chiefly in miniature and

and water-colour painting, and fometimes under the name of rouge, to frefhen the cheeks of pallid or faded beauty, is alfo a preparation of cochineal. It is a light, foft, velvety powder, of a moft rich and magnificent fcarlet, inclining a little to crimfon. It was formerly made from kermes, whence its prefent name is derived.

The preparation of carmine, notwithftanding the numerous proceffes detailed in various works, ftill remains one of thofe fecrets which are confined to the laboratories of a few. Its conftitution, indeed, and the general nature of the procefs for obtaining it, are well known; but excellence in colours of this kind often depending on particular hue, arifing from minute but important conditions in the preparation, approved proceffes are guarded with religious care, confined to the workfhops that gave them birth, in which myftery and prejudice are defpotic.

We fubjoin the following formula without vouching for its merit; it is, however, at leaft, as good as any other publifhed.

Pour two quarts of fine clear river water into a clean copper pan, and, when boiling, add two ounces of the beft grain cochineal, finely ground and fifted. Boil fix minutes, ftirring carefully the whole time. Add fixty grains of fine Roman alum in powder, and boil three minutes longer, after which withdraw it from the fire and let it cool a little. Decant off the liquor carefully from the grounds, and ftrain through a filk fieve fine enough to retain the undiffolved grains. Pour it into well-glazed porcelain difhes and fuffer it to remain undifturbed three or four days, after which time again decant the red liquor into other difhes from off the fediment which has formed, and which, dried in the fhade and free from duft, forms the fine carmine. Another depofition takes place at the end of a few days from the decanted liquor, which forms a good carmine of fecond quality, and there ftill remains colouring matter fufficient in the remaining liquor to afford a rich lake.

The following procefs, not very different from the former, has been recommended; and, if carefully purfued, will yield a pigment greatly fuperior to the carmine that is generally met with. Into a fourteen-gallon boiler of well-tinned copper put ten gallons of diftilled or very clear rain water (fpring water will not anfwer the purpofe). When the water boils, fprinkle in, by degrees, a pound of fine cochineal, previoufly ground in a clean ftone mortar to a moderately fine powder; keep up a gentle ebullition for about half an hour, and then add three ounces and a half of cryftallized carbonat of foda; in a minute or two afterwards draw the fire, and then add to the liquor an ounce and a half of Roman alum, very finely pulverized; ftir the mafs with a clean ftick till the alum is diffolved, then leave it to fettle for 25 minutes, and afterwards draw off the clear liquor with a glafs fyphon, and feparate the reft of the fluid from the fediment by ftraining it through a clofe linen cloth. Replace the clear liquor in the boiler, and ftir in the whites of two eggs, previoufly well beaten with a quart of warm water; then light the fire again and heat the liquor till it begins to boil, at which time the albumen of the eggs will coagulate and combine with the earth of the alum and the fineft part of the colouring matter; this fediment is the *carmine*, and being feparated by filtration, and well wafhed on the filter with diftilled water, it is to be fpread very thin on an earthen plate, and flowly dried in a ftove, after which it is fit for ufe. The fineft part of the colouring matter of the cochineal being thus feparated, the refidue may be employed in the preparation of *red lake* in the following manner: Add two pounds of pearlafh to the red liquor from which the carmine was precipitated, and return it into the boiler together with the dregs of the cochineal, and boil the whole gently for about half an hour; then draw the fire, and, after the fediment has fubfided, drain off all the clear liquor into clean earthenware veffels. Then pour upon the fediment a fecond alkaline ley, prepared by diffolving a pound of pearlafh in two gallons of water, and boil this alfo upon the dregs for half an hour; by which procefs the whole of the colouring matter will be exhaufted. Separate by filtration the liquor from the dregs, and return both the alkaline folutions into the copper. When this bath is as hot as the hand can bear, add, by degrees, three pounds of finely pulverized Roman alum, obferving not to add a fecond portion till the effervefcence from the firft has entirely fubfided. When the whole of the alum has been put in, raife the fire till the liquor fimmers, and continue it at this temperature for about five minutes, at which time, if a little is taken out and put into a wine glafs, it will be found to confift of a coloured fediment diffufed through a clear liquor; after ftanding quiet a while the greater part of the clear fupernatant liquor may be poured off, and the refidue being placed on the filter, will there depofit the coloured lake, which, after being accurately wafhed with clear rain water, may be covered with a cloth, and allowed to remain for a few days till it is half dry: it is now to be feparated from the filter, to be made up in fmall lumps, and placed in a ftove to dry. By this management a pound of good Mexican cochineal will afford one ounce and a half of carmine, and about a pound and a quarter of red lake.

If the colour is required to incline fomewhat towards fcarlet, this may be effected by grinding along with the cochineal from a quarter to half an ounce of the beft annotto.

The French add to the infufion of cochineal a fmall proportion of *autour*, a bark containing yellow colouring matter, and alfo of *chouan*, a greenifh yellow feed, both from the Levant. They ferve to brighten the hue of the carmine, and incline it more to fcarlet. Carmine has a flight tafte, eafily recognized as that of cochineal. It is fparingly foluble in water, to which it communicates its own colour. Mixed up with water it works ftiffly with the pencil and affords a poor colour. Ammonia diffolves it inftantly, forming with it a deep tranfparent crimfon-coloured folution, inclining much to purple. This is the teft of its purity, for the inferior or adulterated carmine is infoluble, and falls to the bottom. The painters generally grind or mix it with ammonia for the deep rich reds, and its folutions in that alkali afford moft beautiful pink or rofe colours.

Carmine appears to be a lake in which the colouring principle predominates very much over the bafis; hence its folubility in ammonia, which the true or perfect lakes do not poffefs.

COCHINO, in *Geography*, a town of European Turkey, in the ifland of Lemnos. N. lat. 39° 57′. E. long. 25° 22′.

COCHITOTOL, in *Ornithology*, the name given by Fernandez to the bird fuppofed by Buffon to be the female orange promerops, the *promerops barbadenfis* of Briffon, the *avis paradifiaca Americana elegantiffima* of Seba, and a variety of the *upupa aurantia* of Gmelin. See UPUPA.

COCHLEA, in *Anatomy*, a part of the labyrinth of the ear, which refembles a fnail fhell. See EAR.

COCHLEA, in *Conchology*, an obfolete term, often applied by old writers to univalve fhells of the fpiral kind, and thofe chiefly of the nerita and helix genera, and fometimes the trochi, and even turbo.

COCHLEA is alfo a fpecies of MADREPORA, which fee.

COCHLEA, in *Mechanics*, one of the five mechanical powers; otherwife called the SCREW, which fee.

It is thus denominated, from the refemblance a fcrew bears to the fpiral fhell of a fnail, which the Latins call *cochlea*.

COCHLEARIA,

COCHLEARIA, in *Botany*, (so called from the form of the leaves, which, being slightly hollowed, resemble an old-fashioned spoon.) Linn. Gen. 803. Schreb. 1079. Willd. 1228. Juss. 240. Vent. 3. 109. Tourn. 101. (Cranson; Encyc.) Class and order, *tetradynamia siliculosa*. Nat. Ord. *Siliquosæ*, Linn. *Cruciferæ*, Juss. Vent.

Gen. Ch. *Cal.* Four-leaved; leaves egg-shaped, concave, open, caducous. *Cor.* Petals four, equal, egg shaped, twice the size of the calyx, open. *Stam.* six, awl-shaped, the length of the calyx; anthers obtuse, compressed. *Pist.* Germ superior, heart-shaped, or oval; style very short, permanent; stigma obtuse. *Peric.* Silicle heart-shaped, gibbous, turgid, somewhat emarginate, tipped with the permanent style, rugged, two-celled.

Ess. Ch. Silicle gibbous, rugged; valves gibbous, obtuse. Seeds several.

Sp. 1. C. *officinalis.* Linn. Sp. Pl. 1. Mart. 1. Lam. 1. Willd. 1. Flor. Dan. tab. 135. Lam. Ill. tab. 558. fig. 1. Woodv. Med. Bot. tab. 29. Eng. Bot. 551. (C. folio subrotundo; Bauh. Pin. Tourn. 215. C. batava; Lob. Ic. 293. Nasturtium; Hall. Helv. n. 503.) Common scurvy-grass. "Root-leaves roundish: stem ones oblong, somewhat sinuated; fruit globular." β. Minor rotundifolia nostras; Rai. Syn. 303. γ. C. groenlandica; With. not Linn. C. rotundifolia; Dill. in Rai. Syn. 302. *Root* annual or biennial, white, rather thick, elongated, with hairy fibres; whole herb smooth, somewhat fleshy, very various in size. *Stems* angular, branched in a corymbose manner; leafy. *Root-leaves* on long petioles, roundish, kidney-shaped, somewhat toothed or repand; stem-leaves alternate, sessile, embracing the stem, angular or sinuated. *Flowers* white, in terminal corymbs, which are afterwards lengthened into racemes; bractes none; calyx obtuse, spreading, concave; petals inversely egg-shaped, entire. *Silicles* globular, not emarginate, but little rugged, slightly veined, crowned with a short style. *Seeds,* five or six in each cell. Common on the sea-coasts of Europe, and not unfrequent in mountainous countries, far inland. On mountains it is generally smaller; but in the rocky wood above Bolton Abbey, in Craven, Yorkshire, eighty miles from the sea, it grows as luxuriantly as on the coast. It has a warm, acrid, bitter taste; and a pungent, rather unpleasant, smell when bruised. Its active matter is extracted by maceration, both in water and spirits; but its principal virtue resides in an essential oil, separable in a very small quantity, by distillation in water. It has long been considered as the most effectual of all the antiscorbutic plants; and is, therefore, most liberally provided by the benevolent author of nature, on the coasts of high latitudes, where the scurvy is most prevalent. Foster found it also in great abundance in the islands of the South sea. A remarkably volatile and pungent spirit, known by the name of *spiritus antiscorbuticus, sive mixtura simplex antiscorbutica dranizii,* is prepared from it, which has been found an useful remedy in paralytic affections, and other diseases that require an active stimulus. But as an antiscorbutic, the expressed juice, or the plant itself, eaten in a salad with water-cresses and brook-lime, is the most beneficial. 2. C. *anglica.* Linn. Sp. Pl. 2. Mart. 3. Lam. 3. Flor. Dan. tab. 329. Eng. Bot. tab. 552. (C. folio sinuato; Bauh. Pin. 110. Tourn. 215. Rai. Syn. 303. C. britannica; Dod. Pempt. 594. Ger. Amen. 401.) English scurvy-grass. "Root-leaves egg-shaped, entire; stem-leaves lanceolate, toothed; silicles elliptical, reticularly veined." *Root* annual or biennial. *Herb* smooth, somewhat fleshy, variable in the form and size of its leaves, generally smaller than the preceding. *Root-leaves* on long petioles, rarely a little toothed or repand; stem ones embracing the stem, scarcely sinuated. Flowers like those of C. officinalis. *Silicle* twice the size, turgid, sometimes almost globular, crowned with a longish style. A native of England on muddy sea-shores. 3. C. *danica.* Linn. Sp. Pl. 4. Mart. 2. Lam. 2. Flor. Dan. 190. Eng. Bot. 696. (C. aremorica; Tourn. 215. Barrel. icon. 1205. fig. 1. C. repens et minor erecta; Bauh. Pin. 53. Thlaspi hederaceum; J. Bauh. 2. p. 933. Lob. ic. 615.) "Leaves all deltoid, and petioled; silicles elliptical, reticularly veined." *Root* annual or biennial, smaller than either of the preceding. *Stems* about five inches long, several, seldom branched, partly decumbent, striated, reddish, smooth. *Leaves* nearly equal in size, uniform, three or rarely five-lobed, somewhat toothed, resembling those of ivy. *Flowers* white, small, in rather short corymbs. *Silicle* quite elliptical, less turgid, crowned with a shorter style. *Seeds* about six in each cell. A native of the sea coasts of Denmark and Sweden. In England less common. First discovered by Lawson in Walney island, Lancashire, afterwards by Llwyd in Anglesea, and is probably to be found in other parts of the western coast. We have observed it abundantly at Blackpool. Mr. Crowe detected it in salt marshes at Wells in Norfolk, and Mr. D. Turner, and Mr. Sowerby in several parts of the southern coast, from Portland island to the Land's End. 4. C. *groenlandica.* Linn. Sp. Pl. 4. Mart. 4. Lam. 4. Willd. 4. "Leaves kidney-shaped, fleshy, quite entire." *Root-leaves* very small, convex underneath, veinless, on long petioles. 5. C. *sibirica.* Willd. 5. "Leaves heart-shaped, gash-toothed." *Stem* erect, a foot high, simple striated, smooth. *Leaves* alternate, on long petioles, obtuse, four lines long, and as many broad, deeply toothed; teeth obtuse; upper petioles the length of the leaves; lower ones four times as long. *Flowers* white, in racemes. *Silicles* small, lanceolate, one or two seeded. A native of Siberia. 6. C. *acaulis.* Willd. 6. Desfont. Atl. 2. p. 69. "Stemless; leaves cordate-kidney shaped; scapes filiform, one-flowered, quite simple." Whole plant scarcely half an inch high, growing in tufts, smooth. *Leaves* small, petioled, somewhat fleshy, smooth. *Scapes* about the length of the leaves. *Flowers* blue or white, the size of those of C. officinalis: border of the petals entire, inversely egg-shaped. *Silicle* inflated, thick, oblong, many-seeded; style very short. A native of Portugal and Morocco. 7. C. *saxatilis.* Lam. 6. (Myagrum saxatile; Linn. Sp. Pl. Mart. Willd. Thlaspi alpinum majus et minus; Bauh. Pin. 107. T. alpinum myagroides; Pon. Bald. 185. Clus. Hist. 338. Alyssum; Hall. Helv. n. 490. Allion. ped. n. 887.) "Lower leaves petioled, ovate-oblong, slightly serrated; upper ones nearly sessile, tongue-shaped; silicle globular." Lam. *Root* perennial. *Stem* six or seven inches high, very slender, weak, smooth, reddish at its base, branched near the top. *Root-leaves* spreading on the ground. A native of rocky ground on the southern coast of France, and on the mountains of Switzerland and Italy. 8. C. *auriculata.* Lam. 7. "Leaves oblong, arrow-shaped at the base, auricled, embracing the stem; racemes long, loose, simple." Entirely smooth. *Stem* six or seven inches high, branched at the base, slender, weak. *Leaves* larger than those of C. saxatilis; root-leaves spatula-shaped, entire, narrowed into petioles; stem ones oblong, generally obtuse, enlarged and furnished with some angular teeth near the summit, embracing the stem; arrow-shaped and auricled at the base. *Flowers* white. *Silicles* oval-globular, crowned with the very short style. Found by La Marck on uncultivated ground in Auvergne. 9. C. *draba.* Linn. Sp. Pl. 8. Mart. 8. Lam. 8. Willd. 11. Jacq. Aust. 4. tab. 315. (Lepidium humile, incanum arvense; Tourn. 216. Draba umbellata, sive major capitulis donata; Bauh. Pin. Morif. Hist. 2. tab. 21. fig. 1. bad. Arabis sive draba et nasturtium babylonicum; Lob. ic. 224.) "Leaves lanceolate, embracing the stem, toothed." *Root* perennial, striking deep. *Stems* several, about a foot high, striated, leafy,

leafy, almoſt ſimple, annual. *Leaves* diſtantly toothed, ſlightly pubeſcent on both ſides, pale green or hoary, with two acute auricles at the baſe. *Flowers* white, ſmall, in ſeveral ſhort racemes, which form a terminal panicled corymb. *Silicle* inflated, heart-ſhaped, ſmooth, with a ſingle ſeed in each cell. A native of Italy, Auſtria, and the ſouth of France. 10. C. *glaſtifolia*. Linn. Sp. Pl. 7. Mart. 7. Lam. 9. Willd. 10. (C. altiſſima, glaſtifolio; Tourn. 215. Lepidium glaſtifolium; Bauh. Pin. Moriſ. Hiſt. 2. tab. 2. fig. 5.) "Stem-leaves cordate-arrow-ſhaped, embracing the ſtem." The habit of a turritis. *Root* biennial. *Stem* from three to five feet high, erect, leafy, cylindrical, ſmooth, with a few ſhort branches. *Lower leaves* oblong, narrowed into a petiole. *Flowers* white, ſmall; in ſhort, alternate racemes, which form an elongated terminal panicle. *Silicles* globular. *Seeds* numerous. A native of Germany, about Ratiſbon. The whole plant is eſteemed deterſive, diuretic, lithontriptic, and antiſcorbutic. 11. C. *armoracia*. Linn. Sp. Pl. 6. Mart. 6. Lam. 10. Willd. 8. Woodv. Med. Bot. tab. 150. (C. folio cubitali; Tourn. 215. Raphanus ruſticanus; Bauh. Pin. 96.) Horſe radiſh. "Root-leaves oblong, crenate; ſtem ones lanceolate, gaſhed or entire." Dr. Smith. *Root* perennial, ſpindle-ſhaped, long, very durable, acrid. *Stems* about two feet high, erect, corymbous, leafy. *Root-leaves* petioled, very large, ſometimes pinnatifid, veined; ſtem ones ſeſſile. *Flowers* white. *Silicle* elliptical, with a very ſhort ſtyle and ſhort ſtigma. *Fruit* often abortive. A native of England and other parts of Europe, in moiſt ground, and on the banks of rivulets. The uſe of its ſcraped root in warm pickles, and as a poignant condiment to various kinds of animal food, is well known. It has alſo acquired much reputation as a medicine, and is a powerful ſtimulant, whether externally or internally employed. *Externally* it readily inflames the ſkin, and if its application be long continued, produces bliſters. In this reſpect it is uſed with advantage in caſes of palſy and rheumatiſm. One dram of the root infuſed in a cloſe veſſel with four ounces of water for two hours, and made into a ſyrup with double its weight of ſugar, taken *internally*, in the quantity of a teaſpoonful or two, and ſwallowed leiſurely, or at leaſt two or three times repeated, has been found to be ſuddenly effectual in relieving that kind of hoarſeneſs which proceeds from an interrupted ſecretion of mucus. Infuſed in water, and taken into the ſtomach, it proves ſtimulant to the nervous ſyſtem, and is on that account uſeful in palſy and chronic rheumatiſm, whether ariſing from ſcurvy or other cauſes. This infuſion, taken with a large draught of warm water, is a ready emetic, either by itſelf, or to aſſiſt the operation of other emetics. The root cut, without bruiſing, into very ſmall pieces, and ſwallowed without chewing, may be taken to the quantity of a table-ſpoonful; and, according to Bergius, has been found very uſeful in arthritic caſes; which, however, Dr. Cullen ſuppoſes to have been of the rheumatic kind. Its matter, like that of other ſiliquoſe plants, paſſes readily to the kidneys, and thus proving a powerful diuretic, is uſeful in dropſy, by promoting both urine and perſpiration. It has alſo long been known as an active antiſcorbutic. It is extremely pungent both to the taſte and ſmell, but nevertheleſs contains a ſecret juice, which ſometimes exudes in little drops upon the ſurface. Its pungent matter is very volatile, being totally diſſipated in drying, and carried off in evaporation or diſtillation by water and rectified ſpirit. It impregnates both water and ſpirit, by infuſion or diſtillation, very richly, with its active matter. In diſtillation with water, it alſo yields a ſmall quantity of eſſential oil, exceedingly penetrating and pungent. See Cullen's Materia Medica, vol. ii. p. 169.; and Woodville's Medical Botany, vol. iii. p. 407. An infuſion of it in cold milk is ſaid, by Dr. Withering, to be one of the ſafeſt and beſt coſmetics. 12. C. *macrocarpa*, Willd. 9. Waldſtein and Kitabel, pl. Hung. "Root-leaves cordate-egg-ſhaped, crenate; ſtem ones lanceolate, cartilaginouſly toothed; ſilicles elliptical, inflated." Nearly allied to the preceding ſpecies. A native of Hungary in moiſt ground.

COCHLEARIA *coronopus*, Linn. &c. See CORONOPUS *ruelii*.

COCHLEARIA, in *Gardening*, comprehends a plant of the top-rooted eſculent kind, the horſe-radiſh (C. *armoracia*) which has a creeping perennial root, the leaves very large, varying much, the flowering ſtem a foot or eighteen inches in height, and the flowers white, in looſe panicles, appearing in May.

Method of Culture. In the culture of this plant there is little difficulty, as it is readily effected by planting ſuch cuttings of the roots as contain buds or eyes. Thoſe made from the tops, and which have the heads or crowns of the plants to them, are the beſt. The off-ſets and ſide-ſhoots may likewiſe be employed for the purpoſe, as is moſtly the caſe with market-gardeners. They ſhould be about an inch or two in length. As theſe plants require to be put into the ground to a great depth, in order that they may form long fine roots, the earth ſhould either be dug over before the cuttings are placed in, or trenched to the depth of fifteen or twenty inches at the time, according to the method of planting that is made uſe of, and in either mode the ground be well looſened, and broken down fully to the above depth.

The ſorts of ground moſt adapted to the growth of theſe roots are thoſe of the more light deep kinds; but they will ſucceed tolerably on almoſt any. When the land has been trenched over in the above manner, the uſual mode of planting is by means of the dibble; but there is another practice which is ſometimes followed, which is that of trenching in the ſets, or placing them in the earth at the time it is dug over to the full depth of the looſened mould.

But in the firſt method, after the ground has been prepared, a line is ſtretched acroſs, beginning at the end, and holes made to the depth of fifteen or twenty inches along it, by means of a long ſharp iron dibble, at the diſtance of nine inches from each other, a ſet or cutting being dropped into each hole, and the mould cloſed upon it. The line ſhould then be moved forward to the diſtance of twenty inches or two feet, and another row put in in the ſame manner, proceeding in the ſame way till the whole of the ground is planted over.

In performing the work in the latter mode, the ground ſhould be made light and looſe, beginning at one end of the piece, and opening a trench two ſpades wide, and one ſpade deep, digging the bottom; then a row of cuttings ſhould be ſet along the middle of the bottom nine inches diſtant, inſerting them to their tops in the earth; then digging the next trench the ſame width and depth, turning the earth into the firſt upon the row of plants, breaking all large clods, and levelling the top. After this, proceed to the ſecond trench, planting it in the ſame way, performing the whole of the work in a ſimilar manner, and then levelling the ſurface by the rake.

The moſt proper ſeaſon, or time of the year for this work, is in the autumn for the dryer ſorts of land, and in the early ſpring, as in February, or beginning of the following month, for ſuch as are of a moiſt quality.

In theſe methods of planting, in order that no time may be loſt, the ground may be ſown the firſt year with ſpinach, radiſhes, or any ſlight-rooting crop, that comes off early in the ſummer, to allow of the plants being kept clean afterwards by hoeing; which is all the culture they require in bringing the roots to a proper ſize for uſe.

Sometimes it is the caſe, eſpecially where the land is ſuitable for them, that the plants make ſuch progreſs as to have roots large

large enough for uſe in the courſe of a few months; but if not much wanted, they are better to remain a twelvemonth, or two or three years, as by ſuch delay they are much larger and finer.

In reſpect to taking up the roots for uſe, the beſt method is to open a trench two ſpades wide, cloſe on the ſide of the firſt row of plants, and fully as deep as the ſtool or bottom of the roots, without diſturbing them; then with a large knife or ſharp ſpade to cut off all the ſhoots, large and ſmall, of each ſtool cloſe and level, from whence they riſe, leaving the old or parent ſtools in the earth; and after having taken up all the plants of the firſt trench, proceeding to the next row in the ſame manner, turning the earth of it into the firſt, and cutting off all the ſhoots as before, taking up the whole in the ſame way as wanted. By this means the remaining undiſturbed ſtools continue to ſend up a freſh ſupply of ſhoots in ſucceſſion for many years; but after the two firſt years the ſtools begin to ſpread at bottom, and ſend up many ſmall ſhoots between and in the rows; all of which intervening ſmall ſpawn ſhould be annually drawn up in the beginning of ſummer, to render the principal ſhoots large and fine. And though the ſtools of theſe roots endure many years, in time they become weak or worn out, as well as the ſoil; conſequently, in ſix or ſeven years, when the ſhoots become weak and ſmall, a freſh plantation ſhould be made in ſome other place. In order to have fine roots it is better, however, to do it every three or four years.

Theſe roots are much uſed for culinary purpoſes when ſcraped very fine, eſpecially for fiſh, and ſome other ſorts of food.

Whenever more of the roots are taken up at a time than are wanted, they may be preſerved in their juicy ſtate for ſome time, by putting them in a little dry ſand.

Cochlearia, in *Ancient Geography*, a place in the iſland of Sardinia, between Uſſia and Portus Luquidonis, according to the Itinerary of Antonine.

Cochlearia, in *Ornithology*, a ſpecies of *Cancroma*, which ſee.

COCHLITES, in *Natural Hiſtory*, a term comprehending ſeveral kinds of foſſil ſhells, found lodged in the Britiſh ſtrata, and reſembling ſnails and periwinkles.

COCHLIUSA, an iſland of Aſia Minor in the Mediterranean ſea, ſituated on the coaſt of Lycia.

COCHRYNNA, a river of Thrace, in the environs of the Chalcidic territory.

COCINTUM, a town of Italy in Brutium, near the eaſtern coaſt, at a ſmall diſtance to the weſt of the promontory of the ſame name.

COCK, Matthew, and Jerome, in *Biography*, two brothers, painters of Antwerp, who flouriſhed about 1551. Matthew is ſaid by Van Mander, to have been one of the firſt artiſts amongſt the Flemings, who painted landſcape in a good ſtyle. However, his pictures, though finiſhed, are hard, and much reſemble thoſe of old Breugel.

Jerome, his brother, though poſſeſſed of no ſmall ſhare of ability, gave himſelf up to engraving, and publiſhing many excellent prints, though in the old dry manner, after the works of Matthew Cock, old Breugel, and Francis Florio, as well as from the pictures of the beſt maſters of Italy, where he long reſided; beſides which, he gave to the world many intereſting collections of antiquities, topography, &c. He died in 1570, many years after the death of Matthew his brother. Baldinucci. Heinecken.

Cock, *of a Muſket*, in *Gunnery*, the part of the lock which ſuſtains the two ſmall pieces of iron called jaws, between which the flint is fixed.

To cock a muſket, piſtol, &c. is to fix the cock in ſuch a manner as to have it ready for an inſtant diſcharge.

Cock, in *Ichthyology*, a ſmall fiſh that is ſometimes very common on the ſhore of Cornwall; the *labrus coquus* of Gmelin, purple, and obſcurely cæruleous, yellow underneath, with a rounded tail.

Cock, *Phaſianus gallus* of Linnæus, in *Ornithology*, the name of the male of gallinaceous birds: the ſpecific character of which is, that it has a compreſſed caruncle on its top, and a double one on its cheek; that its ears are naked, and that its tail is compreſſed and riſing. For the hiſtory and varieties of this bird, ſee Phasianus *Gallus*. For its uſes in domeſtic economy, ſee Eggs, Hatching, Hen, and Poultry.

In the choice of a *dunghill cock*, he ſhould be of a large body, very long from the head to the rump, thick in the girth, the neck long, looſe, and high; the comb, wattles, and throat large; the eyes round and large, and anſwerable to the colour of his plume or main, as grey with grey, yellow with yellow, and ſo of the reſt; his beak ſhould be ſtrong and hooked; and his main or neck-feathers very long and gloſſy, covering his neck and ſhoulders; the legs ſhould be ſtrait, and of a long beam, with very large and long ſpurs, a little bending; the colour ſhould be black, yellow, or browniſh; the claws ſhould be long and ſtrong; the tail long, bending back, and covering the whole body; the wings very ſtrong; and the general colour ſhould be reddiſh. The cock is a heavy bird, and his gait is compoſed and ſlow. His wings are very ſhort, and hence he ſeldom flies, and the violence of his efforts is ſometimes indicated by his ſcreams. He crows either in the night or day, but not regularly at certain hours, and his note is very different from that of the female. He ſcrapes the ground to ſeek his food, and ſwallows, with the grains, ſmall pebbles, which ſerve to aſſiſt digeſtion. He drinks, by taking a little water into his bill, and raiſing his head at each draught. He moſt frequently ſleeps with one foot in the air, and his head covered by the wing on the ſame ſide. The thigh on which the body reſts is commonly more fleſhy than the other; and it is ſaid that our epicures well know how to diſtinguiſh them. In its natural ſituation, the body is nearly parallel to the ground, as is alſo the bill; the neck riſes vertically, the forehead is ornamented with a red fleſhy comb, and the under part with a double pendant of the ſame colour, which, ſays Buffon, is neither fleſh nor membrane, but of a peculiar nature, different from every thing elſe. In both ſexes the noſtrils are ſituated on either ſide of the upper mandible, and the ears on either ſide of the head, and below each ear is ſpread a white piece of ſkin. The feet have commonly four toes, ſometimes five, but always three of them placed behind. The feathers riſe by pairs from each ſhaft. The tail is nearly ſtraight, but admits of a ſmall elevation and depreſſion. The male is diſtinguiſhed by having the two feathers in the middle of the tail much longer than the reſt and bent into an arch; the feathers of the tail and rump are alſo long and narrow, and the feet are armed with ſpurs. A good cock has eyes ſparkling with fire, boldneſs in his demeanour, and freedom in his motions, and diſplays force in all his proportions. He is ſo ſingularly ſalacious, that though he ought not to be allowed more than 12 or 15 hens (Columella recommends, indeed, that they ſhould not exceed five); yet if he had 50 a day, he would not, it is ſaid by Aldrovandus, neglect one of them. However, in this caſe it is not certain that he would fecundate the eggs of the female. Ardent in his paſſion, the firſt thing he does after he is diſcharged from his rooſt in the morning is to tread his hens; and if he is for ſome time deprived of his family, he makes his addreſſes to the firſt female he meets, though of a very different ſpecies, and even courts the firſt male that occurs. The firſt fact is mentioned by Ariſtotle; the ſecond is proved by by an obſervation of Edwards, and may be inferred from a law mentioned by Plutarch, in his treatiſe on the queſtion "Whether brutes reaſon," which enacted, that a cock convicted of this unnatural act, ſhould be burnt alive. The cock is extremely watchful of his females, and manifeſts great inquietude and anxiety; he hardly ever loſes ſight of them; he leads and defends them, and threatens them with his menaces; he collects them together when they ſtraggle, and never eats till he has the pleaſure of ſeeing them feeding around him. The different inflexions of his voice, accompanied by various ſignificant geſtures, are a kind of language that ſerves to communicate his ſentiments. When he loſes them he expreſſes grief. Although he is no leſs jealous than amorous, he does not abuſe his wives, but directs his rage againſt his rivals. Large as is his family, it is obſerved that he has a favourite female to whom he manifeſts peculiar attention. It was known as long ago as the time of Ariſtotle, (vid. de partibus animalium, lib. iv. 5.) that the cock had organs of generation concealed within his body. The bulk of theſe varies in different ſpecies, and in different animals of the ſame ſpecies, at different times; but whatever be their ſize, they are very important in the animal economy, as is evinced by the fecundation of eggs, and the wonderful changes reſulting from their extirpation. This operation is commonly performed when the bird is three or four months old. After emaſculation it grows plumper, and its fleſh becomes more juicy and delicate, and when ſubjected to a chemical analyſis, yields different products from thoſe which it would have afforded before caſtration. The extract of the lean of a capon is ſomewhat leſs than the 40th part of its total weight; whereas it amounts to 1-12th in a pullet, and rather more than 1-7th in a cock. Beſides, the extract of cock's fleſh is very dry, while it is difficult to ſeparate the humidity from that of a capon (Mem. Acad. Roy. Scienc. an. 1730, p. 231.) The capon is no longer liable to moult; his note is altered, his voice broken and ſeldom heard; he is treated roughly by the cocks, with diſdain by the females; and deprived of all the appetites which he naturally poſſeſſed, he is not only excluded from the ſociety of his equals, but extruded, as it were, from his ſpecies. To eat, ſleep, and fatten, are in this ſtate its principal objects. However, he may even now be taught to rear and tend young chickens. For this purpoſe the capon muſt be kept ſome days in a dark place, only bringing it out at regular hours to feed, and accuſtoming it gradually to the ſight and company of a few ſtout chickens; for theſe it will ſoon acquire a fondneſs, and will lead them with as much affection and aſſiduity as their mother. It will conduct even a greater number than a hen; for its wings ſpread and afford more ſpacious ſhelter; and the hen, freed from its ſolicitude and toil, will ſoon begin again to lay.

Some have practiſed another method of teaching a capon to clutch a brood of chickens, more cruel, but no leſs effectual than the former; which is that of rendering him very tame ſo as to feed from one's hand: and then, about evening, plucking the feathers off his breaſt, and rubbing the bare ſkin with nettles; the chickens are then put to him, and preſently run under his breaſt and belly, and probably by rubbing his bare ſkin gently with their heads, allay the pain which the ſtinging of the nettles had occaſioned. This is repeated for two or three nights, till the capon contracts an affection for the chickens, which have given him relief, and takes them under his protection. A capon accuſtomed to this ſervice will repeat it to one brood after another.

Thus the capon, though condemned to ſterility, will ſtill contribute indirectly to the preſervation and multiplication of its ſpecies. Another operation performed on the cock is, after cutting the comb as uſual, to ſubſtitute in its ſtead one of the young ſpurs which has juſt begun to ſhoot; thus engrafted, it gradually ſtrikes root into the fleſh, thence extracts its nouriſhment, and often grows more luxuriantly than it would have done in its natural ſituation.

Chickens are not hatched with that creſt, and thoſe reddiſh membranes which diſtinguiſh them from other birds. Theſe parts do not begin to unfold themſelves for the firſt month, after they have left the ſhell; at two months the young cocks crow, and fight with one another; but it is commonly after an interval of five or ſix months that they manifeſt any paſſion for the hens, and that theſe begin to lay. In both ſexes the complete time of their growth is a year or 15 months. This period of their growth would imply that the ordinary extent of their life does not exceed ſeven or eight years, if the ſame proportion ſubſiſted in birds as in quadrupeds. But this has been obſerved to be much longer. Some have limited their age to 10 years; others have extended it in their domeſtic condition to 20 years; and in a ſtate of abſolute liberty to 30 years. But as cocks and hens are bred for profit, the hens and capons that are deſtined for the table, ſeldom enjoy above one year's exiſtence, and moſt of them have only one ſeaſon. Thoſe which are ſelected for the multiplication of the ſpecies become ſoon exhauſted, and none are permitted to arrive at their natural period; ſo that cocks are ſeldom or never known to die of age.

Cock, *of the Game*, or *Game Cock*, *Phaſianus gallus*, of Linnæus: *Phaſianus gallinaceus* of Ray, Willughby, and other ornithologiſts.

The Engliſh game-cock is vulgarly imagined to be the offspring of the domeſticated fowl and the pheaſant: this idea is, however, not at all aſſented to by ornithologiſts, or the amateurs of the art of cocking. On more ſure grounds its origin is referred to the wild cock of India, found not unfrequently on the continent of India, and the iſles St. Jago, Pulocondore, Timor, Philippine and Molucca iſlands, Sumatra, Java, New Guinea, Tinian, and the iſles of the South Seas. At Sumatra and Java they are noticed as being particularly large. Latham has obſerved that they breed moſt freely in warmer ſituations; in very cold regions, though they live and thrive, they ceaſe to multiply.

According to Mr. Pegge, in the "Archæologia," vol. iii. No. 19, the art of cock-fighting is referred to the Greeks.

Jacobus Palmerius, a writer cited by Mr. Pegge, pretends that the traces of this diverſion may be diſcovered among the barbarians of Aſia, as early as the reign of Crœſus, king of Lydia, A. M. 3426, and 558 years before Chriſt. But the learned antiquary apprehends, that the fact to which this writer refers, furniſhes no evidence that quails, uſed among the ancients and moderns for fighting, as well as cocks, were fitted for the purpoſe of amuſement at ſo early a period. Pliny, however, informs us, (N. H. l. x. c. 21.) that at Pergamus, a city of Aſia, there was an annual exhibition of cock-fighting. But we derive no information from his account, when or where this practice commenced, or for what purpoſe, whether civil or religious, it was introduced. The Dardanii, a people of Troas, had on their coins the repreſentation of two cocks fighting: but as theſe coins are of a late date, the antiquity of this ſpecies of diverſion among the Dardanians cannot be inferred from them. Mr. Pegge ſuggeſts that, perhaps, it might have been introduced among them, and alſo at Pergamus, from Athens, where an annual feſtival, under the title of Ἀλεκτρυόνων ἀγὼν, was inſtituted by Themiſtocles, after the concluſion of the Perſian war. When this famous general was leading the Athenian army againſt the Perſians, he ſaw ſome cocks fighting, and took occaſion from this circumſtance to animate his troops by obſerving to them; "Theſe

"These animals fight not for the gods of their country, nor for the monuments of their anceſtors, nor for glory, nor for freedom, nor for their children, but for the ſake of victory, and that one may not yield to the other;" and from this topic he inſpirited the Athenians. (Vid. Ælian, Var. Hiſt. ii. c. 28.) If we can excuſe the barbarity of this inſtitution, it may be conſidered in ſome degree as commendable, becauſe it was an act of perpetual gratitude to the benevolent deity that preſented him with an occaſion of haranguing his ſoldiers with ſuch effect as to induce them ſucceſsfully to engage their enemies in battle, or at leaſt, as a permanent encouragement to his nation. As to the barbarity of the inſtitution, Ælian remarks, that cruelty and every kind of debauchery were ſo generally interwoven with the religious obſervances and ceremonies of theſe polite Athenians, that they would be but little ſhocked and offended by it on this account; or, however, not more ſo than the more ignorant barbarians of the oppoſite coaſt of Aſia, the Pergamenians or Dardanians. We may further obſerve, that the cock, on account of his vigilance, was ſacred to Apollo, Mercury, and Æſculapius; and for the ſame quality, in conjunction with his magnanimous and daring ſpirit, he was appropriated likewiſe to Mars. This was extremely oppoſite to the purpoſe and intention of the "Spectaculum," or public ſhow, exhibited by Themiſtocles; as theſe creatures, called by Columella "rixoſæ aves," were ſuppoſed to be more addicted to fighting than any others. The ſcene of engagement, however, or in modern phraſe, the "pit," was the theatre; and the ſport laſted one day. But others, as well as Themiſtocles, have taken the advantage of the fight of cock-fighting, and deduced from this circumſtance an argument for the incitement and encouragement of military valour. Socrates endeavoured in the ſame way to inſpire Iphicrates with courage. (Diog. Laert. ii. § 30.) Chryſippus alſo, in his book "De Juſtitia," ſays, "our valour is raiſed by the example of cocks." Lucian likewiſe (de Gymnas. ii. p. 295), introduces Solon, the great Athenian legiſlator, as addreſſing Anacharſis to the ſame purpoſe. Muſonius alſo, cited by Stobæus (Serm. 29), deduced the ſame kind of inſtruction from the battling of quails and cocks; and we are informed that the young men were obliged to attend the exhibitions of the theatre, in order to avail themſelves of this inſtruction. It further appears, that the other Greeks, as well as the Athenians, held a good fighting breed of cocks in high eſtimation, and often amuſed themſelves with this diverſion. We learn from Pliny (ubi ſupra), and Columella (viii. c. 2.), that the iſlanders of Delos were great lovers of this ſport; and Tanagra, a city of Bœotia, the iſle of Rhodes, Chalcis in Eubœa, and the country of Media, were famous for their generous and magnanimous race of chicken. The kingdom of Perſia was probably included in the laſt, from whence this kind of poultry was firſt brought into Greece; and if a judgment may be formed of the reſt from the fowls of Rhodes and Media, the excellency of the broods at that time conſiſted in their weight and bulk (as the fowls of that country were heavy and large), and ſuch as our ſportſmen call "ſhake-bags" or "turn-pokes." At Alexandria, in Egypt, they had a breed of hens, called Μονοσοροι, which produced the beſt fighting-cocks. Upon the whole, it ſhould ſeem, that at firſt cock-fighting was partly a religious and partly a political inſtitution at Athens; and was there continued for the purpoſe of cheriſhing valour in the minds of their youth; but it was afterwards perverted, both here and in other parts of Greece, to a common paſtime, without any moral, political, or religious intention; as it is now practiſed among us.

The Romans, who were prone to imitate the Greeks, followed their example in this kind of diverſion, without any good or laudable motives. Signior Haym (cited by Mr. Pegge,) thinks, that the Romans borrowed the paſtime from Dardanus, in Aſia; but it is needleſs to trace their derivation of it to ſuch a diſtance, more eſpecially as it was generally followed in Greece, and was not introduced among the Romans at a very early period. From a paſſage that occurs in Columella, (ubi ſupra) it appears probable that the Romans did not uſe the ſport of cock-fighting in his time; and he moreover ſpeaks of it in terms of ignominy, as an expenſive amuſement, unbecoming the frugal houſeholder, and as often attended with the ruin of the perſons that purſued it. The Romans ſeem to have been more acquainted with quails as fighting birds than with cocks. At length, however, they paired cocks, as well as quails, for fighting. The firſt cauſe of contention between the two brothers, Baſſianus and Geta, the ſons of the emperor Septimius Severus, happened, according to Herodian, (iii. § 33) in their youth, about the fighting of their quails and cocks; and, as they had often accompanied their father into Greece, they had probably ſeen and learned this paſtime there. It might naturally have been expected that, after the introduction of Chriſtianity into the Roman empire, when the bloody ſcenes of the amphitheatre were diſcarded, this barbarous and inhuman diverſion, which had a tendency towards cheriſhing ferocity and implacability in the minds of men, would have been reſtrained and gradually annihilated. Beſides, this paſtime has been the bane and ruin of thouſands here, as well as of thoſe "laniſtæ avium," cock-feeders, mentioned by Columella, whoſe patrimonial fortunes were entirely diſſipated and conſumed by it.

The cock is not only a very uſeful animal, but ſo ſtately in his figure, and magnificent in his plumage, that Pliny ſpeaks in high terms of his government among his own kind, and Ariſtophanes compares him to the king of Perſia. Such alſo is his tenderneſs to his brood, that he will ſcratch and provide for them with an aſſiduity almoſt equal to that of the hen; and ſuch is his generoſity, that, on finding a hoard of meat, he will chuckle the hens together, and without touching one morſel himſelf, will relinquiſh the whole to them. The cock was called *the bird*, κατ' ἐξοχην, by many of the ancients; he was highly eſteemed in ſome countries, and, in others, was even held ſacred; inſomuch that one cannot forbear regretting, that a creature ſo noble and ſo uſeful ſhould be ſo cruelly treated. It affords, however, ſome ſatisfaction, that the Αλεκτρυοφονια, if ſuch a word be allowed, or the maſſacre of Shrove-Tueſday, is now declining, and this circumſtance encourages the hope, that, in a few years, it will be totally diſuſed; but the cock-pit ſtill continues a reproach to the humanity of Engliſhmen, and to the benign religion which they profeſs.

This ſpecies of paſtime was probably brought into England by the Romans, but the preciſe period of its introduction has not been aſcertained. The bird was here before Cæſar's arrival; but Mr. Pegge, in his Reſearches, has found no notice of his fighting before the time of William Fitz-Stephen, who wrote the life of archbiſhop Becket, ſome time in the reign of king Henry II. William deſcribes the cocking as a ſport of ſchool-boys on Shrove-Tueſday, called "Carnilevaria." The theatre was the ſchool, and the maſter was the director of the ſport. From this time, the diverſion, however abſurd and barbarous, has continued amongſt us; it was followed, though diſapproved and prohibited, 39 Edw. III.; alſo in the reign of Henry VIII.; and A. D. 1569. By ſome it has been called "a royal diverſion;" and much encouraged both by Henry VIII. and

James I; but it was forbidden by one of the acts of Oliver Cromwell, March 31, 1654.

There are no documents that we are acquainted with to inform us in what state the art of fighting cocks existed to the reign of king Henry VIII. who, it is supposed, founded the celebrated national cock-pit at Westminster, afterwards renewed and encouraged by Charles II. whose pile cocks, the introduction of this monarch, are in high estimation among numerous breeders at this day. From that period annual mains have been fought at the royal cockpit in Westminster to the present time.

The institutors of this establishment enacted certain laws for the better regulation of these sports, the leading features of which, as belonging to this art, we shall here briefly describe.

There are three kinds of mains at present in use with cockers; the *long main*, which in general continues for a week, seldom or never longer; the *short main*, of a day or two, (both regulated by the same laws); and the *Welch main*: in the long main the cocks are generally the property of a joint subscription, or of only two individuals, and the cocks thus collected are chosen for the main, according to their weights, those being preferred, as a medium weight, from three pounds eight ounces to four pounds ten ounces, giving or taking an ounce on either side, though they are generally matched to a drachm weight. The cocks, which form the bye-battles in the main, become the objects of separate bettings, and are subject to the same weights and regulations. Cocks, whose weights are above four pounds eight ounces, are termed shake-bags or turn-outs, and are seldom matched against each other by weight.

The short-main lasts only for a day or two, the cocks being fewer in number, or the numbers are doubled for each day. The Welch main is generally fought for a purse, a gold cup, a fat hog, or some other prize; in this main all the fowls are restricted to a certain weight, *viz.* about four pounds four ounces: these are matched against each other, as shall be agreed upon, the winners again taking the winners, till they are reduced to a pair; then the winner of the last battle gains the prize.

Besides this there is also to be noticed the battle-royal, which consists in any number of fowls being put down together on the pit, and the last surviving fowl gains the prize.

Those species of fighting, called the battle-royal and the Welch main, are known no where in the world, as Mr. Pegge conceives, (ubi supra), but in this country; neither in China, where this species of diversion is very prevalent, nor in Persia, nor in Malacca, nor among the savage tribes of America.

The battle of the main always begins with fighting the lightest cocks; it is fair to feed them in any way you please after they are weighed; and those which, proportionately to their bulk, had been previously most reduced, or brought down, now have the opportunity of being fed and brought up again, thereby gaining upon the weight of their opponents; for the lightest cocks are found to be the first prepared by the artifices that are used to bring them to their wind and action.

The following articles are observed by the members of the cock-pit royal, for regulating the mains. "Articles of agreement, made the day of , one thousand eight hundred and , between : First, the said parties have agreed, that each of them shall produce, shew, and weigh, at the , on the day of , beginning at the hour of in the morning, cocks, none to be less than 3lb. 8oz., nor more than 4lb. 10 oz., and as many of each party's cocks that come within one ounce of each other, shall fight for a battle, that is each cock, in as equal divisions as the battles can be divided into six pits, or days play, at the cock-pit beforementioned; and the party's cocks that win the greatest number of battles, matched out of the number before specified, shall be entitled to the sum of , odd battle money, and the sum to be staked into the hands of Mr. before any cocks are pitted, by both parties. And we further agree, to produce, shew, and weigh, on the said weighing days, cocks for bye battles, subject to the same weight as the cocks that fight in the main, and these to be added to the number of cocks unmatched; and as many of them as come within one ounce of each other, shall fight for a battle; the number of cocks so matched, to be equally divided as will permit of, and added to each day's play with the main cocks; and it is also agreed, that the balance of the battle money shall be paid at the end of each day's play. It is also further agreed, for the cocks to fight in silver spurs, and with fair hackles; and to be subject to all the usual rules of cock-fighting, as practised at the cock-pit royal, Westminster; and the profits arising from the spectators, to be equally divided between both parties, after all charges are paid that usually happen on those occasions. Witness our hands, day of 18 ."

It is understood on all occasions, that battles for 5 *l.* and upwards must be fought in silver spurs, unless the contrary is expressly agreed upon, for this reason, that the battle is not so soon ended in silver, and the fowl has more opportunity of displaying his powers than in steel spurs. The setters to of the cocks are not permitted, by the general laws of cocking, to take up their fowls after they are put down upon the pit, unless either of the fowls touch the side of the pit, or are entangled in each other, or in the mat; in either case they may be handled and brought to the centre of the pit; if the fowl is thrown on his back with his legs upwards, and not touching the pit, it is lawful to turn him only; but it is not allowed, on any pretence, to remove feathers, &c. from the beak or eyes during the fight.

If either, or both cocks, through blindness, or any other cause, cease to fight, "the law is told," that is, a person counts twice twenty, when they may be handled and set to again; this telling of the law is repeated as long as both cocks fight; but ten only is counted at each interval after the first, previously to their being put together; either ceasing to peck, is told out by a person counting distinctly and audibly twice twenty, they are then set to beak to beak; if he now refuses to fight, ten is told, and, "once refused," announced; if he continues to refuse, ten more. "twice refused," and so on till he has refused ten different times, when he loses the battle; this is termed the *long law.* If a cock resumes his fighting at any period during the counting, in that case, in counting again, to begin the tens till the refusals make ten following each other. Should both be disabled, and refuse to fight, *before* the long law begins counting, it is a drawn battle, and neither wins; and should both refuse fighting during the telling of the long law, it is that cock's battle which fought last; but should he die before the law is told out, he loses the battle, notwithstanding the other did not fight within the law.

If any one desires to stop this telling him out, he may *pound him*, that is, he bets the cock will be beaten ten pounds to five shillings; in this case he must lay down his hat, handkerchief, glove, or something upon the pit, as a token of the challenge. When the *short law* is told by a person, distinctly counting *twice twenty*, and afterwards repeating the words, *will any one take it?* three times; if no one accepts

cepts the challenge during this ſhort law, the cock is beaten. It is neceſſary, when any one takes the poundage or bet, that he declares it, and alſo lays down ſomething on the pit as ſurety; when the cock muſt fight till death, and ſometimes moſt unexpectedly he recovers and wins.

Having deſcribed the natural origin of this race of birds, the hiſtory of the ſport, and its laws and regulations, we now proceed to conſider the general form and properties of the fighting cock, when in his greateſt perfection, according to the ideas we at preſent entertain.

The general outline of the fineſt cock, taken as a whole, nearly approaches that of a lengthened cone, excluding the legs and tail, the apex of the cone being the head, and the baſe the vent and belly; under ſuch external form, may exiſt the beſt properties of the cock; in deſcribing the beauties of particular parts, the head ſhould be ſmall, the beak ſtrong and pointed, the neck long, and at the ſame time ſtrong, the girth of the ſhoulders, cheſt, and body, broad, feeling broad to the graſp, and tapering again to the rump. The thighs and legs large and ſtrong, and rather long than ſhort; and it is conſidered a good point if he brings them cloſe up to his body, when held in the hands, inſtead of letting them hang looſely down.

The feathers, to amateurs, alſo afford a good criterion of judging of the ſoundneſs of the bird; where theſe lie cloſe to the ſkin, and compacted together, and feel ſhort and ſtiff to the touch, and ſhining and gloſſy in their exterior; ſuch is deemed a ſound feathered bird.

The colours moſt admired are the *reds* and the *duck-wings;* by the red, among cockers, is underſtood a cock with a *hackle* (that is, the feathers of the head and neck) red, and with the hackle generally correſpond the colours of the rump or *ſaddle.*

The *red cock* varies with a black breaſt and *ginger* wing, that is, of a gingerbread or tawny colour, and again with a black-breaſt and a dark wing; ſuch are *dark reds.*

The colour of the wing, as uſed among the amateurs in cocking, is ſometimes taken from the whole wing; as, where the wing is altogether of a ginger-red, excepting the flight, or primary feathers, which are dark, or a part of the wing, as in the duck wings, hereafter to be deſcribed.

The *light-reds*, are thoſe whoſe breaſts are wholly red, or red ſpotted with black, or black ſtreaked with red, and theſe receive their names according to theſe circumſtances, as, *ginger-breaſted, ſpotted-breaſted, ſtreaky-breaſted,* &c.

The *duck-wing* cock derives this name from a bar of ſteel-blue acroſs the greater coverts, like the faſcia acroſs the wild duck's wing; in this caſe it is obſerved, that the ſecondaries are exteriorly white, the hackle alſo white or pale-yellow, or cream-colour, as are the ſaddle-feathers, which correſpond, as we have before noticed, with the hackle.

In diſcriminating the individuals of this breed, it is farther uſual to deſcribe the colours of the breaſt and the ſhoulders; the breaſt may be *black*, or *ſpotted*, or *ſtreaked;* the ſhoulders may be *tawny*, or *dark-red*, or *birchen*, that is, of the colour of the twigs of a birch broom, or *ſilver-ſhouldered,* being nearly white.

The *yellow cock* is merely a variety of the duck-wing, from which it differs only in having the ſecondary feathers, or thoſe next the flight, dark, inſtead of white, which is not of unfrequent occurrence; the blue-bar in theſe cocks is ſometimes ſeen to vary to a light-brown.

The next colour to be noticed is the *dun;* theſe cocks, are in reality of a lead, or ſlate colour, and may be wholly ſo, or duck-wings, with the breaſt, flight, and tail, dun; or a *yellow-dun,* that is, a yellow cock with a dun flight, breaſt, and tail; by flight-feathers are underſtood the primaries, or firſt and ſtrongeſt feathers of the wing; the *red-duns* are red cocks with a dun breaſt, flight, and tail.

Black cocks are ſo coloured, ſome wholly ſo, others with birchen or brazen ſhoulders, which are almoſt the only varieties of this cock.

White cocks are either wholly white, termed *ſmocks*, or with red ſhoulders, which are termed *piles;* when theſe are ſtreaked with any colour in the hackle, breaſt, rump, or tail, they are then termed *ſtreaky-piles.*

If the pile-cocks have a mixture of dun (that is, lead colour on the breaſt and ſhoulders), they are called *dun-piles;* another variety of this fowl is the *cuckoo*, which is deemed rare, that is, a white fowl with the feathers variegated promiſcuouſly, or rather barred with black and yellow.

The *ſpangled fowl* is particularly rare; it is a red fowl, with the feathers tipt with white, or ſometimes white and black.

There is ſtill another breed of cocks we have to mention, called *hen-cocks*, from their feathers being ſhort, reſembling thoſe of a hen; their colour is generally brown, or ſpeckled, they are allowed to fight as well as any other, and to be as good game; we are totally unacquainted from whence originates this breed; in fighting, it frequently happens that they have an advantage, in being miſtaken by their antagoniſt cock for a hen, and frequently from this are enabled to get the firſt blow.

When any coloured fowl has the ſhoulder mixed with black, ſuch cock is denominated *beezy ſhouldered*, a term whoſe origin we are not acquainted with, probably from the French word *bis*, black, or duſky.

The legs, as forming part of the deſcription and character of the cock, ſhould alſo be noticed. Theſe are either yellow, blue, white, olive, or dark green, willow, or light-green, black, or carp-legged, a mixture of black and yellow; the beaks in general correſpond with the colour of the legs.

The eyes are alſo an object of attention, being a point of deſcription in the match-pile; the red, or ferret-eye (the *iris* being red); the pale-yellow, or daw-eye; the dark-brown, or ſloe-eye.

Other qualities of the cock remain to be conſidered, as they conſtitute important properties in the battle; theſe properties conſiſt in the ſpecific weight of the cock, in regard to his bulk, as a large cock may not only feel light in hand, but weigh light in the ſcale, his bone and fleſh being of a lighter quality, while others, though much leſs, ſhall outweigh him; and ſuch are commonly diſtinguiſhed by the phraſe, *lumpy cocks*, while the others are termed *corky*, or light, like cork, which is of more value in the match, as the larger cock has the advantage.

The conſtitution, or rather healthy condition, of the cock is alſo neceſſary to be known; this is more readily aſcertained than would be imagined; firſt, by the feather, as we have before ſtated, being ſound, and difficult to be drawn out, ſhort, ſmooth, hard, and ſhining; his crowing with a ſhrill and clear voice; his looking red in the face; if white, or pale, in that part, or if he pants much, and turns blackiſh after exerciſe, it is preſumed, with tolerable certainty, that he is diſeaſed and unſound; that he is unfit for the *pens* or the battle.

The next conſideration in the fighting cock is the ſpur; to hit well with the ſpur is as neceſſary as to have courage, or any other good quality, as without this all the other qualities may be thrown away; this, however, is not known from any exterior indication, but by actual trial, and is not confined to any particular colour or breed. The piles often are obſerved to carry a fatal ſpur, without having ſo much

 game

game as the other breeds, especially if the battle be of long duration.

And next of the game, or blood of the fowl; for by this term is indicated his courage, or rather his endurance of the battle; this property is so extraordinary in some of these animals, that they fight obstinately to the last, and by this means, though apparently beaten, gain the battle.

Action in fighting, to be excellent, should be rapid, but without hurrying; quick, but cautious; to *break well* with their adversary, that is, on the first onset to throw off, or parry the blow, and then to hit; for if they strike and hit together at the onset, it is not unusual to see the thigh or wing broken, or the spur pass through the body of one or both. It is of consequence also, that in the early part of the battle, they should strike without laying hold, and keep a distance, as laying hold in the beginning of the battle is almost useless, but not so when the first efforts are past, and they become a little weary.

It is usual for the cock to aim at the head with the beak, but his stroke is known to be more fatal when he lays hold of the point of the wing, as in this case the spur enters some part of the body or the wing, and disables the fowl more certainly.

A cock is said to fight *well at the foot*, when he has obtained an advantage, and follows it up till he has killed his adversary, never suffering him to rise after being once down.

On *Breeding*. A well-tried breed of cocks being obtained from actual observation of their powers are to be used as the stock to breed from, and it should be observed that it has been found injurious to breed from two old fowls; on one side or the other they should be young, and three or four hens are fully sufficient for one cock, and the hens should be all of one breed, and if the colours are somewhat alike so much the better, as they unite the more kindly.

The breeding-place should be well aired, and kept entirely free from other poultry; clear water, grass, gravel, and lime rubbish, an occasional change of food, as barley, oats, potatoes boiled, and sometimes a little meat, and toast and beer, are also to be recommended.

The hen-house should be perfectly dry and clean, and the *roost* with perches rather low, as otherwise the heavy fowls jar their feet in coming down and occasion them to swell and become crippled.

The *perches* should be carefully made of the proper size for the grasp of the foot, not being too large or too small, as in the former case the hind claw is brought forward, and he becomes what is called duck-clawed, and in the latter the breast-bone becomes crooked.

There are several injurious things to the health of the fowls, which should be carefully kept away from their breeding place, as any thing which tends to soil the water they drink; the keeping of pigs, ducks, or allowing them access to coal ashes, or any soapsuds, are found by experience to produce the roop; geese and turkies are injurious to fowls, by continually fighting and battering them, and should not be allowed to be near them.

The nests of the hens may be about a foot and a half from the ground, made in an earthen pan or dish of a proper size, and clean straw, rubbed up so as to render it soft. Hay is found by experience to be injurious to the eggs, and to more readily produce vermin; and its faint smell seems also not to suit them.

There should be nests for every hen, and even their number should be rather more than less than the number of hens, as otherwise they are apt to fight and disturb one another from the nests, and break the eggs.

One egg should be always left in the nest for them to lay to, and that should be marked, that it may be easily known. Also the eggs as they are laid should be removed from the nest and marked with the date of their being laid, and the hen laying them, and be placed in a box of bran, and now and then, if laid on the side, be turned over; they are, however, considered best placed with the small end downwards, as it has been found by experience that they keep better in this position, and the following reason is alleged for this effect, the shape of the shell, which is a reversed cone, forms a support to the yolk, and prevents its descending to the shell.

When a hen begins to cluck or be brooding, no more of her eggs should be saved, as from this time her eggs are apt to become imperfect, are frequently without yolks, and often without shells: besides, cockers have a notion that the fowl bred from a clucking hen will not show the same game and bottom as those produced by her first eggs.

If two clutches are wanted from any hen in one season, it is effected more certainly by putting her first clutch of eggs under a dunghill hen, and putting the game hen under a coop where the other hens are about her, till her heat is over, when she may be set at liberty; whereas by removing her, she is forgotten, and when brought back to the other hens fighting ensues.

The next or second clutch she might be allowed to sit upon herself.

When a cock takes a dislike to any brooding or other hen, she should be removed, as he would otherwise injure or destroy her.

About 12 eggs form a proper clutch, as the hen cannot well cover more. When the first chickens are hatched, they may be taken away and placed in a basket with flannel or wool by the fire-side, and be fed with crumbs of bread, and chopped eggs, boiled hard, till the rest are hatched; then they should be placed with the hen at night, as she otherwise might take a dislike and kill them.

The eggs being all hatched, at least, those that are sound and good, the hen and chickens should be conveyed into some dry place, where cats or vermin of any kind cannot get at them. The hen should be cooped to prevent her from wandering from the brood, and getting into wet and dirty places.

The chickens are best fed with crumbs of bread and hard boiled eggs chopped up with it, and this is occasionally changed with advantage for groats or grits, wheat, chopped raw meat, or new cheese and curds, till they are able to eat barley, as they are apt in a short time to cloy with any one kind of food, to pine and die. They should have clean water, at least once a day, and it should be placed out of the sun. About the end of the third or fourth week it is well to set the hen at liberty with her chickens, taking care that she is not annoyed by other hens.

One advantage attends bringing them up under the dunghill hen, which is, that she is less quarrelsome or subject to be disturbed by other hens.

It is a false notion of old times, that the chickens brought up under a dunghill hen will partake of her properties, which is well known by experienced breeders to be untrue.

It is advisable, when the chickens are at an age that their sexes can be distinguished, as at about six weeks or two months old, to select those intended to be kept and to destroy the rest, as the survivors thrive better, and it prevents the brood from being too much distributed, for it is better to purchase fowls for the spit than to keep these to the injury of the rest, unless where the sole object in breeding them is the table.

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In about four months it is ufual for them to begin to crow, and this is the right time to cut their combs, as cutting them early is thought to prevent their fighting together, and they alfo lofe lefs blood than if cut later, when the difficulty of ftopping it is greater, as it is neceffary then to ufe the cautery, or a ftyptic, for the cautery cannot be conveniently applied between the two furfaces or lobes of the comb. In about a few weeks after this, or when they are fent to their walks, their gills and deaf ears may be taken off, by which term is underftood a loofe flefhy whitifh caruncle behind the ear. Some cut the comb clofe, called the "low comb;" others leave an arched portion which is termed the "high comb."

About this period of the life of the young fowl, a difafter frequently happens which fhould be carefully guarded againft; which is, that they will, without any apparent caufe, fight and deftroy each other, and this we think we have obferved to happen more frequently after rain than at other times; perhaps from their being wetted, foiled, and disfigured, they may appear ftrange to each other, and thus are led to begin fighting; at leaft this is the moft probable reafon that has occurred to us.

If this happens before they can with propriety be feparated for different walks, it will be found neceffary to purfue a certain meafure to prevent their fighting; this is ufually accomplifhed by feparating them after fighting and keeping them for fome time without food; another difcipline to prevent this evil confifts in holding the weakeft in your hand, while the ftrongeft fpurs and pecks him till he cries out, or by beating him with a glove or handkerchief, he will afterwards be fatisfied with being fubordinate for a long time; otherwife they are ever fighting and picking or peeling the fkin from the fkull often in a way that they never recover from, and fuch are called peel-pates, and are not allowed in a main.

This ftate of difcipline and fubordination will be promoted by the prefence of the old cock among them, who will fo interfere in their battles as to awe them to a more peaceable demeanour, and this the more effectually if all the hens are removed.

They fhould now, before they are fent to their walks, be marked, and a regular regifter be kept of them. The marks are generally made in the eyelid, noftril, or connecting membrane of the toes by cutting a notch in one or more of them; and are defcribed as right, left, or both eyes or noftrils out or in right or left feet.

Having premifed thus far in raifing them, it is now our bufinefs to fpeak of the moft appropriate walk, which is often among experienced cockers even in fome refpects not fufficiently attended to. Farm-houfes are not always good walks for the reafon above-mentioned, that the game chickens get battered by other fowls. Poor cottages, where they are generally walked, have this difadvantage, that they have not fufficient food; a clear air—good food—pure water, and perfect feclufion from other fowls are the beft requifites on a walk of this kind; at any rate it is proper before they are taken up for fighting that they fhould be feen, and fuch as want it be fed, or, as it is called, hand-fed.

At about a twelvemonth old they are termed *ftags*, and at two years old they are called *cocks*. It may be defirable to try the breed while they are yet ftags, in which cafe the leaft valuable are felected; fuch for inftance as are fhorter-legged than the reft, or are in any refpect deficient in their make; from thefe trials we may be led to prefume upon the courage and action of the reft of the brood, and for this purpofe the ftag may be fought againft a cock of the fame weight, to afcertain his qualities.

Short filver fpurs, in thefe trial-battles, are better than fteel ones, as they are not fo immediately deftructive; and a ftag that beats a cock of equal weight muft have undeniable good qualities, even though he afterwards wins no other battle.

At two years old he becomes a cock, as we have obferved, and is then fit for fighting in the main, or fingle battles. It ftill remains, however, ere we bring him on the ftage, to defcribe the regimen requifite to give him the greateft profpect of advantage, and a fuccefsful iffue to the conteft; as a well-prepared fowl will have the advantage of a fuperior one that is ill-fed, or not prepared.

The fowl is fuppofed to come from his walk in good condition; in which cafe, he will be too fat for fighting, and will have no wind till he is reduced. To effect this, abftinence from food and medicine are required for feven or eight days, before he can be brought to the pit, at leaft, fuch is the regimen purfued by our firft feeders, and is pretty generally as follows: His tail and fpurs being cut fhort, he is put into his pens, and the firft day receives no food; fecond, he has his phyfic, confifting of cream of tartar or jalap, or both united, in the dofe of about five grains of each; or if it be a very fat and large fowl, the dofe may be increafed to ten grains of cream of tartar. Thefe are given him mixed in frefh butter; this generally purges brifkly, and fcours out the inteftines. Immediately after the phyfic is given him, and before it affects him, he is placed on loofe ftraw or a grafs plat with another cock, and allowed to fpar with him. The hots, or muffles, being previoufly tied on their fhort fpurs. In this way he is exercifed till he is a little weary; he is then returned to his pens. Before putting him up it is neceffary to examine his mouth to fee if he has been pecked or wounded in the infide, as fuch wound is apt to canker. To prevent this, it is wafhed with a little vinegar and brandy; he now is allowed his warm mefs to work off his phyfic. This is a diet made of warm ale or fweet wort, and bread in it, with a little fugar-candy; or bread and milk and fugar-candy, a large tea cup full.

He is then fhut up clofe till the next morning, or about 24 hours. If the weather is cold, the room fhould be made warm, or a blanket placed over the pen: if in warm weather he may be clipped out for fighting; but if the weather be cold this is beft left till the time of fighting. The windows of the room fhould alfo be darkened, excepting at feeding times.

Early on the following morning, that is, about the third day, his pen muft be cleaned out from the effects of the phyfic, &c. and clean dry ftraw be given him; his feet alfo fhould be wafhed and wiped clean before he is returned to his pen: if his feet feel cold his pen fhould be made warmer.

He is next to be allowed fome cock-bread, that is, a fort of bread made of ingredients in the following proportions: About three pounds of fine flour and two eggs, and four whites of eggs, and a little yeaft; this is kneaded with a fufficiency of water for a proper confiftence, and is fent to the oven and well baked: fome add, as a great fecret, a fmall number of anifeeds, or a little cinnamon; of this bread, as much as would fill a tea cup, cut into pieces, is given him twice that day; and no water is then given him whatever, as it is conceived highly injurious at the early part of the feeding.

On the fourth day, early in the morning, he fhould receive half a tea cup full of good barley and a little water, in which a toaft has been fteeped fome time. Having eaten this, clean his pen, let him be fupplied with clean ftraw, and let his pen be uncovered for about an hour, while he

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ſcratches and picks the ſtraw. Some think it highly advantageous to prepare the barley for them, by beating and bruiſing it, and thus to take away the ſharp points of the barley, and the huſky ſhell or covering, which is then blown away.

In the afternoon, the ſame quantity of barley may be repeated, but no water.

On the fifth, or next day, he may have the bread as before, but three portions of it, and no water.

On the ſixth, or weighing day, very early in the morning, give him the bread, as before: he is then to be weighed, and afterwards a good feed of barley and water ſhould be given. Some hold it a valuable ſecret to give them fleſh, as ſheep's heart, for this and the ſucceeding day, chopped ſmall, and mixed with the other food.

On the ſeventh day, or day before fighting, early in the morning, let him have the ſame feed of barley; in the afternoon bread and the white of an egg boiled hard, and a little water.

On the eighth, or day of fighting, he may have a little barley, as about 40 grains; ſome recommend it to be previouſly ſteeped in port wine, which, we are not aſſured, is at all uſeful. If, at any period of the feeding, the food ſhould remain in his crop, no more ſhould be given him till it is removed, which a bit of apple or cheeſe will aſſiſt in digeſting: and ſhould the fowl dung looſe or purge, when not required, it may be counteracted, by giving him a little hemp-feed, which ſome ſteep in brandy. A little wheat or millet-feed may alſo be added to his food. Repeated trials have taught us that about 2 oz. may be taken away, or ſuperadded to the weight of a fowl for one day, by the above means without injury: about eight is as much as he ſhould ever gain or loſe in the whole.

He is next cut out for fighting, that is, his wings rounded, the hackle and ſaddle feathers cut ſhorter, the feathers about the vent cut cloſe off, and the curly feathers of the tail, leaving only the vane or fan, which is ſhortened about one-half. The ſpurs are now placed on his legs, and he is fitted for the battle: in placing his ſpurs on, they ſhould not be tied too tight, leaſt he be cramped, or too ſlack, leaſt they get looſe; for ſhould they come off, or even break, during the battle, they are not allowed to be replaced. The point of the ſpur ſhould be carefully obſerved to be neither to the outſide or inſide of the hock or heel, but exactly behind, and in a line with it; the hunckle or hock is taken as a guide for its direction, following that of the natural ſpur.

There remains for us to make one remark more to render theſe matters clear, which is, that, although eight days are found to be a ſufficient time to prepare a fowl for battle, yet, in a main, ten days are commonly taken for the purpoſe, purſuing a ſimilar treatment to the foregoing. The cocks are weighed on the eighth, and the lighteſt begin fighting on the tenth day, ſo that the larger cocks, which are to fight in the latter part of the main, and have been conſiderably reduced, are brought up again by a greater proportion of food than the medium quantity we have deſcribed, and which ought alſo to be adminiſtered oftener in the day. The ſucceſs of the main often depending upon the proper management of the latter fowls, much muſt be left to the ſkill and judgment of the feeder, who ought to be intimately acquainted with the nature and conſtitution of the fowl, that he may be enabled to bring him to the battle in the beſt poſſible health and condition, neither diſtreſſed by medicine or abſtinence, before he is weighed, nor rendered inactive by overfeeding afterwards, as, in either caſe, he has not a fair chance for his life.

Such is the art of cocking; if, by unveiling its myſteries and ſtripping it of diſguiſe, the purſuit becomes leſs alluring and ſeductive to the votaries of the cock-pit, we may have contributed to remove a temptation, the indulgence of which does not appear conducive to the improvement of the morals of mankind. However, it ſhould not be concealed that, conſidered as an art, for maintaining the genuine propenſities of a noble animal; it is entitled to the reſpect of naturaliſts.

"Cock-fighting," ſays Mr. Pegge, "is an heatheniſh mode of diverſion from the firſt; and at this day ought certainly to be confined to thoſe barbarous nations abovementioned; the Chineſe, Perſians, Malayans, and the ſtill more ſavage Americans, whoſe irrational and ſanguinary practices ought, in no caſe, to be objects of imitation to more civilized Europeans."

Cock, in *Mechanics. Figs.* 3 and 4, *Pl.* XIV. *Mechanics,* repreſent two of Handaſyd and Rudder's patent corked plug-cocks, of which A is the end to be driven into the caſk, and B the ſpout, as in common; C. *fig.* 3, is the plug, which has a triangular, or other ſhaped top, and is to be turned by a key, *fig.* 1, which has a ſimilar hole in it. To the part D, a hollow cylinder of braſs, *fig.* 2, is ſoldered; it has a hole in its top, correſponding with the key; in order to keep the plug down in its place, a ſmall ſpiral ſpring, E, is applied, the lower end of which acts on a collar in the plug, *fig.* 3, and the upper end againſt the top of the braſs cylinder, *fig.* 2; at the bottom of the cock at F, the plug does not paſs quite through the cock, but there is a hole at the bottom to pour in oil to the plug of the cock, which hole is then cloſed by a ſcrew.

Figs. 4 and 5, ſhow the application of the ſpring to a common cock, the plug of which is to be turned by a crutch or handle; the plug, *fig.* 5, is ſomewhat longer than the cock, and a ſpring, E, of two turns, is applied, ſo as to act between the bottom of the cock and the head of ſcrew F, ſcrewed into the plug; another part of this patent applies to the putting of a collar of cork round in a groove, G, *fig.* 5, in the plug, as a farther ſecurity againſt leakage.

In 1797, Mr. Joſeph Bramah took out a patent for various improvements in cocks, one of which is ſhown in *figs.* 6 and 7; the plug, *fig.* 6, is hollow, and has a hole, A, in its ſide; the end, B, is ſquare, to put on the handle D, by which it is turned; the cock unſcrews at E, *fig.* 7, for putting the plug in and out, and the ſquare end, B, of the plug comes through a hole in the end of the cock. The end, F, is inſerted into the caſk, and the water is brought to the inſide of the plug, *fig.* 6; it is plain, that when the plug is turned, ſo that the hole, A, correſponds with the hole through the ſpout G, *fig.* 7, the cock is open, and ſhut when they do not coincide, owing to the plug being turned part round; the advantage of this cock is, that the preſſure of the water always tends to puſh the plug farther into it, and by that means keeps it water-tight.

Fig. 8 is another cock, poſſeſſing the ſame advantages, for which Mr. Bramah took out a patent in 1783; A B is a cylindric braſs tube, the end, A, of which is ſcrewed into the veſſel, and the other end has a ſtuffing-box in it, for the poliſhed rod, D, to paſs through; one end of this rod has a knob, E, to move it by, and the other has a plug, F, on it, which fits into the conical end of the tube A B. The operation of opening the cock is puſhing the knob E, which opens the valve or plug, F, and permits the water to run out at the ſpout G. The ſtuffing-box conſiſts of a plate, *a*, with a hole through it, laid upon a ſhoulder near the end of the tube A B; and the end of the tube beyond that is ſcrew-tapped, into which is ſcrewed a plug, *b*, which has alſo a

 hole

hole through it for the rod, D, to pass through, and the part which projects beyond the tube is square, for the convenience of turning it by a winch; between this plate, *a*, and the plug, *b*, a small quantity of hemp, tow, &c. is put round the rod, and by screwing the plug, *b*, tight, it is made to embrace the rod so closely, as to prevent any water getting through.

Fig. 9 is the common ball-cock; the plug, A, of this cock is held in by a screw or rivet, in the common manner; it has a copper rod, B, fastened to it, to the other end of which a globular ball, D, of thin copper plate is soldered, which, by its buoyancy, gradually shuts the cock as the water rises in the vessel, and prevents its running over; and as the water in the vessel is drawn, and again sinks, the cock opens to let in more water.

Figs. 10, 11, 12, 13, 14, and 15, exhibit the sliding or sluice cock, common in breweries, distilleries, &c. A A (*figs.* 14 and 15), is a frame, whose internal edges are nicely polished; on each side of this frame a cast-iron plate, B (*figs.* 15 and 13), is screwed, which has a piece of pipe and a flaunch to connect it with the pipes which bring and carry away the liquor; in the cavity formed by the frame, A, *fig.* 15, a slider, D (*figs.* 15 and 12), is introduced, one face of which is well polished to make it fit close to one of the side-plates B, and it is farther pressed up by two steel springs, *a*, *a*, screwed to the back of the slider D, and acting against one of the side plates B; to the slider, D, a well polished rod, E, is attached, and passes through a stuffing box, F (*figs.* 15 and 11) similar to the one above described; to the other end of the rod, E, a rack, G, (*figs.* 15 and 10) is fastened, which works into a pinion L, (*fig.* 10) in the frame H, (*figs.* 10 and 15) supported by two uprights, I, I, screwed to the upper flaunches of the side plates, B (*figs.* 13 and 15). When the slider, D, is down, as in *fig.* 15, the hole through the side plate, B, is covered, and the liquor assists the springs, *a*, *a*, in pressing the slider close to the plate, and keeping it tight; but when the pinion, L, is turned by a winch, the slider is drawn up, and opens a passage for the liquor.

Cock, *in a watch or clock.* See Balance.

Cock *of a dial*, the pin, style, or gnomon. See Gnomon.

Cock *boats*, small boats used in rivers, or near the shore, which are of no service at sea, because too tender, weak, and small.

Cock, *black*, black grous or game. See Tetrao *tetrix*.

Cock, *bloody-heeled*. See Heeler.

Cock, *castrated*. See Capon, Cock *supra*, and Poultry.

Cock, *gor*, Gor-*cock*, is the moor cock, or red grous, Tetrao *scoticus*

Cock, *grubbing of a*. See Grubbing.

Cock, *high bearing*, is a term used with respect to fighting cocks; denoting one larger than the cock he fights. As a *low-bearing cock* is one overmatched for height.

Cock, *hybrid*, hybrid grous. See Tetrao *hybrida*.

Cock, *Indian*, the origin of our common poultry found wild in India. The Curassow-bird, Crax *alector*, has been called improperly the Indian cock, being an inhabitant of South America.

Cock *of the rock*, or *rock manakin*. See Pipra *rupicola*.

Cock *of the wood*, or *mountain*. See Tetrao *urogallus*.

Cock-*paddle*, in *Ichthyology*, a name by which the common lump-sucker is known.

Cock-*throppled*, a name given by dealers in horses to one whose wind-pipe is small, and bends like a bow when he bridles his head. See Horse and Hunter.

Cock, *wood*, wood-cock. See Scolopax *rusticola*.

Cock-*water* is a stream of water brought in a trough, through a long pole, in order to wash out the sand of the tin-ore into the launder, while it is bruising in the coffer of a stamping-mill.

Cocks, aboard a ship, are little square pieces of brass, with holes in them, and put into wooden shivers to keep them from splitting and galling by the pins of the blocks in which they move.

COCKADE, in French, *cocarde*, in *Military Language*, a ribbon worn in the hat. As a military mark it succeeded the scarf, which was formerly worn by the officers and soldiers belonging to the different nations of Europe, the principal of which, in respect of this mark, are distinguished in the following manner: Both in the British army and navy, the officers wear cockades of black silk ribbons, the non-commissioned officers, private soldiers, and marines, black hair ones. The French cockades are made of light blue, pink, and white ribbons, mixed together, and are called *tricolor*, or three-coloured. The Spanish cockade is red; the Prussian black; the Austrian black; the Russian green, and so forth. Under the old government of France, officers were not permitted to wear a cockade, unless they were dressed in regimentals. There are certain old regiments in the Prussian service, of which neither the officers nor men wear cockades. In this country the cockade, till of late years, was worn by military men of all ranks and descriptions, both with regimentals and without them. But, for reasons best known to those who have the regulation of such matters, a military man, when out of regimentals, is not at present distinguished or known from any other person.

COCKATOO, in *Ornithology*, a family of the psittacus, or parrot tribe, *Brachyuri*, *cauda æquali* of Gmelin, or those having the tail short, and equal at the end. There are nine species of the cockatoo kind; namely, the Crowned, Black, Banksian, Funereal, New South Wales, White, Red-vented, Molucca, and Yellow-crested. See Psittacus.

COCKATOON, a name given by some writers to the white cockatoo, Psittacus *sulphureus*.

COCKBURN, Catharine, in *Biography*, a lady of considerable literary attainments, was born in London in 1679. She was the daughter of captain Trotter, a native of Scotland, and commander in the navy, in the reign of Charles II., who died while his daughter was very young, leaving the family in narrow circumstances. In her own language, in writing, and in French, Miss Trotter was principally her own instructor; but she obtained some aid in acquiring the elements of the Latin tongue, and the first principles of logic; of the latter she drew up an abstract for her own use. She gave very early evidences of a poetic turn, and when she was but a mere child, surprised her friends with some extemporary verses on an incident that happened in the street. She was educated in the principles of Protestantism, from which, however, she was estranged, by her intimacy with some Roman catholic families. Considerable pains were taken to bring her back to the religion in which she had been brought up, but without effect. When she was only 17, she wrote a tragedy, entitled "Agnes de Castro," which was well received by the public, and acted with considerable applause at the theatre royal. Two years after she composed another tragedy, entitled "Fatal Friendship," which was represented at the theatre in Lincolns Inn Fields, and obtained for the author a considerable share of celebrity. This play is regarded as the most perfect of her dramatic performances. About this period she

wrote

wrote ſeveral other poetical pieces, ſome of which were intended for, and introduced on the Engliſh ſtage. Her genius, and the powers of her mind, were not confined to poetry; ſhe was devoted to metaphyſical ſtudies, and was a great admirer of the "Eſſay on the Human Underſtanding." When ſhe was but 22 years of age, ſhe vindicated the principles of Locke, againſt an attack made upon them by Dr. Thomas Burnet. To this work ſhe did not affix her name, as well from an apprehenſion that the public might be prejudiced againſt a metaphyſical treatiſe written by a woman, as from a ſort of dread of being known to Mr. Locke as his defender. In an anonymous addreſs to that great man, ſhe ſtyles her work "a bold and unlicenſed undertaking;" and declares, that though ſhe ventures to publiſh her defence of Mr. Locke, yet it was "not without much apprehenſion and awe of his diſpleaſure." Her name was not long concealed, and Mr. Locke wrote her a very kind letter of thanks; and through his relation, Mr. King, afterwards lord chancellor, he made her a preſent of ſome books. She was ſtill a Roman catholic, and is ſaid to have injured her health, by the frequent abſtinence and faſtings enjoined by that church. She was, however, no bigot, and exhibited the utmoſt liberality to thoſe who held different religious tenets; and, upon a full inveſtigation of the queſtion, ſhe returned to the communion of the church of England, from which ſhe never afterwards departed. This change occurred in 1707, and in the following year ſhe married Mr. Cockburn, a clergyman, who had taken orders; but his ſcruples concerning the oath of abjuration, required at the acceſſion of George I., obliged him to reſign his employment as a clergyman, and to undertake the laborious office of aſſiſtant to a ſchool. He now found much difficulty in maintaining his family; but Mrs. Cockburn applied herſelf with great aſſiduity to the important duties of wife and mother. In the year 1726, ſhe again became the defender of Mr. Locke, whoſe opinion with regard to the reſurrection of the ſame body, had been controverted by Dr. Holdſworth. About this period Mr. Cockburn had overcome thoſe ſcruples which drove him from the church, and was invited to take the office of miniſter to an epiſcopal congregation at Aberdeen. Mrs. Cockburn wrote "Remarks upon ſome Writers in the Controverſy concerning the foundation of Moral Duty and Moral Obligation," which were publiſhed in the "Hiſtory of the Works of the Learned." She next drew up a confutation of Dr. Rutherford's "Eſſay on the Nature and Obligation of Virtue," in vindication of the contrary principles and reaſonings enforced in the writings of the late Dr. Clarke. This was publiſhed by Dr. Warburton, to whom ſhe had ſent it in MS. and who wrote a preface on the occaſion, in which he ſays, that "it contains all the clearneſs of expreſſion, the ſtrength of reaſon, the preciſion of logic, and attachment to truth, which make books of this nature really uſeful to the common cauſe of virtue and religion." The merit of this performance, the vivacity, acuteneſs, and ſtrength which were diſplayed in it, in the diſcuſſion of ſome of the moſt intricate and abſtruſe queſtions, excited the curioſity of the public reſpecting the concealed author. Her friends now ſet on foot a ſubſcription to publiſh all her works, in which ſhe readily concurred, but ſhe did not live long enough to diſcharge the office of editor; this was afterwards undertaken and executed by Dr. Birch. She died on the 11th of May, 1749, in the 71ſt year of her age, having ſurvived her huſband only about four months. In early life Mrs. Cockburn was celebrated for beauty, as well as for her genius, and other accompliſhments. Her figure was not prepoſſeſſing, but ſhe was diſtinguiſhed by the unuſual vivacity of her eyes, and the delicacy of her complexion. She was ſtrictly virtuous, benevolent, and generous, as far as her ſtraitened circumſtances would admit. In the year 1751, her works were publiſhed in two vols. 8vo. by Dr. Birch, who ſays of the author, that "her abilities as a writer, and the merit of her works, will not have full juſtice done them, without a due attention to the peculiar circumſtances in which they were produced; her early youth, when ſhe wrote ſome; her very advanced age, and ill ſtate of health, when ſhe drew up others; the uneaſy ſituation of her fortune during the whole of life; and an interval of nearly 20 years in the vigour of it, ſpent in the care of a family, without the leaſt leiſure for reading or contemplation. After which, with a mind ſo long diverted and encumbered, reſuming her ſtudies, ſhe inſtantly recovered its entire powers, and in the hours of relaxation from her domeſtic employments, purſued, to their utmoſt limits, ſome of the deepeſt inquiries of which the human mind is capable." Birch. Biog. Brit.

Cockburn *iſlands*, in *Geography*, a group of ſmall iſlands that lie off the N.E. coaſt of New Holland, S.W. of Cape Grenville, which lies in S. lat. 11° 58′, W. long. 217° 38′.

COCKBURNE, a townſhip of America, in the northern part of New Hampſhire, and the county of Grafton, on the E. bank of Connecticut river, S. of Colebrooke.

Cockburne, William, in *Biography*, an ingenious and learned phyſician, flouriſhed the latter part of the 17th and beginning of the laſt centuries. He was for ſome years phyſician to the royal navy, where he acquired a knowledge of the ſcurvy, and other diſeaſes incident to ſailors. Quitting the navy, he came to London, where he ſoon diſtinguiſhed himſelf by his ſuperior ſkill and abilities, and was thence aſſociated with the college of phyſicians, made a fellow of the royal ſociety, and phyſician to king William. His works are a "Treatiſe on Sea Diſeaſes, explaining their Nature, Cauſes, and Cure, to which is added an Eſſay on Bleeding in Fevers." This book has been frequently re-printed, and was early tranſlated into the German and French languages. The principal cauſe of ſcurvy is the diet, to which ſailors are neceſſarily confined in long voyages. Medicine can do little in the cure, which can only be effected by a diet of freſh proviſion, and taking the ſick on ſhore. Fevers are to be cured by emetics and purges, and not by ſudorifics, which, by waſting the fluids, occaſion coſtiveneſs, to which ſailors are much inclined, from feeding on biſcuit. He defends the uſe of the Peruvian bark, which many at that time denied. "Profluvia Ventri," 1702, 8vo., afterwards tranſlated and publiſhed in 1721, under the title of "A Cure of Looſeneſſes." "The Symptoms, Nature, Cauſes, and Cure of Gonorrhœa," London, 1713. 8vo. That it may exiſt, he contends, without any taint of the venereal diſeaſe. The cure is to be effected by giving firſt purges, and afterwards terebinthinate medicines. "Œconomia Corporis Humani," London, 1695, 8vo. Neither the pulſe nor urine, he ſays, afford any certain indices of the ſtate of fever: neither is perſpiration burſting out ſpontaneouſly, often critical; it is ſtill leſs ſo when excited by warm medicines and drink. This work was much noticed in its time; but more accurate treatiſes on the ſubject have occaſioned it to fall into neglect. Haller. Bib. Med. Eloy. Dict. Hiſt.

COCK-CHAFFER, in *Entomology*, the *ſcarabæus melolontha* of Linnæus, and *melolontha vulgaris* of Fabricius. The colour is teſtaceous brown, with the thorax hairy; tail inflected, and a triangular white ſpot at each inciſure of the abdomen.

Inhabits the northern parts of Europe, and is highly injurious to agriculture. The larva is ſoft and grey, wi

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the head and legs protected by a shelly covering of a yellow brown colour. While in the larva state, which continues for the space of three years, it devours the roots of grass, corn, and other vegetables. This mischievous creature subsists also on the leaves and tender buds of trees, and is from that circumstance denominated the *tree-beetle.* They are eagerly sought after, and devoured by crows, rooks, and other birds, as well as animals: it is the larva of this insect that is so frequently turned up in ploughing, and in quest of which the crows are often seen following the track of the plough-shares.

COCKER, a river of England, which runs into the Derwent at Cockermouth.

COCKERINGS, an exaction or tribute in Ireland, now reduced to chief rents.

COCKERMOUTH, in *Geography*, a borough town of Cumberland in England, derives its name from its situation at the mouth of the river Cocker, which separates it into two parts, and then falls into the Derwent, near the western extremity of the town. The streets are spacious, but irregularly built; yet many of the houses are neat, especially those on the acclivity towards the castle. The moot-hall, market-house, and shambles, have an ancient gloomy appearance, and, like most public buildings in the northern towns, prove a considerable obstruction to passengers, from being situated in the midst of a principal street. The church, which is spacious, but has no aisles, was rebuilt of free-stone in the year 1711, with the exception of the ancient tower. Several schools have been founded by subscriptions and bequests: and a dispensary for the relief of the indigent poor was established in 1793, to the benefit of which several thousand persons have been admitted. The ruins of the castle occupy the summit of an artificial mount, raised on a precipice above the Derwent, near its confluence with the Cocker. It appears to have been a fortress of great strength and extent, of a square form, and guarded by square towers: the compass of the wall measuring almost six hundred yards. It was anciently the baronial mansion of the lords of Allerdale; and is generally affirmed to have been built within a few years after the conquest, by Waldeof, the first of those lords. Cockermouth was anciently a hamlet to Brigham, but was constituted a distinct parish in the reign of Edward III. It has only enjoyed the privilege of representation in parliament since the year 1640, except one return made 23 Edward I. The right of election is in the inhabitants having burgage tenure, whose number is 165. The parts of the town, on each side of the Cocker, are connected by a bridge of one arch: on the north side is an artificial eminence, called Toot-hill, resembling the large barrows found in many parts of England. The hills on the opposite side of the Derwent, in this neighbourhood, are of a kind of calcareous stone, almost wholly composed of shells of the anomia genus. Cockermouth is 305 miles N. from London; has a weekly market on Mondays: the population under the late return was nearly 3000, the number of houses 433. The chief manufactures are hats, common woollen cloths, shalloons, checks, and coarse linens. Hutchinson's Hist. of Cumberland.

COCKERMOUTH, a town of America, in Grafton county, New Hampshire, about 15 miles N.E. of Dartmouth college. It was incorporated in 1766, and in 1775 contained 118 inhabitants, and in 1790, 373.

COCKET, or COCQUET, a seal belonging to the king's custom-house.

COCKET, or *Cocquet*, is a scroll of parchment, sealed and delivered by the officers of the custom-house to the merchants, upon entering their goods; certifying that the goods were customed. It likewise gives name to an office appointed for this purpose.

The same word is also used in the statute of bread and ale, 15 Hen. III. in which is mentioned *cocket-bread*, among several other kinds; it seems to have been hard sea-biscuit, which, perhaps, had then some cocket, mark, or seal; or else was so called from its being designed for the use of the cockswains or seamen.

COCKING *Cloth*, a device for the catching of pheasants. It consists of a piece of coarse canvas, about an ell square, dipped in a tan-pit to colour it; and kept stretched by two sticks, placed from corner to corner, diagonal-wise; a hole being left to peep through. The sportsman then, being provided with a short gun, carries the cloth before him at arm's-end; under cover of which, he may approach his game as near as he pleases: when near enough, he puts the nosle of his gun through the hole, and shoots.

COCKLE, in *Botany*. See AGROSTEMMA *githago*, and LOLIUM *temulentum*. See also DARNEL-*grass*.

COCKLE, in *Conchology*. See CARDIUM. Many fossil shells, known under this name, are found lodged in the British strata; *e. g.* within the soil of Norfolk, in the lime-stone strata of Derbyshire, in the free-stone quarries upon King's down, near Bath, &c.

COCKLE-*stairs*. See STAIRS.

COCKLE-*shell Bay*, in *Geography*, a bay on the east coast of the island of St. Christopher. N. lat. 17° 22′. W. long. 62° 22′.

COCK-KNEE STONE. See ECHINUS.

COCKPIT, a sort of theatre, whereon game-cocks fight their battles. The cockpit is usually a house or hovel, covered over: they fight on the clod, or green sod; which is generally marked out round, and encompassed with seats, one above another. See COCK *of the Game*.

COCKPIT, in a man of war, is a place on the lower floor, or deck, abaft the main-capstan, lying between the platform and the steward's room; where are subdivisions or partitions, for the purser, the surgeon, and his mates.

COCK-*roach*, in *Entomology*. See BLATTA *orientalis*.

COCKROAD, a contrivance for the taking of woodcocks. This bird lies close by day, under some hedge, or near the root of an old tree, to peck for worms under dry leaves, and will scarce stir out, unless disturbed; as not seeing his way so well in the morning; towards the evening he takes wing to seek for water, flying generally low; and when he finds any thoroughfare in a wood, he ventures through it.

To take them, therefore, they plant nets in such places; or, for want of such places ready to their hands, they cut roads through woods, thickets, groves, &c.

These roads they usually make thirty-five, or forty feet broad, perfectly straight and clear; and to two opposite trees they tie the net, which has a stone fastened to each corner. Then, having a stand, or a place to lie concealed in, at a proper distance, with a stake near the same, to fasten the lines of the net to; when they perceive the game flying up the road, they unwind the lines from off the stake; upon which, the stones drawing it down, the birds are entangled in the same.

COCK'S-*comb*, in *Botany*. See CELOSIA *cristata*, C. *margaritacea*, C. *coccinea*, and RHINANTHUS *crista galli*.

COCK'S-*foot grass*. See DACTYLIS.

COCK'S-*head*. See HEDYSARUM *onobrychis*.

COCKSON, THOMAS, in *Biography*, an engraver, in all probability an Englishman, by whom we have a great many portraits, executed with the graver in a neat, but rather a stiff manner. Amongst other prints by him are the following: King James I. sitting in parliament, a large print; king Charles I. sitting in parliament, likewise a large print; the

the princefs Elizabeth, daughter of James I.; Samuel Daniel, dated 1609: Concini, Marquis d'Ancre, 1617, &c. Strutt Heinecken.

COCKSWAIN, Cockson, or Coxen, an officer on board a man of war, who hath the care of the boat or floop, and all things belonging to it. He is always to be ready with his boat's gang or crew, and to man the boat on all occafions. He fits in the ftern of the boat and fteers; and hath a whiftle to call and encourage his men.

COCLES, Publius Horatius, in *Biography*, a celebrated Roman, defcended from one of the Horatii who fought againft the Curiatii. In the year of the city 247, he oppofed the whole army of Porfenna, king of the Etrufcans, at the head of a wooden bridge acrofs the Tiber, which joined the Janiculum to the city. When the bridge was deftroyed, Cocles, though wounded by the darts of the enemy, leaped into the Tiber, and fwam with all his armour on his back. A brazen ftatue was raifed to him in the temple of Vulcan, by the conful Publicola, for his great fervices. He had the ufe of only one eye, as the name Cocles fignifies. Livy. Val. Max. Virgil.

Cocoa *Iflands, Great and Little*, in *Geography*, a group of iflands, fo called from their being clothed with cocoa-nut trees of unufual luxuriance, and fituated in the Indian ocean, to the north of the Andaman iflands, about N. lat. 14° 20′. E. long. 93°. Thefe iflands are fmall, flat, and fwampy; they are uninhabited, and deftitute of good water. In fteering between the Southern Cocoa, and the north end of the ifland of Andaman, Port Cornwallis opens on the eaft fide of the latter.

Cocoa-*nut Ifland*, or Cocos, a fmall ifland at the entrance of Carteret's harbour, on the S. E. coaft of New Ireland. Between this ifland and Leigh's or Laig ifland, there is fhoal water, and each of them forms an entrance into the harbour; the S. E. or weather entrance is formed by Leigh's ifland, in which is a rock appearing above water, called by Capt. Carteret "Booby rock:" the paffage is between the rock and the ifland, nor is the rock dangerous, there being deep water clofe to it. The N. W. or lee entrance, is formed by Cocoa-nut ifland, and this is the beft, becaufe it has good anchorage, the water in the other being too deep. Capt. Carteret entered the harbour by the S. E. paffage, and went out of it by the N. W. At the S. E. end of the harbour there is a large cove, which is fecure from all winds, and fit to haul a fhip into. Into this cove a river feemed to empty itfelf. In the N. W. part of the harbour, there is another cove, fit for a fhip to haul into, fupplying good water, and very convenient both for wooding and watering. The higheft part of the ifland of Cocos is not above 75 toifes above the level of the fea, and is formed of calcareous ftones. This ifland is terminated on the S. E. and N. W. by the fame kind of ftones. It is covered by large trees, which always preferve their verdure. The ifland produces fig-trees and vines of different fpecies in great abundance; but cocoa-nuts are fcarce. Cocos and Laig abound with infects of various forms and colours.

Cocoa-*nut*, in *Botany*. See Cocos.

Cocoa-*plum*. See Chrysobalanus.

Cocoa-*point*, in *Geography*, a cape on the coaft of the ifland of Tinian.

COCOI, in *Ornithology*, a beautiful bird of the ardea or heron tribe, the blue heron of Albin and other Englifh writers. This fpecies inhabits Brafil and Cayenne; its length is about three feet, and it is fpecifically diftinguifhed by having the hind head, pendent creft, and back cinereous; neck beneath fpotted with black, and the fides of the head black. This is the *foco* of Buffon, and *ardea cayanenfis criftata* of Briffon.

COCOMARICOPAS, in *Geography*, a kind of favages in Spanifh North America, who live near the banks of the river Colorado, and who are dextrous in fwimming acrofs, holding in the left hand a piece of wood, which fupports their arms and burthen, and fteering with the right; while the women, fupported by a kind of petticoat of bafket work, upon which they place their children, pafs in like manner.

COCONATO, a town of Italy, in the principality of Piedmont; 4 miles S. of Crefcentio.

COCONOR. See Kokonor.

COCOON. See Silk.

COCORTO. a town of Afia, in the country of Thibet; 50 miles S. S. W. of Tchontori.

COCOS, in *Botany*, (according to Cafpar Bauhin, the fruit is called by the Portuguefe *coco*, or *coquen*, from the three holes at the end of the fhell, which give it the appearance of a monkey's head.) Linn. Gen. 1223. Schreb. 1692. Juff. 38. Vent. 2. 128. (Coccos; Gært. 21. Cocotier; Encyc.) Clafs and order, *monœcia hexandria*. Nat. Ord. *Palmæ*; Linn. Juff. Vent. Male and female flowers on the fame fpadix. *Cal.* Spathe univerfal, one-valved, fpadix branched. *Males.* *Perianth* three-leaved; leaves almoft trigonous, fmall, acute, concave, coloured. (fix-leaved; Gært.) *Cor.* Petals three, egg-fhaped, acute, fpreading (none; Gært.) *Stam.* Filaments fix, the length of the corolla; arrow-fhaped. *Pift.* Germ fcarcely vifible, abortive; ftyles three, fhort; ftigma obfolete. *Females.* *Perianth* three-leaved; leaves roundifh, concave, converging, coloured, permanent. *Cor.* Petals three, refembling the leaves of the calyx, permanent. *Pift.* Germ fuperior, roundifh or egg-fhaped, (three-celled; Gært.); ftyle none; ftigmas three. *Peric.* Drupe very large, coriaceous, roundifh, obfcurely triangular; nut large, fomewhat egg-fhaped, acuminate, one-celled, valvelefs, hard, obtufely triangular, perforated by three holes; kernel hollow.

Eff. Ch. *Males.* Calyx three-leaved; corolla three-petalled, ftamens fix. *Females.* Cal. and Cor. as in the males; ftigmas three, drupe coriaceous.

Sp. 1. C. *nucifera*. Cocoa-nut tree. Linn. Sp. Pl. Mart. 1. Lam 1. Jacq. Amer. 277. tab. 168. Pict. 135. Gært. tab. 4, 5. Lam. Ill. tab. 894. (Palma indica coccifera angulofa; Bauh. Pin. 508. Nux indica; Lob. ic. 2. p. 273. Tenga; Rheed. Mal. 1. tab. 1, 2, 3, 4. Calappa; Rumph. Amb. tab. 1, 2.) "Unarmed; fronds pinnated; leaflets folded back, enfiform." *Trunk* from forty to fixty feet high, of a moderate thicknefs in proportion to its height, ftraight, naked, marked with the fcars of fallen leaves. *Leaves* from ten to twelve, cluftered, forming a terminal head; upper ones erect, middle ones horizontal, lower ones rather drooping, from ten to fifteen feet long, about three feet broad, pinnated; common petiole naked near its bafe; leaflets numerous, petioles in two ranks, which are a little inclined to each other. *Spathes* oblong, acute, opening on one fide. *Flowers* yellowifh white, feffile, in a branched panicle; female ones near the bafe of the branches; male ones more numerous, covering the upper part. *Fruit* nearly as large as a man's head, cluftered, egg-fhaped, obfcurely three-fided, with rounded angles, umbilicated at both ends, with three obtufe projections; external rind thin, even-furfaced, very tough; inner one extremely fibrous; fhell of the nut nearly globular, hard, with three raifed fpurious futures, and three holes at the bafe clofed with a black membrane; kernel white, in firmnefs and tafte refembling that of the hazel-nut, hollow, containing a milky fluid. This kernel in fome plants is near an inch thick, enclofing about a pint of fweet, delicate, wholefome refrefhing liquor. A native of Africa, of the Eaft and Weft Indies, and of South America, in a fandy foil; bearing

fruit

fruit twice or three times a year. Travellers, from the time of Dampier to the prefent day, are profufe in their praifes of this tree, and of the various ufeful purpofes to which it is applied by the inhabitants of the warm climates, in which it is indigenous. Its trunk is made into boats, rafters, the frames of houfes, and gutters to convey water. The leaves are ufed for thatching buildings, and are wrought into mats, bafkets, and many other things for which ofiers are employed in Europe. They are alfo written upon by the Eaft Indians as a fubftitute for our paper and parchment. The fibrous coat or hufk of the fhell, after being foaked in water, is beaten into oakum, fpun into a variety of yarns, woven into fail-cloth, and twifted into ropes and cables even for the largeft fhips. For thefe purpofes it is preferable to hemp on account of its greater durability. (fee COIR). The woody fhell itfelf, or nut which enclofes the kernel, is polifhed and formed into goblets, powder-boxes, and various kinds of cups. In Siam it is generally employed as a liquid meafure, and its capacity is determined by filling it with cowries (cypræa moneta: Linn.) fmall univalve fhells current in that country inftead of coined money. Thus there are cocoas of 1000 cowries, of 500, &c The kernels, preffed in a mill, yield an oil, which is faid to be the only one ufed in the Indies at the table. When recent it is equal in goodnefs to the oil of fweet almonds; but it foon becomes rancid, and is then employed only by painters. If the end of the young fpathes be cut off, or the body of the tree be bored, there exudes from the wound a white, fweet liquor, which is collected by the natives in pots, properly tried for the purpofe; but by this operation the tree is inevitably rendered barren: the juices neceffary for the ripening of the fruit being entirely exhaufted. The liquor, thus procured, is called palm wine, and is a favourite beverage in the country. It is very fweet when frefh; kept a few hours, it becomes more poignant and agreeable; but the next day it begins to grow four, and in the fpace of twenty-four hours is compleat vinegar. By diftillation it produces a tolerably good brandy, or as it is there called arack, more efteemed than that obtained from rice. Boiled with quick-lime, it thickens into the confiftence of honey; and after long evaporation, acquires the folidity, and in fome degree the thicknefs of fugar. As fuch it is ufed by the confectioners, but is much inferior to the produce of the fugar-cane. The tender leaves, before they fully expand, are fometimes eaten in place of cabbage and other culinary greens; but as this luxury can be obtained only by the deftruction of fo valuable a tree, it is generally thought too expenfive a treat, except in thofe parts of the country where the plantations are numerous. 2. C. *butyracea*, Linn. jun. Supp. 454. Mart. 2. Lam. 2. (Pindova; Pif. Braf. 125. Pindoba; Rai. Hift. 1361.) "Unarmed; fronds pinnated; leaflets fimple." A loftier tree than the preceding fpecies, with a larger head. *Univerfal fpathe* from four to fix feet long, cylindrical-oblong, leffened at both ends, woody; even-furfaced within; rendered uneven on the outfide by numerous, longitudinal parallel projections, a little remote from each other about the middle of the fpathe, but approaching, and almoft united near the fummit; fplitting longitudinally, and falling off after the expanfion of the fpadix. *Spadix* the length of the fpathe, branched; branchlets a foot long, quite fimple, much crowded, one or two in each palm, containing only male flowers; fix or eight others, both male and female. In thofe which have only males, each of the flowers is fupported by a fmall, fomewhat egg-fhaped, rigid bracte; leaves of the proper perianth three, refembling fcales, very fmall, oblong, flattifh, a little united at the bafe, rather erect; petals three, linear, roundifh, leffened at both ends, fix or eight lines long, bent different ways above the middle, very white, fucculent, flightly connected at the bafe, alternating with the calyx-fcales, even furfaced; filaments fix, filiform, three times fhorter than the petals, inferted into the receptacle, fomewhat united; anthers linear, the length of the filament, verfatile, bifid at the bafe, two-celled; pollen refembling fawduft, white, very fmall. Thefe flowers fall off at the irruption of the fpadix, or on the leaft touch, making a great heap under the tree. Male flowers of the androgynous fpadixes fimilar to the former, but continuing longer; thofe intermingled with the females, thinly fcattered, but in the upper part, where there are no females, much crowded; petals thinner; filaments fhorter; anthers with two horns. Female flowers crowded in an imbricate manner; bractes triple, rather loofe, quite flat; leaves of the calyx three, hard, cartilaginous, large, egg-fhaped, concave, broad and fomewhat rounded at the bafe, nearly covering the other parts of the flower; petals three, white, flefhy, refembling the leaves of the calyx, but fhorter and thinner; nectary corolla-fhaped, tubular, very white and very thin, three times fhorter than the petals, furrounding the greateft part of the germ; germ egg-fhaped, rather acuminate, quite fmooth, the length of the corolla; ftyle fcarcely any; ftigmas three, rather long, even furfaced on the outer fide, roughifh on the inner one, fomewhat erect. *Drupe* inverfely egg-fhaped, obfcurely trigonous, one-celled, fucculent, furrounded by the permanent calyx and corolla; rind cartilaginous; pulp fibrous; nut dry, very hard, flightly ftriated, with fmall longitudinal lines, convex on one fide, flattifh on the other, oblong, a little acute at both ends, perforated at the bafe with three oblique holes; kernel cartilaginous, very hard, with the flavour of that of C. nucifera. A native of South America, where the inhabitants obtain from the imperfectly ground nuts, without preffure, or the application of fire, and by fimple maceration in water, a kind of butter which fwims at the top, the heavier parts finking to the bottom. All the butteraceous matter is extracted by the third maceration. It does not, however, acquire the confiftence of butter in a temperature, above the twentieth degree of Reaumur; at the twenty-third it is perfectly liquid like other oils. The fucculent pulp is rather fweet, very mucilaginous, and excellent for fattening hogs. The oil or butter procured from the kernel, is in conftant ufe among the Indians of South America as an article of food, and as a medicine, while it continues frefh, but is rancid and noxious when old. 3. C. *guineenfis*, prickly pole. Linn. Syft. Nat. 2. Mant. p. 137. Mart. 3. Lam. 3. (Bactris minima; Gært. tab. 139. fig. 5. B. minor fructibus fubrotundis; Jacq. Amer. tab. 171. fig. 1. Palma fpinofa minor; Sloane. Jam. Hift. 2. p. 121. P. americana fpinofa; Baub. Pin. 507. Pluk. Alm. tab. 103. fig. 1. L. Avoira caune; Aubl. Guian. obf. 97. Autara; Marg. Braf. 64. bad.) "Whole plant prickly; fronds diftant; root creeping." *Root* knotty, cylindrical, thicker than the trunk, fhort, bent horizontally directly below the furface, prefently putting out another trunk fo as to form a thicket, whilft it fixes itfelf firmly in the foil by flender fibrous roots. *Stem* about ten feet high in open fituations, fomewhat higher in woods, about an inch in diameter, erect, armed in its whole length with numerous fpines as fharp as needles. *Leaves* pinnated, diftant, common petiole embracing the ftem, prickly; leaflets enfiform, flat, acuminate, fhining, with numerous fcarcely perceptible fpines at their edges, and a few fcattered larger ones on both furfaces. *Spathes* axillary, folitary, fpreading, permanent after the maturity of the fruit. *Flowers* pale yellow, fcentlefs, calyx many times fmaller than the corolla, fometimes three-leaved; corolla triquetrous, frequently three-cleft almoft to the bafe. *Drupes* roundifh, dark purple, about the fize of a common cherry; yielding an acidulous juice, of which the Americans make a kind of wine; eatable, but not pleafant, and affording food chiefly to the wild hogs. Jacq. and Browne. *Drupe* roundifh, fomewhat depreffed, fucculent, acidulous; rind coriaceous; nut fomewhat globular, hard as ftone, very thick, roughened on all fides by obfolete tubercles, ftamped about the middle with three holes, ftriated in rays at their mouths; two fmaller ones not paffing through the fhell; the other pervious, leading to the central cell. *Seed* conoid, horizontally decumbent, tubercled, brown, with a very prominent papilla at the bafe of the cone; albumen flefhy, friable; with a large cavity in the centre; embryo awl-fhaped, horizontal, fituated within the papilla. A native of the Weft Indies and of South America. The trivial name given by Linnæus in the firft mantiffa, and continued by all fubfequent authors, was probably a mifprint for guianenfis; canes are made of the trunk, ftripped of its bark; they are very light, knotty, black, and fhining. The French call them cannes de Tobago, under which name they are fometimes imported into Europe. In allufion to their ufe as walking canes, Jacquin named this palm, *Bactris* απο του βακτρου. 4. C. *aculeata*. Great macaw-tree. Mart. 4. Swartz. Prodr. 151. Brown. Jam. 344. n. 7. Sloan. Jam. 2. 119. tab. 214. Jacq. Amer. 278. tab. 169? (Bactris globofa minor; Gært. 1. 22. fig. 9.) "Aculeate-fpinous; trunk fpindle-fhaped; fronds pinnated; ftipes and fpathes fpinous." *Trunk* the thicknefs of the human body, thirty feet high, thick fet with fharp black prickles of different lengths, and placed ufually in rings. *Leaflets* very long and prickly. *Fruit* the fize and fhape of a crab; rind green; pulp thin, fweetifh, aftringent; kernel white, fweet, eatable. Sloane. *Drupe* globular, a little flattened, about an inch in diameter, terminated by three acute feffile ftigmas, protected at the bafe by the permanent calyx and corolla; leaves of the calyx fmall; rind thick, coriaceous; flefh thick, fucculent, at length fungous-coriaceous, adhering to the fhell of the nut; nut globular, fomewhat lenticular, hard as ftone, thick, of a ferruginous bay colour, one-celled; ftamped at the fides with three holes, two of them clofed at the bottom, the third pervious. *Receptacle* none. *Seed* fingle, fomewhat globular, lying horizontally oppofite to the pervious hole of the fhell, flattifh, or flightly depreffed near the hole, reticulated on all fides with arched ftriæ, of a brown bay colour. *Albumen* flefhy, oleaginous, white, fomewhat friable, hollow within. *Embryo* horizontal, oblong, milky white, elongated from a roundifh bafe into a thick oblong lamina. Gært. A native of the Caribbee iflands. Obf. Gærtner feparates the laft two fpecies from cocos, on account of the horizontal pofition of the embryo. Whether fuch a difference in the internal ftructure of the feed be a fufficient generic character, we may doubt, but will not determine.

Cocos *nypa*; Loureiro. See Nipa.

Propagation and Culture. The cocoa-nut tree is fometimes raifed in our ftoves; but it is many years in advancing to any confiderable height; the young leaves, however, being pretty large, they make a good appearance among other tender exotics in two or three years. The nuts muft be imported when they are fully ripe, in a tub filled with dry fand, and carefully fecured from vermin; they will frequently fprout in their paffage, which is an advantage, becaufe they may be immediately planted in pots of earth, and plunged into the hot-bed. As their roots fhoot deeply and widely, they will not bear tranfplanting, unlefs when very young, and even then great caution is requifite to prevent their being injured.

Cocos, in *Geography*, a fmall ifland in the Pacific ocean; uninhabited, but affording anchorage, the beft at the north-eaft extremity, excellent water, wood, fifh, birds, and cocoa-nut trees, whence its name. The anchoring place is by Vancouver's obfervations in N. lat. 5° 35'. E. long. 86° 55'.

Cocos, a group of fmall iflands in the Indian fea, fituated about the diftance of 165 leagues to the S.W. of *Flat* point, the moft fouthern of the ifland of Sumatra. The northernmoft is a fingle low ifland, in S. lat. 11° 50'. E. long. 97° 8'. and lies due N. from the moft weftern of the clufter of iflands, at the diftance of 14 miles. Between them is a fair paffage. The fouthernmoft are a circular range of low iflands, whofe latitude is from 12° 4' to 12° 23' S. Their eaftern extreme 97° 19' E. long.; and their weftern extreme under the meridian of the moft northern iflands.

Cocos, *Cape*, a cape on the eaft coaft of the ifland of Madagafcar. S. lat. 14° 20'. E. long. 55° 58'.

Cocos, in *Natural Hiftory*, a pyritic foffil, found in the cliff of the ifland of Shepey, annexed by fir Jofeph Banks to the collection in the Britifh Mufeum.

COCOSA, in *Ancient Geography*, a place of Gaul, on one of the routes from Aquæ Tarbellicæ to Burdigala.

COCOSATES, a people of Gaul, in Aquitaine.

COCOSSII, a people of Africa, im Mauritania Tingitana. Ptolemy.

COCOTZIN, in *Ornithology*, the name given by Buffon and others to the Indian turtle or ground dove, *columba pafferina*. See Columba.

COCOXIHUITL, in *Botany*, Her. Mex. See Bocconia.

COCROTALEON, in *Natural Hiftory*. Under this name the ancients defcribe a ferocious hybrid brute, generated, as they pretended, between the hyæna and the lionefs. This animal, according to their account, poffeffed many qualities of the mantichora; and as fome believe was only another name for the fame beaft; it was alfo called leucrocotta, and leucrocatta, or fimply crocotta, and cocrotta. We regard the whole hiftory of this creature as fabulous; the production of a hybrid brute engendered between the two animals before-mentioned, is within the limits of poffibility, but their defcription is inadmiffible; they tell us the body refembled that of the lionefs, that the tail was annulated, and the vifage human.

COCTIER, James, or Cottier, as Chaumel calls him, in *Biography*, in his "Effay on the State of Medicine in France," was phyfician to Lewis XI. and obtained fuch influence over the mind of that voluptuous and cruel prince, as to be feared, the hiftorians of the times fay, by him, who was the dread of the reft of the world. Having cured the king of a complaint which had baffled the endeavours of the phyficians and furgeons who had been ufed to attend him, he had the art to get them difmiffed, and to have their places filled by his own creatures, who, finding their patient enfeebled by difeafe, and dreadfully afraid of dying, were unceafing in their commendations of their patron, whom they extolled as the only phyfician capable of prolonging his life. Coctier, on his part, took care to profit by this weaknefs, extorting from him immenfe fums, as the reward for his fervices. On the death of Lewis, in 1483, a commiffion was inftituted to inquire by what means Coctier had acquired his prodigious poffeffions; when it appeared he had received from the king 98,000 crowns within the laft eight months. Coctier, finding he was in danger of lofing the whole of his ill-gotten wealth, had the addrefs to prevail on the king, Charles VIII. to accept 50,000 crowns, and to put an end to the inquiry. Philip de Comines. Eloy. Dict. Hift.

COCTION, a general name for all alterations made in bodies, by the application of fire or heat. See Boiling.

COCUJUS,

COCUJUS, in *Entomology*, the name under which Mouffet deſcribes the inſect vulgarly known by the name of Jamaica fire-fly; it is of the elater genus, and has a large oval lucid, or ſhining yellow ſpot on each ſide of the thorax. Brown, in his "Hiſtory of Jamaica," calls it *elater major fuſcus phoſphoricus*; and tells us, that the lucid ſpots on the thorax are phoſphoreſcent, in which particular, his aſſertion is corroborated by the teſtimony of other writers. This inſect is the *elater noctilucus* of Linnæus.

COCUMONT, in *Geography*, a town of France, in the department of the Lot and Garonne; two leagues S.W. of Marmande.

COCUSUS, or Cucusus, in *Ancient Geography*, a town of Cataonia, upon the Carmalus, near the frontiers of Cilicia, N.E. of Irenopolis.

COCYLIUM, a town of Myſia.

COCYTA, a river of Epirus, which ran near the town of Cichyra, according to Pauſanias.—Alſo a river of Italy, in Campania, near the Lucrine lake, according to Silius Italicus, and Petronius.

Cocyta, in *Entomology*, the *papilio cocyta* of Cramer, is the ſpecies deſcribed by Fabricius, under the name of *papilio morpheus*, which ſee.

COCYTUS, in *Mythology*, one of the rivers of Hell; ſo named from a Greek word κωκυειν, to *lament*; Thus, Milton (Par. Loſt, B. ii.)

> "Cocytus, named from lamentation loud
> Heard on the rueful ſtream."

Cocytus and Phlegethon were branches of the river Styx, which flowed in contrary directions, and afterwards reuniting, augmented the large channel of the Acheron. According to Horace, Cocytus flowed with a dull and languid ſtream. Hence was derived "Cocyta virgo," the appellation of Alecto, one of the Furies.

COD, in *Ichthyology*, a genus of fiſhes, comprehending about twenty different ſpecies. See Gadus.

Cod, *Cape*, in *Geography*, a cape of North America, the ſouth-eaſtern point of Maſſachuſetts' bay, in the ſtate of Maſſachuſetts'. N. lat. 42° 4′. W. long 70° 10′. It probably derives its name from the multitude of cod-fiſh, found on its coaſt. Its form reſembles a man's bended arm, with the hand turned inwards towards the body. The cape comprehends the county of Barnſtaple, though the name "Cape Cod," ſtrictly ſpeaking, ought to be confined. See Barnstaple, and Province-town. What is called "Race-point," known to all ſeamen, is the north-weſterly extremity of the cape, and lies N.W. from Province-town, diſtant three miles. See Race-point. The ſoil of Cape Cod is, in general, more thin and barren than any other part of New England, but the ſea-air impregnates all vegetables with a quality which renders them much more nutritious to cattle than the ſame quantity far inland. The ſalt-hay, which is almoſt their only forage, affords a manure which is ſuperior to that which is procured at a diſtance from the ſea. This greatly aſſiſts their crops of corn and rye. The lands of Cape Cod, however, could never ſupport its inhabitants, which are reckoned to amount to upwards of 18,000. The men and boys are, therefore, for the moſt part, conſtantly employed at ſea; ſo that Cape Cod is an excellent nurſery for ſeamen. The Cape abounds with clear freſh ponds, well ſtocked with fiſh; and formerly the inhabitants took many whales round the Cape; but that buſineſs is almoſt at an end. The manner of taking black-fiſh, which are of the whale kind, about five tons in weight, and yield oil, like the whale, is ſomewhat ſingular. When a ſhoal of them is diſcovered, ſometimes conſiſting of ſeveral hundreds, the inhabitants put off in boats, and getting beyond them, drive them, like a herd of cattle, to the ſhore and flats, where they are left by the tide, and thus become an eaſy prey. The ſhore of the Cape is, in many places, covered with the huge bones of theſe fiſh, and of whales, which remain unconſumed for many years. The wood on the Cape is generally pitch-pine.

It has been conjectured that the Cape is gradually wearing away, and that it will ultimately fall a ſacrifice to the ravages of the winds and ſeas. Many circumſtances ſeem to favour this opinion. At Province-town harbour, ſtumps of trees are ſeen, which are now covered by the ſea in common tides. When the Engliſh firſt ſettled upon the Cape, about the year 1620, there was an iſland off Chatham, at the diſtance of three leagues, called "Webb's iſland," containing 20 acres, covered with red cedar or ſavin. The inhabitants of Nantucket uſed to carry wood from it. This iſland has been wholly worn away for almoſt a century. A large rock, that was upon the iſland, and which ſettled as the earth waſhed away, now marks the place; it riſes as much above the bottom of the ſea, as it uſed to riſe above the ſurface of the ground. On this ſpot the water is ſix fathoms deep, and in many places on the Cape the ſea appears to be encroaching upon the land. The Cape is ſo much expoſed to various winds, that fruit trees do not thrive. The ſituation is healthy, but the piercing winds that proceed from the ſea are trying to delicate conſtitutions. The inhabitants, however, live in general, as long as thoſe of other parts of the northern ſtates. The winds in every direction come from the ſea; and invalids, by viſiting the Cape, ſometimes experience the ſame benefit as from going to ſea.

Cod's *Head*, a cape on the S.W. coaſt of Ireland. N. lat. 51° 36′. W. long. 9° 59.′

Cod-*fiſh*, in *Ichthyology*. See Gadus *morhua*.

Cod-*fiſhery*. See Fishery.

CODA, Benedetto, in *Biography*, a Ferrareſe painter, who was, according to Vaſari, a ſcholar of Giovanni Bellini; he afterwards ſettled in Rimini, where he painted many works, in a ſtyle ſomething leſs dry than thoſe of his maſter. Amongſt his beſt pictures, is the marriage of the Madonna, which is placed in the Duomo, with the inſcription "opus Benedicti," and that of the roſary, at the Dominicans. He died about the year 1520. Benedetto was, however, far ſurpaſſed by his ſon, Bartolommio Coda, of whom there is, at the church of St. Rock, at Peſaro, an altar picture, repreſenting the tutelar ſaint, and St. Sebaſtian, one on each ſide the throne of the Madonna, accompanied by a choir of angels full of grace; it bears date 1528, and is in almoſt every reſpect a performance worthy the golden age in which it was painted. Lanzi. Storia Pitt.

Coda, *Ital.* a tail-piece, addition to, or termination of, a movement in muſic.

Coda *lancea*, in *Ornithology*, the name given by the Italian authors to the *anas caudacuta*, and vulgarly known in England by the names of *cracker*, or *ſea pheaſant*; the *pintail duck* of Engliſh, and *anas acuta* of modern Latin writers. This bird is diſtinguiſhed by having the two middle tail-feathers longer than the reſt, and acute or pointed; the hind head on each ſide marked with a white line, and the back aſh-coloured and undulated. The female is rather ſmaller than the male. It inhabits America, Europe, and Aſia.

CODAGAM, in *Botany*: Rheed. Mal. See Hydrocotyle *aſiatica*.

CODAGA-PALA. Rheed. Mal. See Nerium *antidyſentericum*.

CODANA, in *Ancient Geography*, a place of Aſia, ſituated, according to Ptolemy, on the coaſt of Gedroſia.

CODANONIA, an iſland, placed by Mela in the Codanus Sinus; ſuppoſed to be the iſle of Seeland or Zealand.

CODANUS Sinus, the Baltic ſea, a gulf N. of Germany, between this country and Scandinavia. Mela repreſents it as diverſified with large and ſmall iſlands, inhabited by the Cimbri and Teutones. See Baltic.

CODA-PILAVA, in *Botany*. Rheed. Mal. See Morinda *citrifolia*.

CODARIUM. Solander. Vahl. Claſs and Order, *diandria monogynia*.

Eſſ. Ch. Calyx five-leaved. Corolla one-petalled, linear-lanceolate, inſerted into the ring of the nectary. Legume pediceſled, filled with a farinaceous ſubſtance, generally with a ſingle ſeed, but ſometimes with two or three, valveleſs.

Sp. C. *guineenſe* (dialium guineenſe. Willd.) A tree, or ſhrub. *Branches* cylindrical; bark grey, uneven with chinks and wartlike projections. *Leaves* alternate, unequally pinnated; leaflets five, oblong, quite entire, ending in an obtuſe point, veined; ſmooth and ſhining on the upper ſurface, uneven underneath, with papillæ, which are not viſible without a lens; petioles pubeſcent, tranſverſely wrinkled. *Flowers* numerous, in a very compound panicle, pubeſcent; calyx-leaves coriaceous, pubeſcent on the outſide; upper one broader, oblong, emarginate: the others oblong, acute; filaments two, thick, awl-ſhaped, incurved; anthers two on each filament, connate, oblong; germ ſuperior; ſtyle awl-ſhaped, incurved; ſtigma awl-ſhaped. A native of Guinea.

CODBECK, in *Geography*, a river of England, in the north-riding of Yorkſhire, which paſſes by Thirſk, and joins the Willowbeck, about 2 miles below that town; and about 2 miles after their union they fall into the Swale.

CODDA-PANNA, in *Botany*. Rheed. Mal. See Corypha.

CODDAM-PULLI. Rheed. Mal. See Cambogia.

CODDED *Corn violet*. See Campanula *hybrida*.

CODDY-moddy, in *Ornithology*, the Engliſh name of a ſpecies of gull, very common in the winter ſeaſon on our coaſts; it is the winter-mew of ſome Engliſh authors, and *larus hybernus* of Gmelin; *larus fuſcus ſ. hybernus*, Ray. *Larus canus β cinereus ſubtus niveus, capite albo maculis fuſcis vario, collo ſupra fuſco, alis variis, rectricibus albis faſcia nigra.* Lath. Ind. Orn. It is cinereous, beneath ſnowy white, the head white and varied with brown ſpots, the neck brown, wings ſpotted with brown, and the tail marked with a black band. Suppoſed to be a young bird, of the common gull kind, which has not attained its full ſtate of plumage.

CODE, Codex, a collection of the laws and conſtitutions of the Roman emperors, made by order of Juſtinian.

The word comes from the Latin *codex, a paper book*; ſo called *à codicibus*, or *caudicibus arborum, the trunks of trees*; the bark whereof, being ſtripped off, ſerved the ancients to write their books on.

The code is compriſed in twelve books, and makes the ſecond part of the civil, or Roman law.

There were ſeveral other codes before the time of Juſtinian, all of them collections or abridgements of the Roman laws. The moſt ancient code, or digeſt, was ſtyled "jus Papirianum," from the firſt compiler, Papirius, who flouriſhed about the time of the Regifugium. Mr. Gibbon, however, ſuſpects, that the Caius Papirius, the pontifex maximus, who revived the laws of Numa (Dionyſ. Hal. l. iii. p. 179), left only an oral tradition; and that the "jus Papirianum" of Granius Flaccus, (Pandect. l. 4. tit. xvi. leg. 144.) was not a commentary, but an original work, compiled in the time of Cæſar (Cenſorin. de die natali. l. iii. p. 13. Duker de Latinitate J. C. p. 157.) Gregorius and Hermogenes, or Hermogenianus, two lawyers, who flouriſhed under Conſtantine and his children, made each a collection of this kind, called, from their names, the *Gregorian Code*, and *Hermogenian Code*. The former included the conſtitutions of the emperors from Adrian, or, as ſome ſay, Auguſtus, to Diocleſian and Maximian. This was publiſhed in Schultens's "Juriſprudentia Ant. Juſtitiæ." The latter, which is a ſupplement to the former, was compiled in the age of the Conſtantines, and compriſed all the imperial conſtitutions of Diocleſian and Maximian, beſides thoſe of Claudius, Aurelian, Probus, Caius, and Caginus, to the year 306, or 312. The authors, in compiling theſe, their reſpective works, followed the order of time; which was afterwards obſerved in the codes of Theodoſius and Juſtinian. They were both abridged by thoſe who abridged the Theodoſian code; Gregorius is commonly believed to have been the moſt ancient of the two. The ſtyle of Hermogenianus is very uncouth, and often obſcure.

Cujas aſſigns to Gregory the reigns from Adrian to Gallienus, and the continuation to his fellow-labourer Hermogenes. But though this general diſtribution may be juſt; yet they often treſpaſſed on each other's ground. We have nothing remaining of them but a few fragments in different books of juriſprudence; the compilations themſelves falling to the ground for want of authority to put them in execution.

Theodoſius the Younger was the firſt emperor who made a code, which was compriſed in 16 books, formed out of the conſtitutions of the emperors from Conſtantine the Great to his own time; and compiled by eight able civilians, at the head of whom was Antiochus, who had been conſul in 431; abrogating all other laws not included in it; and this is what we call the Theodoſian code, which was publiſhed in the year 438, and received and obſerved in the eaſt for about 90 years, till annulled by the code of Juſtinian.

The Theodoſian code has been a long time loſt in the Weſt; Cujas took a great deal of pains to retrieve it, and to publiſh it in a better condition than ever. Gothofred has given us a comment on the Theodoſian code; a work which coſt him thirty years.

Theodoſius, in publiſhing the code, enacted, that the laws made by one prince ſhould be of no force in the dominions of the other, unleſs confirmed and ſigned by him.

In 506, Alaric, king of the Goths, made a new collection of the Roman laws, taken from the three former codes, the Gregorian, Hermogenean, and Theodoſian, which he likewiſe publiſhed under the title of the Theodoſian code. This code of Alaric continued a long time in force; and was all the Roman law received into France. It is ſometimes called the code of Anian, becauſe compiled by Anian, who was chancellor to Alaric.

Laſtly, the emperor Juſtinian, finding the authority of the Roman law exceedingly weakened in the Weſt, upon the decline of the empire, made a general collection of the whole Roman juriſprudence. The management hereof he committed to his chancellor, Trebonianus; who choſe out the moſt excellent conſtitutions of the emperors, from Adrian to his own time; and publiſhed his work in 529, under the title of the New Code.

But becauſe Juſtinian had made ſeveral new deciſions, which made ſome alteration in the ancient juriſprudence, he retrenched ſome of the conſtitutions inſerted by Trebonianus, and added his own in their place; on which account he publiſhed a new edition of the code in 534, and abrogated the former. See Civil *Law*.

There have been various other later codes, particularly of the ancient Gothic, and ſince of the French kings; as the code

code of Frederic, the code Michault, code Louis, code Neron, code Henry, code Marchand, code des Eaux, code Noire, &c.

Code *of canons*, *Codex canonum*. See Canon.

CODECEIRO, in *Geography*, a town of Portugal, in the province of Beira; six miles S. from Guarda.

CODEN, a town of America, in the state of Virginia, nine miles S.E. of Cumberland.

CODERA, Cape, a cape of South America, on the N. coast of Terra Firma, in the district of Caraccas. N. lat. 10° 50'. W. long. 66° 21'.

CODESI, a town of European Turkey, in the province of Epire, 16 miles E. of Valona.

CODEX, in *Antiquity*, a kind of punishment by means of a clog, or block of wood, to which slaves, who had offended, were tied fast, and obliged to drag it along with them; and sometimes they sat on it closely bound.

Codex *Argenteus*. See Argenteus *Codex*.

CODIA, in *Botany*, (from κωδια, a *little bail*; the flowers growing in a small head.) Linn. jun. Supp. 33. Schreb. 675. Willd. 783. Forst. Gen. 30. Juss. 430. Class and order, *octandria digynia*.

Gen. Ch. *Cal. common.* Involucre four-leaved, leaves oblong, horizontal. *Cal. proper.* Perianth four-leaved; leaves elliptical, erect. *Cor.* Petals four, linear, with claws. *Stam.* Filaments eight, longer than the corolla, growing two together at the base of each petal. *Pist.* Germ superior, very small, villous; styles two, awl-shaped, the length of the stamens; stigmas simple. *Receptacle common*, villous.

Eff. Ch. Calyx four-leaved Petals four. Common receptacle involucred

Sp. C. *montana.* A shrub. *Leaves* opposite, petioled, elliptical, obtuse, entire, very smooth. *Heads of flowers* globular, peduncled, short, axillary and terminal. *Fruit* unknown. A native of New Caledonia.

CODIÆUM, Rumph. See Croton *Variegatum.*

CODIAVANACU, Rheed. See Tragia *Chamælea.*

CODICIL, a schedule, or supplement to a will, or other writing.

It is used as an addition to a testament, when any thing is omitted which the testator would add, explain, alter, or retract; and is of the same nature as a testament, except that it is without an heir, or executor. So that a codicil is a less solemn will, of one that dies either testate or intestate, without the appointment of an heir; testate, when he that hath made his codicil hath either before or afterwards made his testament, on which that codicil depends, or to which it refers; intestate, when one leaves behind him only a codicil without a testament, wherein he gives legacies only to be paid by the heir at law, and not by any heir instituted by will, or testament.

A codicil, as well as a will, may be either *written*, or *nuncupative*. Some authors call a testament, a *great will;* and a codicil, a *little one*.

But there is this further difference between a codicil and a testament, that a codicil cannot contain the institution of an heir; and that in a codicil, a man is not obliged to observe strictly all the formalities prescribed by law for solemn testaments.

In customary countries, testaments, properly speaking, are no more than codicils; because custom itself names the heir, and does not allow of testamentary inheritors.

Codicils were first brought into use in the time of Augustus, by L. Lentulus; they were originally intended to follow the testament; which was, as it were, their basis. In process of time, codicils came to have their effect, even though made before the testament; provided there was nothing in the testament contrary to the codicil. People were also allowed to make codicils without testaments. Conquest and the formalities of law, says Mr. Gibbon, (Hist. of the Decline and Fall of the Roman Empire, vol. viii. p. 80) established the use of codicils. If a Roman was surprised by death in a remote province of the empire, he addressed a short epistle to his legitimate or testamentary heir; who fulfilled with honour, or neglected with impunity, this last request, which the judges before the age of Augustus were not authorised to enforce. A codicil might be expressed in any mode, or in any language; but the subscription of five witnesses must declare that it was the genuine composition of the author.

Raymond Lully has a book which he calls the "Codicil;" wherein he pretends to have left his readers the secret of the philosophers' stone; provided they do but understand it.

CODINA, in *Geography*, a town of the island of Sardinia, 14 miles E.S.E. of Oristagni.

CODINUS, George, in *Biography*, flourished in the latter part of the fifteenth century. To him, in conjunction with others, was entrusted the care of the palace of Constantinople. He wrote a treatise concerning the origin of that city in the Greek language, and another concerning the officers of the palace, and those of the great church in that city. These works were translated into the Latin, and printed in Greek and Latin at Paris, in 1615.

CODIROSSO, in *Ornithology*, the name under which Olina describes the red-start, *motacilla phœnicurus*. See Motacilla.

Codirosso-*maggiore*, of Olina, is the rock-shrike, *lanius infaustus* of Gmelin, merle de roche of Buffon. See Lanius.

CODIUM, in *Botany*, a genus formed by Stackhouse, for the fucus tomentosus of Linnæus, to which he gives the following character. *Fructification* in small implicated tubes. *Frond* cylindric-compressed; when wet, having the appearance of spunge; when dry, tomentous. See Fucus.

CODLINS and Cream. See Epilobium *Hirsutum.*

CODMA, in *Geography*, a town of Persia, in the province of Segistan, 154 miles S.S.W. of Zareng.

CODOGNO, a town of Italy, in the Lodesan, at the conflux of the Adda and the Po; 12 miles S.S.E. of Lodi.

CODOLAN, Cape, a cape on the E. coast of the island of Formentera, in the Mediterranean.

CODON, in *Antiquity*, a cymbal, or rather little brass bell, resembling the head of a poppy. They were fastened to the trappings and bridles of horses.

Codon is also used to signify the orifice of a trumpet.

Codon, in *Botany*, (from κωδων, a *little bell.*) Linn. Gen. 1285. Syst. Nat. Ed. 13. vol. ii. p. 292. Schreb. 715. Willd. 823. Gært. 596. Juss. 422. Class and order, *decandria monogynia.* Nat. Ord. *undetermined*; Juss. *Borragineæ;* Lam.

Gen. Ch. *Cal.* Perianth one-leafed, deeply ten-cleft; permanent; segments narrow, linear. *Cor.* monopetalous, campanulate, torulose at the base; border ten-cleft, regular; nectary consisting of ten scales, inserted into the base of the stamens, covering the receptacle. *Stam.* Filaments ten, the length of the corolla; anthers thick. *Pist.* Germ superior, conical; style the length of the stamens; stigmas two, long, bristle-shaped, diverging. *Peric.* two-celled. *Seeds* roundish, echinate, bedded in a juiceless coloured pulp.

Eff. Ch. Calyx ten-cleft, permanent. Corolla bell-shaped; border ten-cleft. Nectary composed of ten scales. Pericarp two-celled, containing several seeds.

Sp. C. *Royeni.* Mart. Lam. Willd. (C. aculeatum; Gært. tab. 95. fig. 7.) *Root* annual. *Stem* about a foot high, herbaceous, firm, full of pith, cottony, echinate, with numerous very white prickles, branched. *Leaves* alternate, petioled, egg-ſhaped; clothed on each ſide with a ſhort cottony down, and rough with ſmall hard prickles, ſimilar to thoſe which are found in moſt of the borragineæ; nerves and petioles beſet with white prickles. *Flowers* ſituated a little above the axils of the leaves, ſolitary, rather large; peduncles ſhort, cottony, and like the calyxes, very prickly. Lam. From a ſpecimen ſent to Juſſieu by ſir Joſeph Banks. *Fruit.* capſule, encloſed in the permanent, connivent calyx; ovate-acuminate, terminated by the compreſſed forked ſtyle, marked along both ſides with a ſharp ſuture, ſmooth, two-celled, two-valved; partition contrary to the valves, cloven and ſpongy next the axis. *Seeds* numerous, ſmall, variouſly angular, blood-red, covered on all ſides with ſoft papillæ of the ſame colour. Gært. Native country unknown.

CODORUS, in *Geography*, a townſhip of America, in York county, Pennſylvania.

CODRANA, in *Ancient Geography*, a town of India, on this ſide of the Ganges. Ptolemy.

CODRINGTON, Christopher, in *Biography*, was born at Barbadoes in the year 1688. When he was able to bear the fatigues of the voyage he was ſent to England, and, after ſome continuance at a private ſchool at Enfield, he was removed to Chriſt-church, Oxford. Here he took the degree of maſter of arts, and then was entered as probationer-fellow of All-Souls college, where he completed his ſtudies, and juſtly obtained the character of an accompliſhed gentleman and univerſal ſcholar. Without quitting the fellowſhip of his college, he joined the army, and, through the intereſt of the prince, ſoon attained the rank of captain in the firſt regiment of guards. He was inſtrumental in driving the French out of the iſland of St. Chriſtophers, which they had ſeized at the breaking out of the war between France and England. He diſtinguiſhed himſelf at the ſiege of Namur; and upon the peace of Ryſwick he was made captain-general, and governor of the Leeward Caribbee iſlands. For his conduct in this office he was charged with miſdemeanors, and ſeveral articles of impeachment were exhibited againſt him to the Houſe of Commons in England; to which an anſwer was publiſhed, with atteſtations in his favour, from the lieutenant-governor, members of the council, and the repreſentatives of Nevis. In 1703, he ſhowed the greateſt courage in the attack upon Guadaloupe, though the enterprize failed: this was probably the laſt warlike expedition in which he engaged, and he ſhortly after reſigned his government, and retired to enjoy a literary leiſure. He died in 1710, at his ſeat in Barbadoes, and was at firſt buried in that iſland, but in 1716 his body was removed to England and interred in the chapel of All-Souls, in which two orations were delivered on the occaſion, one by Digby Cotes, univerſity orator, the other by Edward Young, LL. B. By his laſt will he bequeathed a conſiderable eſtate in Barbadoes to the ſociety for the propagation of the Goſpel in foreign parts; he left alſo ten thouſand pounds to the college of All-Souls, for the purpoſe of building a library and the purchaſe of books. Biog. Brit.

CODRIO, in *Ancient Geography*, a ſtrong town of Macedonia, mentioned by Livy, l. xxxi. c. 27.

CODRONCHUS, Baptist, in *Biography*, a learned and intelligent phyſician of Imola in Italy, and author of ſeveral ingenious works on the ſubject of medicine, flouriſhed the latter end of the 16th and beginning of the 17th centuries. That he was much valued, we learn from his correſponding with the moſt eſteemed writers in his time; his works are alſo in the liſt of thoſe recommended by Boerhaave in his "Methodus ſtudii Medici." The titles of the principal of them are, "De chriſtiana et tuta medendi ratione, cum tractatu de baccis orientalibus, (cocculis indicis) et antimonio." Ferraria, 4to. 1591. The Indian berries were uſed as poſſeſſing an intoxicating power to attract or intice fiſh to the hook. They have long been ſuppoſed to be uſed by brewers, to give their beer a power of ſtupefying, without infuſing ſo much malt as would otherwiſe be required. In too large a doſe they would deſtroy life; the uſe of them in brewing is, therefore, very properly prohibited. "De morbis qui Imolæ et alibi communiter, anno 1602, vagati ſunt, commentarius, in quo potiſſimum de lumbricis tractatur, et de morbo novo, prolapſu nempe cartilaginis mucronatæ." Bononiæ, 1603, 4to. In this complaint, which appears to have been a fever, the patients were not relieved until after diſcharging a kind of worm, which the author deſcribes as differing from thoſe commonly found in the inteſtines. The author wrote alſo on the effects of different kinds of poiſons, and the remedies for each kind, and the diſeaſes occaſioned by witchcraft, in which he appears to have had great faith: On hoarſeneſs and other affections of the voice, and on the method of giving evidence in courts of juſtice: On the hydrophobia, of which he had ſeen ſome inſtances, and on the adminiſtering of hellebore, which he highly commends as a cathartic. Haller Bib. Med. Eloy. Dict. Hiſt.

CODROPIO, in *Geography*, a town of Italy, belonging to the ſtate of Venice, in the country of Friuli; 10 miles S.S.W. of Udina.

CODROPOLIS, in *Ancient Geography*, a town of Illyria, ſituated at the lower part of the Adriatic ſea, and ſerving as a boundary to the empire, divided between Auguſtus and Marc Antony.

COD-ROY, in *Geography*, a river of Newfoundland, which runs into the ſea, between cape Ray and cape Anguille.

CODRUS, in *Biography*, the 17th and laſt king of Athens, is celebrated for the noble act of ſacrificing his life for his country. He was the ſon of Melanthus, and had reigned twenty years, when the Heraclidæ made war againſt Athens. On this occaſion the Delphic oracle was conſulted, who declared that victory would decide for that people whoſe ſovereign was ſlain in battle. The enemy gave ſtrict charge to ſpare the life of Codrus, but the monarch, reſolving to enrol his name among the benefactors of his people, diſguiſed himſelf as a peaſant, and was ſlain in combat. When this was known to the Heraclidæ, they, dreading the accompliſhment of the prediction, broke up the camp and retreated. From this period, the Athenians regarded Codrus as the father of his country, and to pay the higheſt poſſible regard to his memory, they reſolved that no man was fit to reign as king after him; the monarchy was accordingly aboliſhed, and the government placed in the hands of elective magiſtrates, entitled archons, of whom the firſt was Medon, ſon of Codrus, who ſuſtained the office 20 years. This event took place about 1070 years before the Chriſtian æra. Juſtin. Univer. Hiſt. Du Freſnoy.

CODUTÆ, or Cudutæ, in *Ancient Geography*, a people of India, on the other ſide of the Ganges. Ptolemy.

CŒCILA, a town of Spain, placed by Ptolemy in Bœotia, in the country of the Turduli.

CŒCILIANA, a place on the river Calipos, E. of Cetobriga, and S.E. of Uliſipo.

CŒCINUM, a town of Italy, on the eaſtern coaſt of Brutium.

CŒCINUS,

CŒCINUS, a ſmall river which watered the town of Cœcinum, and diſcharged itſelf into the ſea to the eaſt.

CŒCK, Pieter, in *Biography*, called likewiſe *P. Van Aelſt*, from the place of his nativity, a town in Flanders, was, if we can form any judgment from the writers who have ſpoken of him, or from the admirable prints remaining from his deſigns, one of the greateſt painters which either Germany or Flanders produced in his time. After he had been ſometime inſtructed in the ſchool of Bernard of Bruſſels, he went to Rome to complete his ſtudies, and ſoon proved himſelf an excellent deſigner, and a bold and ſpirited painter, as well in freſco as in oil. At his return to his own country he married, but his wife ſoon dying, he once more gave way to his natural inclination for travelling, and at the ſolicitations of a merchant, a friend of his, accompanied him to Conſtantinople in the year 1531.

Having ſtaid ſome time with the Turks, and drawn ſome moſt animated repreſentations of their cuſtoms and ceremonies, which he afterwards cut in wood, he once more arrived in the place of his nativity, and took a ſecond wife. Towards the latter part of his life he wrote ſome excellent treatiſes upon geometry, architecture, and perſpective. His pictures of hiſtory, as well as his portraits, were much eſteemed. He was made painter to the emperor Charles V. and died at Antwerp, in the year 1550. After his death the prints which he had made of Turkiſh coſtume were publiſhed by his widow. This admirable work conſiſts of ſeven large pieces, which, when joined together, form a frieze, divided into compartments by Cariaticles: on a tablet in the firſt block is written in old French, "Les mœurs et fachom de faire de turez, avecq les regions y appertenantes, ont eſt au vif contrefaicetze par Pierre Cœck d'Aloſt, luy eſtant en Turque, l'an de Jeſu Chriſt, MDXXXIII. lequel auſſy de ſa main propre a pourtraict ces figures duyſantes a l'impreſſion dy'celles;" and on the laſt is this inſcription, "Marie ver hulſt, vefue du dict Pierre d'Aloſt, tres paſſe en l'an MDL. a faict imprimer les dict figures, ſoubz grace et privilege d'l'imperialle majeſte en l'an MCCCCCLIII." Theſe prints are very rare. Baldinucci. Strutt.

CŒCUM, in *Anatomy*, the firſt portion of the large inteſtine, in which the ſmall inteſtine ends. As its dimenſions exceed thoſe of the reſt of the canal, it is alſo known by the name of *caput coli*. See Intestine.

CŒDAMUSII, in *Ancient Geography*, a people of Africa, mentioned by Ptolemy, who inhabited the environs of the town of Sitiphæ, and of the river Ampſagas, in Mauritania Cæſarienſis.

CO-EFFICIENTS, in *Algebra*, are numbers, or given quantities, prefixed to letters, or unknown quantities, into which they are ſuppoſed to be multiplied; and therefore, with ſuch letters, or with the quantities repreſented by them, making a product or co-efficient production; whence the name, firſt given by Vieta.

Thus, in $3a$, or bx, or cxx; 3 is the co-efficient of $3a$; b, of bx; and c, of cxx. If a letter have no number prefixed, it is always ſuppoſed to have unit for the co-efficient. Thus, a, or bc, import as much as $1a$, or $1bc$.

In any equation whoſe higheſt power or term has 1 for its co-efficient, the co-efficient of the ſecond term is always the aggregate of all the roots retaining their proper ſigns; ſo that if all the negatives be equal to all the affirmatives, the ſecond term will vaniſh; and where the ſecond term is thus wanting, it is a ſign that the quantities under contrary ſigns were thus equal.

The co-efficient of the third term is the aggregate of all the rectangles or products ariſing by the multiplication of every two of the roots, how many ways ſoever thoſe combinations of duals can be had; as once in a quadratic, three times in a cubic, ſix times in a biquadratic equation, &c.

The co-efficient of the fourth term is the aggregate of all the ſolids made by the continual multiplication of every three of the roots, how often ſoever ſuch a ternary can be had; as once in a cubic, four times in a biquadratic, ten times in an equation of five dimenſions, &c. And thus it will go on infinitely.

Co-efficients *of the ſame order*, is a term ſometimes uſed for the co-efficients prefixed to the ſame unknown quantities, in different equations.

Thus, in the equations $\left\{\begin{matrix} ax+by+cz=m \\ dx+ey+fz=n \\ gx+hy+kz=p \end{matrix}\right\}$ the co-efficients a, d, g, are of the ſame order, being the co-efficients of x; alſo b, e, h, are of the ſame order, being the co-efficients of y, &c. The co-efficients alſo that affect no unknown quantity, are ſaid to be of the ſame order.

Co-efficients, *oppoſite*, ſuch as are taken each from a different equation, and from a different order of co-efficients. Thus, in the foregoing equations, a, e, k, and a, h, f, as alſo d, b, k, are oppoſite co-efficients.

COEHORN, in *Gunnery*. See Mortars, under the article Cannon.

COEL, in *Geography*, a town of Hindooſtan, in the country of Delhi, 65 miles S.E. of Delhi, and 33 N. of Agra. N. lat. 27° 48'. E. long. 78° 27'.

COELA, in *Ancient Geography*, the name of a part of the Elide, a country of Peloponneſus, according to Pauſanias and Strabo.—Alſo, a town ſituated on the ſtrait of the Helleſpont, S. of Seſtos, and at the lower part of the creek, or ſmall bay in the Thracian Cherſoneſus, whence it took its name "Portus Coelos." Pomponius Mela ſays, that the port of Coela is famous on account of the victory which the Athenians obtained here over the Lacedæmonians, whoſe fleet was utterly deſtroyed. The town of Coela, advantageouſly ſeated both for navigation and commerce, acquired, under Adrian, the privileges and dignity of a municipium; and it was recogniſed under the appellation of "Ælium," from his proper name. After the diſmemberment of the greater provinces of the empire, it became a part of the province of Thrace, called "Europe," under the metropolis of Heraclea.

Coela *of Eubœa*, a place of Greece in the iſland of Eubœa, denoting the ſpace or diſtrict which lay between Aulide and Gereſte.

COELÆ, a ſmall iſland ſituated before the town of Smyrna, on the coaſt of Aſia Minor. Pliny.

COELALETÆ, a people of Thrace, mentioned by Tacitus, and diſtinguiſhed by Pliny into the greater and leſs, and called Cœlatæ. He places the former at the foot of mount Hæmus, and the latter at the foot of mount Rhodope.

COELERINI, a people of Hiſpania Tarragonenſis. Pliny and Ptolemy.

COELESTIAL, in a general ſenſe, denotes any thing belonging to *cœlum* or the heavens. Thus,

Coelestial *obſervations*, are obſervations of the phenomena of the heavenly bodies, made with a proper apparatus of aſtronomical inſtruments, in order to determine their places, motions, phaſes, &c.

Obſervations in the day-time are eaſy; becauſe the croſs hairs in the focus of the object-glaſs of the teleſcope are then diſtinctly perceivable; in the night, thoſe croſs hairs are to be illumined to make them viſible. This illumination is either performed by a candle, placed obliquely near them, ſo that the ſmoke does not intercept the rays; or, where this is inconvenient, by making an aperture in the tube of the teleſcope,

telescope, near the focus of the object-glass, through which a candle is applied to illumine the cross hairs. M. De la Hire has made an improvement on the first method. which renders it of very good use; and it is by covering that end of the tube next to the object-glass with a piece of gause, or fine white silken crape. For, in such case, a link, placed at a good distance from the tube, so enlightens the gause, as to render the cross hairs very perceivable.

Observations of the sun are not to be made without placing a glass, smoked in the flame of a lamp or candle, between the telescope and the eye; to take off from its lustre, which would otherwise damage the eye, were not a good part of its beams intercepted.

Coelestial observations are chiefly of two kinds; the one when the objects are in the meridian; the other, when they are in vertical circles. For an account of the instruments with which observations are made, see our articles CIRCLE, and OBSERVATORY.

COELESTIAL *globe*. See GLOBE.

COELESTIAL *Sphere*. See SPHERE.

COELESTINE. The native sulphat of strontian, called coelestine, from the blueish tint which it generally assumes, is divided into three varieties, the foliated, fibrous, and compact.

1. Foliated. Its colour is milk-white passing into blue. It occurs in mass, or crystallized in strait rhomboidal prisms, or cuneiform octohedrons, or short hexahedral prisms. Its lustre is glittering or shining. Its fracture is imperfectly foliated. It is semitransparent, rarely transparent. It is somewhat softer than flour spar, and is easily frangible. Sp. Gr. 3.5.

It consists, according to Vauquelin, of

54	Strontian.
46	Sulphuric acid.
100	

It occurs in the neighbourhood of Bristol in loose nodules, and very finely crystallized in Sicily.

2. Fibrous. Its colour is between indigo blue and blueish-grey, passing into milk-white; by long keeping it loses its colour. It occurs in mass and in plates. Its longitudinal fracture is curved-fibrous approaching to foliated, with a shining lustre; its cross fracture is splintery, with a glittering pearly lustre. It is translucent, somewhat softer than the preceding variety, and easily frangible. Sp. Gr. 3.83.

It consists, according to an analysis by Klaproth, of

58	Strontian.
42	Sulphuric acid, with a trace of iron.
100	

It occurs in ferruginous marl in the vicinity of Bristol, and at Frankstown in Pennsylvania.

3. Compact. Its colour is blueish or yellowish-grey. It occurs in mass, and in flattened spheroidal and kidney-shaped masses. Its fracture is fine-splintery, passing into foliated. It is opake, and sometimes translucent on the edges. It is soft and easily frangible. Sp. Gr. 3.59.

According to Vauquelin it consists of

91.42	Sulphat of strontian.
8.33	Carbonat of lime.
0.25	Oxyd of iron.
100.	

It occurs imbedded in clay in the gypsum quarries of Mont Mortre, near Paris.

COELESTIS DEA, in *Ancient Mythology*, the *heavenly goddess*, a deity worshipped in Africa, and supposed to be the same with the Mithra of the Persians, and Astarte of the Phœnicians. It had a splendid temple at Carthage, dedicated by one Aurelius, a Pagan high-priest, and destroyed by another Aurelius, created bishop of Carthage, A. D. 390, who converted the Pagan temple into a Christian church, and placed his episcopal chair on the spot where the statue of the goddess had stood. At Rome, on the base of a stone on which the statue of this deity was placed, is found this inscription, "Invictæ Coelesti."

CŒLE-SYRIA, or COELO-SYRIA, in *Ancient Geography*, lay, according to Strabo, between the two mountains Libanus and Antilibanus, and was thence called *Cœle-Syria*, or the Hollow Syria. The cities and towns in this part of Syria, were, according to Ptolemy, Heliopolis, Abila Lysaniæ, Gaana, Ina, Damascus, Samulis, Abida, Hippus, Capitolias, Adra, Scythopolis, Gerasa, Pella, Dium, Gadora, Philadelphia, and Canatha; to which some add Laodicea Cabiosa, or ad Libanum. According to Galen, this country produced black inflammable stones, probably a species of surturbrand or bituminized wood, similar to the Bovey-coal of England; these, he says, were generated in the hills on the east side of the Dead sea, where the bitumen is produced, and had a scent similar to bitumen.

COELIA, Κοιλια, or Κοιλη, in *Anatomy*. This has many different significations; first, it imports a cavity in any part of the body, or in any of the viscera; secondly, it implies the same as *alvus*. The κοιλη, with the addition of ανω, that is, ἡ κατω κοιλη, is the lower belly, or intestinal tube

COELIACA ARTERIA, a large artery derived from the trunk of the aorta, soon after that vessel has entered the abdomen, and distributed to the stomach and duodenum, the liver, spleen, and pancreas. See ARTERIES.

COELIACA *ganglia*, are the nervous ganglia found in the coeliac plexus. See the description of the great sympathetic nerve in the article NERVE.

COELIACA, or the *Cœliac passion*, in *Medicine*, a term used by the older writers, to denote a diarrhœa, in which the stools were of a white appearance, resembling, or consisting of chyle. A distinction was made between this disease and the lientery; inasmuch as the food passed off in an undigested state in the latter; whilst in the cœliac passion the stomach completed the act of digestion, but the chyle, produced by this function, not being absorbed by the lacteals, was discharged by stool. This species of diarrhœa rarely, if ever, occurs; since, where the glands and absorbents of the mesentery, or the intestines themselves, are considerably diseased, the stomach is generally enfeebled in its functions, by sympathy. See DIARRHOEA, and LIENTERY.

COELIACUS *plexus*, in *Anatomy*, is a most intricate nervous network, formed chiefly by the splanchnic nerves, and some branches of the par vagum; consisting of several ganglia, which vary considerably in number, form, size, and position, and are connected to each other by larger and smaller nervous chords; and surrounding the root of the coeliac artery. See NERVE.

CŒLIANUM, in *Ancient Geography*, a place of Lucania, on the route which led from Opinum to Heraclea.

COELICOLÆ, in *Ecclesiastical History*, a sect called also "Hypsistarii," which arose about A. D. 300, or somewhat sooner. They are mentioned in the Theodosian code, as heretics; and seem to have been persons who, rejecting idolatry and polytheism, and all revealed religions, admitted only natural religion. See Wetstein's Proleg. in N. T. p. 38.

COELICOLOR, in *Natural History*, a name given by some to the OPAL.

COELIOBRIGA, in *Ancient Geography*, a place upon the Nebis, in the country of the Callaici, W. of Bracara Augusta.

COELIUS *Mons*, one of the seven mountains or hills of the city of Rome, which owes its name to Coelius, or Coeles, a famous Tuscan general, who pitched his tents there, when he came to the assistance of Romulus, against the Sabines. Livy (l. i. c. 30.) and Dionysius Halicarnassensis (l. iii.) attribute the inclosure of it to Tullus Hostilius; but Strabo (l. v.) to Ancus Martius. The other names by which it was sometimes known, were Querculanus, or Quercitulanus, and Augustus: the first, occasioned by the abundance of oaks growing there: the other imposed by Tiberius, when he had erected new buildings upon it after a fire which consumed the whole of this quarter of the city. (Tacit. Annal. L. Suet. in Tiber. c. 48.) One part of this hill was called "Coeliolus," and "Minor Coelius." To the east it had the city walls; to the south "Mons Aventinus;" to the west, "Mons Palatinus;" to the north, "Mons Esquilinus." Its compass was about 2½ miles.

COELLO, Alonzo Sanchez, in *Biography*, a Portuguese painter, was born in 1526: after having studied some time in Rome, he visited Spain, where he profited from the instruction of Antonio Moro: (sir Antony More): from Spain he passed into Portugal, and was employed by don Juan, and afterwards by donna Juanna, his widow, sister to Philip II. of Spain. About this time, Antonio Moro, in consequence of an indiscretion he had been guilty of, found it advisable to retire from the court of Spain; and Philip solicited his sister to send Coello to occupy his place; on his arrival at Madrid he was treated by that monarch with every mark of respect and condescension, and several times employed to paint the portrait of Philip, on foot, and on horseback, as well as those of the nobles of his court. There are several altar-pieces by Coello in the Escurial, and two of his pictures, representing Sisiphus and Titius, in the royal palace of Madrid; but his greatest composition is the martyrdom of St. Sebastian, in the church of San Geronimo in that city; on the right of the saint stands the figure of Christ, on the left that of the Madonna, and below them San Bernardo and San Francesco; the figure of the Almighty, enveloped in glory, forms the top of the picture. This, like his other works, is executed with great boldness of design and expression, and a style of colouring nearly resembling that of the great Titian. This artist, who certainly ranks amongst the first of the Spanish school of that period, died in the sixty-fifth year of his age in 1590. Cumberland.

Coello, Claudio, of the same family with the abovementioned artist, was born in Madrid in the seventeenth century, but in what year is not known. He became the favourite disciple of Francesco Ricci, painter to Philip III. and through his means gained access to the royal collection, where he assiduously copied many of the finest works of Titian, Rubens, Vandyke, and other masters. With these advantages, and these alone, for he never was out of Spain, Coello became, in the opinion of many, the greatest painter of the school, and decidedly holds a place in the first class. There is a Nativity by this master in the royal palace at Madrid, which, although hanging in the same room with the Adoration of Rubens, loses nothing by the comparison. But his chef d'œuvre is the picture "de las Colocazion de las Santas Formas," which hangs at the altar of the grand Sacristy of St. Lorenzo in the Escurial; this piece is executed in so masterly a style, with so striking an effect of chiaroscuro, and so much harmony, that the eye of the spectator is immediately attracted by it, although it is surrounded by many of the works of Raphael, Titian, and others, of the Italian and Flemish masters; the portraits of the king and the principal nobility are introduced in the great group of the procession, without any wise disturbing the order or solemnity of the whole. The artist was seven years in completing this admirable composition; after which he returned to Madrid, in the year 1689, and was liberally rewarded. It is much to be regretted, that many of Coello's works, in the churches and convents of Madrid, Toledo, and Saragossa, are placed in such bad lights and injudicious situations, as not to appear to that advantage which they so deservedly merit.

His style is said to resemble that of Paul Veronese, particularly in his draperies, colouring, and characters; nor does he fall short of him in magnificence of composition.

His death, which happened in 1693, was, it is supposed, accelerated by the mortification he felt, upon Luca Giordano's being sent for by Charles II., to paint the frescos of the great staircase of the Escurial. Cumberland.

COELMANS, James, an engraver of Antwerp, where he was born in 1670. His chief work consists of some prints, executed by him entirely with the graver, about 1709, from the collection of pictures belonging to M. de Boyer, Comte d'Aguilles, at Aix in Provence; but we cannot say much for his style in general, as it is too dark, heavy, and inharmonious, and by no means correct in point of drawing. Amongst the best of his engravings, for the above mentioned work, are, "The Murder of the Innocents," from Claude Spierre, and "The Fall of the Giants, with Victory crowning David," from Nicolo Poussin. His death happened in the year 1735. Strutt. Heinecken.

COELOMA, in *Surgery*, a hollow and round ulcer, in the horny tunic of the eye.

COELOS, in *Ancient Geography*, a town and port of the sea of the Thracian Chersonesus, between Elæa and Cardia, according to Pliny. It is called "Cœla" by Ammianus Marcellinus. See Cœla.

COELOSSA, or Coelusa, a mountain of the Peloponnesus, in the Argolide, according to Strabo. The Carnæate mountain formed a part of it.

COELUM. See Heaven.

Coelum is also used by some anatomists for the cavity of the eye towards the angles, or *canthi*. See Eye, Canthus, &c.

COELUS, in *Mythology*, one of the heathen deities, the same with the Greek *Uranus*.

COEMETERIUM. See Cemetery.

COEMPTION, among the *Romans*, a rite of marriage, practised on the part of the bride, which, when she was bought by the husband of her parents, she fulfilled by purchasing, with three pieces of copper, a just introduction to his house and houshold deities.

COEMPTIONALES, among the Romans, an appellation given to old slaves, which were sold in a lot with others, because they could not be sold alone.

COEN, John Pieterzoon, in *Biography*, was born in 1587, at Hoorn, in the United Provinces. He was sent to Rome at an early age, to be instructed in trade and commerce, under Piscatore, a celebrated merchant there. In 1607, he went to India; and in 1613, the whole management of the India trade was devolved on him, under the title of "director general," an office which seems to have been made for him. He was chosen president of Bantam, where he fixed his residence, and had great powers entrusted to him. There a plot was laid to assassinate him, which, though it miscarried, led him to the resolution of changing his

his abode. In consequence of this, the Dutch, in the year 1619, took possession of Batavia, where they established the seat of their commerce. For several years the Dutch had to contend with the native king of the place, assisted by the English. Peace was at length concluded between the two companies. The English re-embarked, and Coen laid the foundation of a new city, the streets of which were laid out in straight lines, and so spacious as to admit of canals of water, bordered by trees, that they might afford a shade to those who passed backwards and forwards in boats. The place was fortified, and put into a state of defence, and then it was declared the capital of the Dutch settlements in India. In the year 1622, Coen obtained leave to return to Europe, and in the following January he set sail with five ships, richly laden, and arrived at Zealand in December, having held the supreme command in India for more than four years. In 1627, he proceeded to India again, but he had not been long at Batavia, before the emperor of Java, jealous of the Dutch power, endeavoured to drive them from the island. Twice he laid siege to this city, but so many of the Javanese were killed by the artillery of the besieged, that a contagious distemper broke out among them, to which great numbers fell a sacrifice. It extended even to the Dutch camp and city, and destroyed many of the inhabitants. The Javanese were forced, ultimately, to raise the siege; exasperated with the defeat, they attempted to assassinate Coen. With this view, they sent to Batavia several small vessels laden with provisions, having some armed men concealed in the bottom of them below bamboos. They proceeded to the market-place, where the conspirators hoped to accomplish their purpose, but Coen was too strongly guarded for them to venture upon an attack. He died in September, 1629. Gen. Dict. Univer. Hist.

COENA *domini, bull.* See BULL.

COENA *Triumphalis*, in *Military Language*. When a victorious general made his triumphal entry, it was customary for him to give a banquet or entertainment to the Roman people.

CŒNAKER, in *Geography*, a town of the island of Ceylon, near the south coast; 100 miles S. of Candy.

COENDOU, in *Zoology*, the French name of the Brasilian porcupine, *Hystrix prehensilis.*

CŒNE, or COENOPOLIS, in *Ancient Geography*. See CÆNE.

CŒNENUM, a town, placed by Ptolemy in the northern part of Germany.

COENNERN, or KONNERN, in *Geography*, a town of Germany, in the circle of Lower Saxony, and duchy of Magdeburg, containing about 333 houses; 38 miles S. of Magdeburg.

CŒNOBITE, in *Ecclesiastical History*, formed of κοινος, *common*, βιος, *life*, a religious, who lives in a convent, or in community, under a certain rule; in opposition to *anachoret*, or *hermit*, who lives in solitude.

Cassian makes this difference between a *convent* and a *monastery*, that the latter may be applied to the residence of a single religious, or recluse; whereas the *convent* implies *cœ*-[illegible] living in common.

[illegible] of three kinds of monks in Egypt; [illegible] who continue to live in community; and *sarabaites*, who are a kind of monks errant, that stroll from place to place. (See MONK.) He refers the institution of cœnobites to the times of the apostles, and makes it a kind of imitation of the ordinary lives of the faithful at Jerusalem. Though St. Pachomius is commonly owned the institutor of the *cœnobite* life; as being the first who gave a rule to any community.

COENOBIUM, the state of living in a society or community, where all things are in common. Pythagoras is thought to be the author, or first institutor of this kind of life; his disciples, though some hundreds in number, being obliged all to give up their private estates, in order to be annexed to the joint stock of the whole. The Essenians among the Jews, and Platonists, are said to have lived in the same manner. Many of the Christians also have thought this the most perfect kind of society, as being that in which Christ and his apostles chose to live. See COENOBITE.

COENOTAPH. See CENOTAPH.

COENSIS CIVITAS, in *Ancient Geography*, the same with Cos, the capital of an island of the same name, which was an episcopal see.

COENYRÆ, a place in the island of Tasos, between which, and that called Ænyræ, or Annyræ, there were very rich mines.

CO-EQUALITY, a term expressing the relation of equality between two things.

The retainers to St. Athanasius's doctrine of the Trinity hold the Son and Holy Spirit *co-equal* with the Father. The Arians, &c. deny the *co-equality*. See TRINITY and ARIAN.

COEQUOSA, in *Ancient Geography*, a town of Gaul in Aquitaine, placed by the Itinerary of Antonine on the route from Aquæ Tarbellicæ to Burdigala.

COERULEUM MONTANUM. See COPPER, *ores of*.

COERULEUM *nativum*. See ARMENIUS *lapis*.

COES, among *Miners*, are little houses which the miners make over their mines to lay ore in.

COESCOES, in *Zoology*, the Surinam opossum, *Didelphis orientalis*, is described by Valentine under this name.

COESFIELD, in *Geography*, a town of Germany, in the circle of Westphalia, and bishopric of Munster, the ordinary residence of the bishop, containing two parish churches and five convents; 14 miles W. of Munster.

COESNON, a river of France, which runs into the sea, between Pontorson and Mont St. Michael.

COESTOBOCI, in *Ancient Geography*, a people of European Sarmatia, according to Ptolemy.

CO-ETERNITY is used among *Divines* to denote the eternity of one being equal to that of another. The orthodox hold the second and third persons in the Trinity *co-eternal* with the first.

COETI, in *Ancient Geography*, a people of Asia, in the vicinity of the Tibareni and of the river Thermodon.

COEUR, JACQUES, in *Biography*, a celebrated French merchant, and administrator of the finances under Charles VII. Of such consequence were his commercial pursuits, that he is said to have had 300 clerks in the ports of the east, and that he became the richest individual in Europe. His liberality was as extensive as his wealth was great, and he advanced very considerable sums to his sovereign, to enable him to recover his dominions from the English; in return for this generosity, he was raised to the highest offices of state, and was employed on many important embassies; in these his own wealth was made use of to enhance the glory of his country. His good fortune excited the jealousy of his contemporaries, who exhibited against him many heavy charges, from most of which he readily cleared himself, but he was convicted, by a partial tribunal, of others, and was condemned to pay an enormous fine; his estates were confiscated, and he himself was confined to the convent of Cordeliers at Beaucaire, from whence he escaped to Rome. His subsequent history is involved in obscurity, but it is generally believed that he embarked in an expedition

expedition fitted out againſt the Turks by pope Callixtus III. and died at the iſle of Chio in 1456. Nouv. Dict. Hiſt.

COEUR, in *Heraldry.—Party en* COEUR, ſignifies a ſhort line of partition in pale, in the centre of the eſcutcheon, which extends but a little way, much ſhort of top and bottom; being met by other lines, which form an irregular partition of the eſcutcheon.

COEUS, in *Ancient Geography*, a river of the Peloponneſus, in Meſſenia, which watered the town of Electra, according to Pauſanias.

COEUVRES, or ESTREES, in *Geography*, a town of France, in the department of the Aiſne, and diſtrict of Soiſſons; 7 miles S.W. of it.

CO-EXISTENCE, a term of relation, denoting two or more things to exiſt together at the ſame time, &c. See EXISTENCE.

COEYMANS, in *Geography*, a townſhip of America, in the ſtate of New York and county of Albany; 12 miles below Albany.

COFFEA, in *Botany*, (its true name, according to Bruce, is *Caffé*, from Caffa, the ſouth province of Narea, in Africa, where it grows ſpontaneouſly in great abundance), Linn. Gen. 230. Schreb. 314. Willd. 353. Gært. 139. Juſſ. 204. Vent. 2. 583. (Caffeyer, Encyc.) Claſs and order, *pentandria monogynia*. Nat. Ord. *Stillatæ*, Linn. *Rubiaceæ*, Juſſ. Vent.

Gen. Ch. *Cal.* Perianth ſuperior, very ſmall; four, five, or ſix-toothed. *Cor.* monopetalous, ſalver or funnel-ſhaped; tube cylindrical, ſlender, much longer than the calyx; border longer than the tube, four, five, or ſix-cleft; ſegments lanceolate, expanding, or obliquely reflexed. *Stam.* Filaments four or five, inſerted into the tube of the corolla; anthers linear. *Piſt.* Germ inferior; ſtyle ſimple, the length of the corolla; ſtigmas two, awl-ſhaped, reflexed. *Peric.* Berry roundiſh, about the ſize of a cherry, umbilicated at its ſummit. *Seeds* one or two, elliptically hemiſpherical, gibbous on one ſide, flat and furrowed longitudinally on the other, involved in an aril.

Eſſ. Ch. Corolla ſalver or funnel-ſhaped. Stamens inſerted into the tube. Berry inferior, one or two-ſeeded. Seeds arilled.

Sp. 1. C. *arabica*, Arabian coffee-tree. Linn. Sp. Pl. 1. Mart. 1. Lam. 1. Willd. 4. Lam. Ill. tab. 160. fig. 1. Woodv. Med. Bot. tab. 230. Gært. tab. 25. (Jaſminum arabicum, Juſſ. Act. 1713. p. 388. tab. 7. Till. Piſ. 87. tab. 32. Evonymo. ſimilis œgyptiaca, Bauh. Pin. 428. Bon five ban, Alp. Ægyp. tab. 36. Pluk. Almag. 69. tab. 272. fig. 1.) "Flowers five-cleft; berries with two ſeeds." Linn. "Leaves oblong-acuminate; peduncles axillary, aggregate; corollas five-cleft." Willd. An evergreen ſhrub, from fifteen to twenty feet high. *Trunk* erect, not more than two or three inches in diameter; branches brachiate, two growing at every joint, almoſt cylindrical, flexible, looſe, expanding; lower ones extending horizontally, generally ſimple. *Leaves* four or five inches long, two inches broad, oppoſite, ſimple, ovate-lanceolate, acuminate, quite entire, ſmooth, green, ſhining on the upper ſurface, pale green underneath, on very ſhort petioles. *Stipules* two at each knot of the branch, awl-ſhaped, enlarged at the baſe, oppoſite, intrafoliaceous. *Flowers* white, ſeſſile, axillary, cluſtered four or five together, ſweet-ſcented, ſoon falling off. *Berries* oval-globular, of a dark red colour when fully ripe. Lam. *Berry* inferior, elliptic-ſphæroidal, with a little circular area at the ſummit, having within it a callous point; two-celled, containing a fleſhy, ſomewhat gelatinous pulp; partition vaſcular-fleſhy. *Seeds* one in each cell, elliptical, convex on one ſide, flattiſh, with a longitudinal chink on the other, of a pale glaucous colour; aril of a ſubſtance reſembling paper, elaſtic, pellucid, looſely ſurrounding the ſeed, and entirely covering it. Gært. A native of the old continent and adjacent iſlands, between or near the tropics. 2. C. *mauritiana*. Lam. 2. Illuſ. tab. 160. fig. 2. (C. arabica β. Willd.) "Berries oblong, acute at the baſe; ſeeds two." Lam. *Branches* compound; branchlets oppoſite. *Leaves* only two inches and a half long, ſomewhat acute, but not acuminate, narrowed to a point at the baſe, ſcarcely petioled, ſmooth, much veined. *Berries* axillary, almoſt ſeſſile, never globular, but oblong and narrowed to a point at their baſe, two-celled. *Seeds* one in each cell, oblong, cartilaginous, pointed at one end, not having much thickneſs. Deſcribed by La Marck from a ſpecimen without flowers ſent to Juſſieu. It is evidently nearly allied to the preceding, but eſteemed by La Marck to be ſpecifically diſtinct, on account of the different ſhape of the fruit. This eminent botaniſt has, however, been unaccountably negligent with reſpect to their ſpecific characters, having retained, without addition, that formed by Linnæus for C. arabica, which, in the Species Plantarum, is oppoſed only to C. occidentalis, and by no means excludes any part of the ſpecific character given by La Marck to his C. mauritiana. The following ones will, we believe, ſufficiently diſcriminate them from each other, and from all the ſucceeding ſpecies. C. *arabica*. "Flowers five-cleft; peduncles axillary, cluſtered; leaves acuminate; berries nearly globular; two-celled, with two ſeeds." C. *mauritiana*. "Peduncles axillary, generally ſolitary; leaves ſomewhat acute; berries oblong, leſſened to a point at their baſe, two-celled, with two ſeeds." But after all, it may be doubted whether the ſuperior plumpneſs of the berries of the Arabian coffee may not be entirely the effect of cultivation. A native of the iſle of Bourbon. La Marck, when he wrote the article in the Encyclopedie, did not know whether the coffee, imported into France by the name of caffé de Bourbon, is the produce of the indigenous tree, or of cultivated plants brought originally from Arabia. It has ſince been aſcertained, that the Bourbon coffee is obtained from Arabian plants ſent from Mocha in the year 1717. And we learn from the Memoirs of the Academy of Sciences at Paris for the year 1715, that the inhabitants of the iſland, on ſeeing a branch of the common coffee-tree with leaves and fruit, brought from Mocha in a French ſhip, inſtantly recollected that they had obſerved a ſimilar tree growing wild on their mountains, which was ſoon after produced, and found to be little different. 3. C. *guianenſis*. Mart. 5. Lam. 3. Willd. 6. Aubl. Guian. 1. tab. 57. "Leaves lanceolate; peduncles axillary, aggregate; corollas quadrifid." Willd. "Flowers quadrifid; berries ſmall, violet-coloured, with two ſeeds." Aubl. A ſhrub, one or two feet high. *Branches* quadrangular, knotty. *Leaves* oppoſite, brachiate, acute, quite entire, green, ſmooth, ſhining, on ſhort petioles. *Stipules* two at each joint, oppoſite, intrafoliaceous, acute. *Flowers* white, ſeſſile. *Berries* ſpherical. *Seeds* coriaceous. A native of Guiana. 4. C. *triflora*. Mart. 10. Willd. 5. Forſt. Prod. 95. "Leaves ovate-lanceolate, acuminate; peduncles three, terminal, one-flowered." A native of Otaheite. 5. C. *paniculata*. Mart. 6. Lam. 4. Willd. 7. Aubl. Guian. 1. tab. 58. "Leaves oblong, acuminate; panicle terminal, divaricated; corollas quadrifid; branches quadrangular." Willd. "Branches quadrangular; leaves large, ovate-oblong, acute; corollas quadrifid; berries with two ſeeds." Aubl. A ſhrub. *Trunk* ſeven or eight feet high, five or ſix inches in diameter; covered with a grey, wrinkled, cracked bark. *Branches* oppoſite, compound, knotty. *Leaves* oppoſite, brachiate, on on short petioles. *Stipules* intrafoliaceous, caducous. *Flowers* white, sweet-scented; peduncles quadrangular, with opposite brachiate ramifications; calyx four-toothed; stamens four. *Berries* bluish; one of the seeds frequently abortive. A native of Guiana. 6. C. *occidentalis*. Linn. Sp. Pl. 2. Mart. 2. Lam. 5. Willd. 8. Jacq. Amer. 67. tab. 47. (Pavetta, Brown. Jam. 142. tab. 6. fig. 1. Jasminum, Burm. Amer. tab. 156. fig. 2.) "Flowers four-cleft; berries with one seed." Linn. "Leaves oblong-lanceolate, acuminate; panicle terminal, trifid, few-flowered; berries with one seed; little branches quadrangular." Willd. A shrub about six feet high. *Branches* long, compound, brittle. *Leaves* opposite, quite entire, shining, on short petioles. *Stipules* intrafoliaceous. *Flowers* white, sweet-scented; stamens four; anthers scarcely projecting beyond the tube. *Berries* roundish, about the size of an olive, crowned at the top, of a bluish black colour when ripe. *Seeds* solitary, roundish, cartilaginous, striated, enclosed in a membranous aril. A native of Jamaica, St. Domingo, and Martinico. 7. C. *racemosa*. Mart. 3. Lour. Cochin. 145. "Much branched; leaves rugged; racemes terminal; berries with two seeds." A small tree, only four feet high. *Branches* numerous, cylindrical, diffuse. *Leaves* opposite, ovate-lanceolate, quite entire, beset with many tubercles, on short petioles. *Flowers* in erect brachiate racemes; common peduncle long, quadrangular; partial ones shorter, cylindrical, opposite or stellate. *Berry* roundish, small, red, watery, one-celled, with two hemispherical seeds. A native of Mozambique. 8. C. *zanguebariæ*. Mart. 4. Lour. Cochin. 145. "Corollas six or seven-cleft; fruit angularly nerved, with two seeds." A small upright tree, six feet high. *Branches* thick, short, spreading. *Leaves* ovate-lanceolate, smooth, opposite. *Flowers* white, axillary, several together, on short one-flowered peduncles. *Berries* red, oblong-ovate, angular with longitudinal nerves. A native of Africa on the coast of Zanguebar; and cultivated near Mozambique with the preceding species. 9. C. *sambucina*. Mart. 7. Willd. 1. Forst. Prod. 92. "Leaves oblong-lanceolate, cymes corymbous, terminal." A native of the Friendly Islands. 10. C. *opulina*. Mart. 8 Willd. 2. Forst. Prod. 93. "Leaves ovate-lanceolate; cymes contracted, globular, terminal." A native of New Caledonia. 10. C. *odorata*. Mart. 9. Willd. 3. Forst. Prod. 94. "Leaves egg-shaped, acute; cymes corymbous, axillary." A native of Tanna and the Friendly Islands.

Propagation and Culture. None of the species, except the first, have been cultivated in Europe; and as this, like all the others, is a native of tropical climates, it is of course confined to our stoves, to which its evergreen-leaves, beautifully white flowers, and succeeding red berries, are a valuable ornament. It is raised most successfully from the berries, which must be fully ripe, and sown soon after they are gathered, for if kept out of the ground a short time, they will not grow. If fresh berries cannot be obtained, young plants must be procured in small pots. The pots in which the seeds are sown should be filled with a light kitchen-garden earth, plunged into a hot-bed of tanners' bark, and sparingly watered once or twice in a week. In a month or five weeks the plants will appear, and in two months more will be fit to transplant. As many of the berries will produce two plants, these must be carefully separated, and treated as before. The plants should have free air admitted to them every day according to the warmth of the season. In summer they will require frequent watering, but should have only a small quantity at a time. They should not be transplanted more than twice a year, and unless they have made great progress in their growth, once will be sufficient. The stove in which they are placed should be kept to the heat assigned for the ananas in the botanical thermometer.

COFFEE, in *Domestic Economy* and *Medicine*, the name of a well known potable liquor, made by a decoction, or simple infusion of the seeds of the coffee-berry, after they have been properly roasted, and ground to powder in a small mill, constructed for the purpose. Its introduction into the civilized world is comparatively of modern date. It was unknown to the Greeks and Romans; nor is it mentioned by any of the European writers who were engaged in the crusades; it could not, therefore, have been used in Syria during the 12th and 13th centuries. We are assured by Mr. Bruce, that it is a native of Abyssinia, and is found wild in great abundance from Caffa to the banks of the Nile.

It is also generally said to have been cultivated in that country from time immemorial. M. Lagrenée, one of the most intelligent agents that France ever had in the India service, says the abbé Raynal, procured some of the fruit, and made trial of it. He found it, as the abbé informs us, to be larger, rather longer, and almost as fragrant as that which is obtained from Arabia. That the qualities of the wild, or cultivated berry, have been long known in that part of Africa, is confirmed by Bruce. The Gallæ, he tells us, a wandering nation of Africa, in their incursions on Abyssinia, being obliged to traverse immense deserts, and being also desirous of falling upon the towns and villages in the cultivated part of Abyssinia without warning; carry nothing with them to eat, but coffee roasted till it can be pulverized, and then mixed with butter to a consistency, that will suffer it to be rolled up in balls, and put into a leathern bag. One of these, about the size of a billiard ball, keeps them, they say, in strength and spirits during a whole day's fatigue. better than a loaf of bread, or a meal of meat. Bruce's Travels, vol. ii. p. 226.

It is, however, from Arabia that coffee was first brought into Europe. Whether it is indigenous in that country, has not been positively ascertained; and it is not possible to reconcile the reports concerning it, which are given by different oriental writers. According to some, the use of it was first introduced by the prior of an Arabian monastery, who, being informed by a goat-herd of the effects produced on his goats, when they had happened to browse on the coffee-tree, gave an infusion of the berries to his monks, to prevent the inclination to sleep, which frequently interfered with the due performance of their nocturnal prayers. According to others, a mollack, named Chadely, was the first among the Arabians who made use of coffee, to relieve himself from a continual drowsiness which hindered him from attending punctually to his nightly devotions. His dervises did the same, and their example was followed by the lawyers. It was soon found out, that this liquor purified the blood by a gentle agitation; dissipated the crudities of the stomach, and raised the spirits; and, in consequence of these properties, it was soon adopted by those who had no occasion to keep themselves awake. Both these accounts, especially the former, clearly imply that the coffee-tree grew wild in Arabia at that time, but was not till then cultivated for the sake of its fruit. The author of an Arabian manuscript, formerly in the library of the king of France, and now deposited in the Bibliotheque Nationale, attributes the first introduction of this beverage into Arabia, to Megaleddin, mufti of Aden, about the middle of the 15th century. He is said to have met with it on a journey into Persia, where it was then only coming into use; and, on his return, to have employed it himself, and given it to the dervises, with whom he was accustomed to spend the night in prayer.

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The example of the mufti rendered this new luxury popular in Aden, whence it rapidly extended to Mecca, Medina, and the other cities of Arabia Felix. Public coffee-houses were opened within a small space of time in Persia, as well as in those cities, which afforded a lounge to the idle, and a relaxation to the man of business. There the politician retailed the news, the poet recited his verses, and the mollacks delivered their sermons. The same of this bewitching potation quickly reached Grand Cairo, and was received with equal avidity at Constantinople. But in these populous cities, it did not obtain similar favour from the ruling powers. At Grand Cairo it was opposed on religious grounds. In the year 1511, it was prohibited by Khaiae Beg, from a persuasion that it had an inebriating quality, and produced inclinations forbidden by the Koran. But the prohibition was soon after taken off by his successor, Causon. In the year 1523, Abdallah Ibrahim again denounced it in a sermon delivered in the mosque of Hassananie. A violent commotion was produced, and the parties came to blows. Upon this the sheik, El-beiet, commander of the city, assembled the doctors, and, after giving a patient hearing to their tedious harangues, treated them all with coffee, first setting the example, by drinking it himself, and then dismissed the assembly without uttering another word. By this prudent conduct, the public peace was restored; and coffee continued to be drank at Grand Cairo without further molestation.

At Constantinople it had to encounter political, as well as religious, opposition. Religion, as usual, took the lead. The dervises had the sagacity to discover, that coffee, when roasted, has become a kind of coal; they, therefore, declaimed against it with fury, coal being one of the substances which their prophet declared not intended by God for human food. The mufti was of their party, and the coffee-houses were soon shut up. A more sensible mufti succeeded, who assured the faithful, that roasted coffee is not coal, and they were again opened. But, though religious superstition thus easily gave way to the seductive influence of sensitive enjoyment, a submission not at all uncommon, the political objections were not so readily silenced. The ever-trembling apprehensions of a despotic government found, or fancied that they found, in the public coffee-houses, receptacles for the disaffected, and nurseries of sedition. These dangerous places of resort were, consequently, always regarded with a jealous eye; and, after several vicissitudes of connivance and discouragement, were at length finally prohibited. But they were not deemed formidable beyond the precincts of Constantinople. They were of too much importance to the public revenue to be entirely suppressed, and were suffered to remain, without much restraint, in all other parts of the empire. Nor in the capital itself was the use of coffee in private families at all discouraged; scruples of conscience were no longer excited against it; and it has ever since been allowed to all ranks of men, with the full permission both of the mufti and of the civil government. The Turks have now a particular officer, whom they call *Kahveghi*, or inspector of coffee; and in the seraglio there are several Kahveghis, each of whom presides over twenty or thirty Battagis, who are solely employed in preparing this favourite liquor for the inhabitants. A refusal to supply a wife with coffee, is even said to be reckoned among the legal causes of a divorce.

The first mention of coffee in the west of Europe is by Rauwolff, a German traveller, who returned from Syria in 1573. The tree was particularly described in 1591 by Prosper Alpinus in his "Medicina Ægyptiorum," and also in his "History of Ægyptian Plants," printed at Venice in 1592. Its use, as a beverage, is noticed by two English travellers in the beginning of the 17th century; Biddulph about 1603, and William Finch in 1607. The former says, "The Turks have for their most common drink coffee; which is a black kind of drink, made of a kind of pulse, like pease, called *coava*." The latter, "The people in the island of Socotora have, for their best entertainment, a China dish of cobo, a black bitterish drink, made of a berry like a bay-berry brought from Mecca, supped off hot." Pietro della Valle, a Venetian, tells his friend in a letter written from Constantinople in 1615, that, upon his return, he should bring with him some coffee, which, he believed, was a thing unknown in his country. In France, it was introduced first at Marseilles, in the year 1644, by some gentlemen who accompanied Monf. de la Haye to Constantinople, and brought with them on their return, not only some coffee, but the proper apparatus and vessels for making and drinking it. In 1660, several bales were imported from Egypt: and in 1671, a coffee-house was opened at Marseilles, in the neighbourhood of the exchange, where people met to smoke, talk of business, and divert themselves with play. It was first brought to Paris in 1657, by the celebrated traveller Thevenot; but only in a small quantity, and consequently was confined to his own family and particular friends. By the public at large it was never seen, and scarcely heard of, but from the account of travellers. In 1669, it was more generally introduced by Soliman Aga, ambassador from the sultan Mahomet IV.: and in 1672, a public coffee-house was opened by an Armenian, called Pascal, who afterwards removed to London. But the use of coffee had been introduced in the English capital before the return of Thevenot from the East. For, in 1652, Daniel Edwards, a Turkish merchant, brought home with him a Greek servant, whose name was Pasqua, who understood the method of roasting and making it. This servant was the first that publicly sold coffee, and kept a house for that purpose in George Yard, Lombard-street. The first mention of coffee in our statute books is anno 1660 (12 Car. II. cap. 24.) when a duty of four-pence was laid upon every gallon of coffee made and sold, to be paid by the maker. In 1663, it was ordered, by a particular statute, that all coffee-houses should be licensed at the general quarter sessions of peace for the county. And in 1675, Charles II. issued a proclamation to shut them up as seminaries of sedition; but in a few days the proclamation was abrogated by a second. Since that time coffee is often mentioned in our statute books, but only with a view to the regulation of the duties. Ray, in his "History of Plants," published in 1688, supposes that there were then in London as many coffee-houses as in Grand Cairo itself, and that similar houses were to be met with in all the principal cities and towns in England. At the same time he expresses his surprize that the neighbouring countries should permit so rich a treasure to be confined to a single province, and wonders what watchful dragon is employed by the natives to prevent strangers from procuring either the plant itself or its recent seeds; which, he doubts not, would readily grow in a similar climate and soil to the great advantage of the cultivator. It cannot be imagined that the enterprising commercial nations of Western Europe, which have formed colonies in the tropical regions, would be inattentive to the value of such an acquisition. The Dutch were the first who made the attempt with success. We are informed by Boerhaave, in his "Index to the Leyden Garden," that Nicholas Witsen, burgomaster of Amsterdam, and governor of the East India company, instructed Van Hoorn, governor of Batavia, to procure from Mocha, in Arabia Felix, some berries of the coffee-tree to be sown at Batavia. This was accordingly done, and about 1690, many plants were raised

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from ſeeds, one of which was ſent to the garden at Amſterdam, where it bore fruit, and in a ſhort time many other plants were raiſed from it. In the year 1714, the magiſtrates of Amſterdam ſent to Lewis XIV. a fine tree about five feet high, in full foliage, with both green and ripe fruit. This plant is ſaid by Du Tour to have been the parent of all that have ſince been cultivated in France and in the French Weſt India iſlands. In 1717, ſeveral plants were ſent to Martinico, under the care of M. de Clieux, who approved himſelf worthy of the truſt. For the voyage being long, and the weather unfavourable, they all died but one; and the whole ſhip's company being at length reduced to ſhort allowance of water, this zealous patriot divided his own ſhare between himſelf and the plant committed to his charge, and happily ſucceeded in bringing it ſafe to Martinico, where it flouriſhed, and afforded a ſtock for the neighbouring iſlands. In 1718, the Dutch colony at Surinam firſt began to plant coffee; and, in 1722, the French governor of Cayenne, having buſineſs at Surinam, contrived by an artifice to bring away a plant, which, in the year 1725, had produced many thouſands. In the year 1732, coffee was cultivated in Jamaica, and an act paſſed to encourage its growth in that iſland.

It is well known that the Arabian coffee is univerſally allowed to be better in quality, and conſequently bears a higher price than that which is raiſed in any of the European colonies. The reaſons that have been aſſigned for this difference may be reduced to five: 1. Difference of climate and ſoil. That part of Arabia where the coffee tree is cultivated is rocky, dry, and hot. At Batavia the ſoil is rich and deep; and in the rainy periods the quantity of wet that falls is exceſſive. Hence it is probable that the plant had in ſome meaſure degenerated before it arrived in Europe. Nor was it likely to be improved by its removal to the Weſt Indies, where it is generally cultivated on the richeſt ground. For though the planters know by experience that coffee grown in a light ſoil, and on dry and elevated ſlopes, ſuch as are choſen for it in Arabia, has a ſmaller berry, with a delicate flavour; while that which is produced in a low, fertile, and moiſt ſoil, has a larger berry, but comparatively flat and inſipid: yet, as they alſo learn from experience, that the trees in this rich ſoil commonly yield from twelve to ſixteen ounces per plant; while thoſe in the drier ſoils will ſcarcely furniſh more than from ſix to eight ounces, making a difference of one half in the weight; and as in all the European markets the ſtated difference in the price of each is only from 15 to 20 per cent. it is evidently their intereſt to raiſe their coffee in the richeſt ſoil, notwithſtanding the deterioration in the quality of the berry, which is the neceſſary conſequence. 2. The cuſtom of pollarding the trees, which is univerſal in almoſt all the French iſlands. The branches are obliged by this operation to take more of a lateral direction, in conſequence of which they grow thicker, and afford leſs acceſs to the rays of the ſun; they are alſo apt to become decumbent, and more expoſed to the moiſt evaporations of the ſoil: and hence, as Du Tour imagines, the berries are ſeldom perfectly ripened. 3. Gathering the fruit before it is perfectly ripe, and not drying it in a proper manner. In Arabia the coffee berries are not gathered till they readily fall off on ſhaking the tree, when they are received on linen ſheets ſpread for the purpoſe, and are then removed to a ſituation where they can be completely dried in the ſhade on mats, which are fitted to imbibe their moiſture. But in the Weſt Indies this cannot be effected, for though the air in thoſe climates is hot, it is always ſo damp, that coffee could never be dried in the ſhade, ſufficiently for exportation to Europe. The rains, moreover, which are then very frequent, often make the berries fall before they are perfectly ripe. Du Tour recommends the drying of them in ſtoves. The method of curing coffee in the Weſt Indies, as it is deſcribed by Dr. Titford of Spaniſh-town, Jamaica, (ſee the 9th volume of the Tranſactions of the Society of Arts, &c.) is as follows: They bring the coffee-berries, after they are ripened on the trees, to a machine called a peeling-mill, where it is diveſted of its outer ſkin and pulp: after which it is put in heaps, and undergoes a ſlight fermentation, which is then ſpread out and dried on platforms or terraces, until it is perfectly cured, when it is ſtored till the whole crop is got in. When this work is completed, they begin to prepare it for market, by again putting it in the ſun, and carrying it to the peeling and winnowing-mills, where it is totally diveſted of its coats and impurities, and the broken and bad coffee picked out, &c.; after which it is fit for market. The ſmall and needy planters, however, who have no mills, beat out their coffee in large wooden mortars, or troughs, which occaſion a waſte by breaking the berry. When any coffee is kept for private uſe, or iſland conſumption, it does not undergo the above proceſſes; but the ripe fruit, as it is picked from the tree, is ſpread out in the ſun, and ſimply well dried, and beat out as it is wanted for uſe or ſale. Coffee is well known to improve, when ſo preſerved, by drying it in the berry; but to be impaired, when it is diveſted of its coverings, as it is now ſent to market. Dr. Titford, therefore, recommends its being ſent home, in the whole berry, well dried. One advantage attending this mode is the ſaving of the labour to the negro, and conſequent expence to the planter; and another is the prevention of the coffee's imbibing the ill flavour of ſugar, rum, pimento, &c. which may be ſhipped with it, and which, it is ſaid, is the principal objection to the uſe of the Weſt India coffee in England. 4. Want of proper care in ſtowing them for the voyage. If they come in a ſhip with raw ſugars and rum, they are ſure to contract a taſte which cannot be driven off by the ſubſequent roaſting. The French are in this reſpect much more attentive than the Engliſh, and, in conſequence, their coffee, eſpecially that from the Windward iſlands, is commonly better. This ſuperiority is the effect of peculiar circumſtances. Moſt of the Engliſh ſhips are hired for the freight; the captains ſtow the goods as they receive them, and the owners are ſatisfied, if the veſſel is but well filled. The French ſhips are generally laden for the proprietor's own uſe; the captains buy the goods themſelves; and that they may be able to give a good account of their management, they are obliged to pay great attention to the ſtowage of their veſſel, and the preſervation of their cargoes. 5. Uſing the coffee-berries too ſoon. Dr. Browne aſſerts, that the worſt coffee produced in America will, in a courſe of years, not exceeding fourteen or fifteen, be as good, parch and mix as well, and have as high a flavour, as the beſt we now have from Turkey, if kept in a dry place, and properly preſerved; and that ſmall-grained coffee, or that which is raiſed in a dry ſoil and warm ſituation, will, in about three years, be as good as that which is now uſed in the London coffee-houſes. Du Tour, on the other hand, aſſerts, that whether it be old or new is of little importance, provided it have been gathered when fully ripe, and have loſt all its vegetable juices. He is, moreover, of opinion that, *cæteris paribus*, it is always beſt when new; and aſſures us that he has drank in St. Domingo the coffee of that country made of berries gathered only ſix weeks before, which was not worſe, if not better, than Mocha coffee that was three years old. It is true, he adds, that he gathered the berries himſelf when they were juſt ready to fall, deprived

prived them immediately of their pulp, dried the feeds in the fun as fpeedily as poffible, and roafted them when they ceafed to diminifh in fize, and when he could fcarcely break them with his teeth. In all other refpects he treated the two kinds of coffee in the fame manner, and made ufe of them in equal proportions.

Thus, in the courfe of three centuries and a half, has a berry, which was not before known as an article of food, except to fome favage tribes in the confines of Abyffinia, made its way through the whole civilized world. In the nations which profefs the religion of Mahomet, it is drunk at leaft twice a day by all ranks of men, from the fultan and mufti to the artificer and the peafant. Among the profeffors of Chriftianity, by whom it has been known little more than a century and a half, it is ftill regarded rather as a luxury, and is ufed only by the middle and upper claffes. In England, indeed, tea is moft generally preferred; but on the continent, efpecially in France, coffee is in univerfal requeft. In confequence of this prevailing fafhion, the tree which produces it is now extenfively cultivated in the tropical climates of both hemifpheres. Of Arabia Felix it may be reckoned the moft valuable produce. The Dutch, as we have feen, early introduced it into the ifland of Java, and foon after into Ceylon. The Englifh have plantations of it about Madras; the French once had at Pondicherry, and ftill raife it in great quantities in the Ifles of France and of Bourbon. In America it is cultivated by the colonifts of thefe three maritime powers, and in fome degree by the Spaniards. It is not poffible to procure an accurate account of the quantity that is raifed and confumed; but fome idea may be formed from the following partial details.

	Pounds Weight.	
Arabia furnifhes annually to the European companies	1,500,000	
——— Perfians	3,500.000	
——— fleet from Suez	6,500,000	
——— to Hindooftan, the Maldives, and the Arabian colonies on the coaft of Africa	50,000	
——— to the Caravans	1,000,000	
Total	12,550,000	Raynal.

Surinam exported in 1775		15,387,000	Do.
Martinico		9,688,960	Do.
Guadaloupe		6,302,902	Do.
Cayenne		65,888	Do.
St. Domingo exported in 1767		12,197,977	Do.
———	in 1775	45,933,941	Do.
———	immediately before the French revolution	71,663,187	Edwards.
St. Lucia	in 1752	about 5,000,000	Raynal.
Porto Rico	in 1778	1,116,325	Do.
Grenada	in 1776	1,827,166	Edwards.
———	in 1787	987,004	Do.
St. Vincent	in 1787	71,041	Do.
Dominica	in 1787	2,032,778	Do.
———	in favourable years	3,000,000	Do.
Jamaica	in 1768	420,300	Do.
———	in 1774	650,700	Do.
———	in 1787	716,315	Do.
———	in 1790	1,783,740	Do.

A pound of coffee is generally more than the produce of a fingle tree; but vigorous trees of a proper age fometimes produce four pounds or more; and at Surinam fome that were five years old and eighteen feet high, have been known to produce even feven pounds.

The Arabians and Turks drink their coffee very hot, and without fugar. People of the firft fafhion ufe only what is called fultana coffee, made of the dried pulp of the berry. This pulp, after it has been bruifed, is put into an iron or earthen pan, placed on a charcoal fire, and ftirred about till it becomes a little brown, but not of fo deep a colour as the common coffee; it is then thrown into boiling water, with the addition of at leaft a fourth part of the membranous hufk or aril of the feeds, commonly called, in the Weft Indies, the parchment. The whole is boiled together in the manner of common coffee. The feeds are thought by the Arabians to be too heating; the common people, therefore, generally ufe a weak liquor made of the membranous hufks alone. Thefe, as well as the pulpy part, are carefully taken off from all the coffee that is fent to the weft of Europe, and the feeds, becoming dry, foon lofe their vegetative life. The excellence of our coffee depends in a great meafure on the fkill and attention employed in the roafting; if done too little, it has little flavour, and lies heavy on the ftomach; if too much, it becomes acrid, acquires a difagreeable burnt tafte, and is rendered pernicious, or at leaft, is deprived of its beft qualities; whereas, according to Du Tour, the action of fire, when nicely regulated, takes away its rawnefs, and the aqueous part of its mucilage, deprives it of its faline qualities, and gives it that empyreumatic fcent, which is fo pleafant and refrefhing, and which is fomewhat fimilar, but greatly fuperior, to that produced by broiling meat on a gridiron.

In England the feeds are commonly roafted in a cylindrical tin box, perforated with numerous holes, and fixed upon a fpit which runs longitudinally through the centre, and is turned by means of a jack. The whole is fufpended over a large charcoal fire in a femicircular hearth; or, as in Yorkfhire, placed directly in front of the large kitchen fire, and taken off occafionally, that the berries may be fhaken and preferved from burning. When the oil rifes, and the feeds have a dark brown colour, it is emptied into receivers made

made with large hoops, and with iron plates at the bottom; there the coffee is again ſhaken and left to cool. If it look bright and oily, it is a ſign that it is well done. In Perſia boiling water is frequently poured upon the entire ſeeds, which makes a weak, but agreeable infuſion. And in Europe ſome are of opinion that the coffee has a more delicate flavour when the ſeeds have only been bruiſed or pounded in a mortar; but the common method is to grind it in a mill to a fine powder. It is generally allowed that it is much the beſt when it has been recently roaſted. The powdered coffee is ſometimes put into a linen bag or ſtrainer, ſuſpended at the mouth of a coffee-can, or as it is called in the north of England, a coffee-biggin: boiling water is then poured upon it, till the can is ſo full as to keep the ſtrainer completely immerſed in the hot water. When it has ſtood a ſufficient time, the liquor is conveyed through the ſpout of the can, clear of the coffee grounds. This is pronounced by Du Tour to be a good method. But, in his opinion, the following is much better. Let the powder be poured into a coffee-pot filled with boiling water in the proportion of two ounces and a half to two pounds, or two Engliſh pints of water: let the mixture be ſtirred with a ſpoon, and the coffee-pot be ſoon taken off the fire, but ſuffered to remain cloſely ſhut, for at leaſt two hours on the warm aſhes. During the infuſion, the liquor ſhould be ſeveral times agitated by a chocolate frother, or ſomething of the ſame kind, and be finally left for about a quarter of an hour to ſettle. Coffee thus prepared, adds the experienced French naturaliſt, is perfect. In France coffee is almoſt univerſally made ſtronger than in England. The Engliſh, ſays a lively French traveller, care little about the quality of their coffee, if they can but get enough of it. Dr. Fothergil recommends the following method of making it for breakfaſt: Let it be made in the uſual manner, only a third part ſtronger than uſual, and let as much boiling milk be added to it before it is taken from the fire, as there is water. When it has ſettled, drink it either with cream or without, but with very little ſugar, which is apt to make it become acid on weak ſtomachs. Our Engliſh phyſician was of opinion, that if our poor and middling people were able to procure this, it would be much more nouriſhing and beneficial than the wretched beverage of ordinary tea, in which they now indulge themſelves.

In none of the ſtates of Chriſtendom was the uſe of coffee oppoſed by religious fanaticiſm; nor had it to encounter political jealouſy, except for a few days in the reign of our Charles II. But, like every other ſubject which has occupied the human mind, it could not fail to occaſion a difference of opinion. Among the profeſſors of medicine in particular, it met with aſſailants and abettors. The Theſis, entitled *Potus Coffeæ*, delivered by a Swediſh ſtudent in the univerſity of Upſal, and publiſhed in the "Amænitates Academicæ" under the direction of Linnæus himſelf, is a ſarcaſtic entertaining invective againſt the introduction of this novel luxury, which the patriotic youth apprehended would vitiate the native taſte, and debauch the ſimple manners of his countrymen. He accordingly inveighs againſt it with an honeſt indignation, as one of the pernicious irrational indulgences which had been imported into Sweden from degenerate France; and gives a ludicrous liſt of the expenſive utenſils required for its uſe in that faſhionable ſtyle which the vanity of his fair country women would not permit them to forego; and enumerates, with ſomewhat of a triumphant ſatisfaction, the numerous bodily diſorders, which it has been known, or is likely to generate. Nor is it without ſome reluctance that he acknowledges its beneficial effects in a few particular caſes. Others, on the contrary, are as vehement in its praiſe. If we may believe Du Tour, it baniſhes languor and anxiety, gives thoſe who drink it a pleaſing ſenſation of their own well-being, and diffuſes through their whole frame a vivifying delightful warmth; it is alſo highly favourable to the ſocial virtues, promotes cheerful converſation, ſharpens the capacity for witty repartee, ſmooths the wrinkled brow, and is ſometimes able to convert enemies into friends. Did it certainly poſſeſs the latter property, who would not devoutly wiſh that Napoleon and all the other monarchs of Europe, without inquiring whether they have acquired their crowns by uſurpation or by legal hereditary ſucceſſion, would meet once a year, each accompanied by his prime miniſter, and take an exhilarating cup of coffee together? How in that caſe would they ſmile upon each other, and in what good humour would they return to their reſpective palaces, to diſcharge, with benevolent faithfulneſs, the important duties of their elevated ſtation! But to deſcend from theſe extravagancies of cenſure and panegyric, the truth ſeems to be, that coffee, like tea, has different effects upon different conſtitutions, and that phyſicians are inclined to recommend or diſparage the one or the other, as it happens to agree or to diſagree with their own. Dr. Fothergil did not venture to decide which of the two is abſolutely the beſt. From his perſonal experience he preferred coffee; but obſerves that neither of them afford any material ſupport, and that they are rather the vehicles of nouriſhment than nutritious of themſelves. The complaints ſaid to have been produced by the frequent or exceſſive uſe of coffee are habitual head-achs, vertigo, tremors, maſculine imbecility, pimples of the face, weakened viſion, and according to profeſſor Murray, apoplexy. It has alſo been ſuſpected of producing palſies, and Dr. Percival aſſures us, from his own obſervation, that the ſuſpicion is not altogether without foundation. As it produces or aggravates hyſterical and hypochondriacal affections, Tiſſot cautions literary and ſedentary people againſt its uſe. To thoſe, however, who are inclined to trim the midnight lamp, it cannot but be acceptable: but they will perhaps do well to uſe it rather as an occaſional refreſhment than a regular beverage. Coffee, ſays Dr. Percival, is ſlightly aſtringent and antiſeptic; it moderates alimentary fermentation, and is powerfully ſedative. Its action on the nervous ſyſtem probably depends upon the oil which it contains, which receives its flavour, and is rendered mildly empyreumatic by the proceſs of roaſting. Its medicinal qualities ſeem to be derived from the grateful ſenſation it produces on the ſtomach, and from the ſedative powers it exerts on the *vis vitæ*. Hence it aſſiſts digeſtion, and relieves the head-ach; but in delicate habits, it often occaſions watchfulneſs, tremors, and many of thoſe complaints which are denominated nervous. Dr. Fothergil thought the French practice of drinking coffee immediately after dinner, with a view to promote digeſtion, much better than our cuſtom of taking it later in the evening; and that at any rate it is a deſirable ſubſtitute for the bottle, which, in England and the northern parts of Europe, detains the gentlemen at the dinner-table ſo long after the cloth is drawn, to the prejudice of their health, and ſometimes to the injury of their fortunes. (See Ellis's Hiſtory of Coffee. The abbé Raynal's Hiſtory of European Settlements: French Edition of 1780. Bruce's Travels in Abyſſinia. Edwards's Hiſtory of the Britiſh Weſt India Iſlands. Woodville's Medical Botany. Du Tour in Nouveaux Dictionaire d'Hiſtorie Naturelle, and Dictionaire Encyclopedie Methodique, Agriculture, under the word Caffayer).

By

By 43 G. III. c. 68. all former duties of customs on coffee are repealed, and the following new duties imposed: For that which is the produce of any British colony or plantation in America, or of any other country or place, on importation, to be secured in warehouses, 6*d.* per cwt.; and when taken out of such warehouses for home consumption, 5*d.* per lb. By 43 G. III. c. 69. all former duties of excise are in like manner repealed, and in lieu of them the following are imposed: For every lb. weight avoirdupoise of coffee, of the growth or produce of any British colony or plantation in America, imported into Great Britain, 1*s.* 1*d.*; for the same, if imported by the East India Company, 1*s.* 6*d.*; and for the same of all other coffee imported into Great Britain, 2*s.* No coffee shall be imported into Great Britain otherwise than in chests, cases, or packages, containing at least 112 lb., on pain of forfeiting the same; and none other shall be entered for exportation. 5 G. III. c. 43. 23 G. III. c. 79. 42 G. III. c. 93. Officers of the excise and customs may go on board ships, search, and seize. 11 G. III. c. 80. By 5 G. III. c. 43. if any vessel, coming from foreign parts, having on board 20 lbs. of coffee, shall be found at anchor, or hovering within two leagues of the shore, the coffee shall be forfeited, and the vessel, &c. be also forfeited, provided such vessel doth not exceed the burden of 50 tons. By 35 G. III. c. 118. the commissioners of excise shall provide near to the respective ports warehouses for lodging coffee and cocoa-nuts: and officers of excise shall mark every cask or package of these articles on board of ships importing them: and if they are shipped before they are marked, they shall be forfeited and seized. When they are taken out of warehouses, the proprietor shall give written notice to the officers, if for home consumption one hour, if for exportation 12 hours; bring them to be weighed, and pay the duty. On producing a certificate of the payment of the duties, a permit for the removal of them shall be granted. The importer, within 30 days after the entry of the vessel, shall enter the coffee, cocoa-nuts, &c. with the officer of excise appointed for this purpose; and the same shall be landed or warehoused, on paying or securing the duties. In default of such entry, the same shall be deemed clandestinely run, and forfeited. 10 G. c. 10. 5 G. III. c. 43. Coffee, &c. not removed, and delivered within the time, specified in the permit, shall be deemed as removed without permit. Coffee, and also tea, intended to be taken out for exportation, shall be delivered on security given that they shall be exported, and not relanded; which security shall be discharged, on a certificate under the common seal of the chief magistrate beyond the seas, or under the hands and seals of two known British merchants there, that the same were landed, or on proof by credible persons, that they were taken by enemies, or perished in the seas. 10 G. c. 10. By 21 G. III. c. 55. no damaged coffee, which cannot be sold for 1*s.* 6*d.* a pound, nor cocoa-nuts for 1*s.* a pound, shall be sold to be consumed in this kingdom, but secured in warehouses, and not taken out till security be given for the exportation of them. Officers of excise seizing forfeited coffee, &c. shall be allowed one-third of the clear sum that shall arise from the sale after condemnation, &c. 21 G. III. c. 55. Every person keeping a public-house, shop, &c. for selling of brandy and other spirituous liquors, who shall have in his custody coffee, tea, chocolate, or cocoa-nuts above 6 lbs. weight, shall be deemed a dealer in such articles. 11 G. c. 30. By 20 G. III. c. 35. no person shall sell any coffee, &c. without a licence; for which he shall pay (by 43 G. III. c. 69.) 5*s.* 6*d.* to be annually renewed: and selling without such licence, incurs a forfeiture of 20*l.* Houses of manufacturing and sale are to be entered at the office for the division on pain of forfeiting 200*l.* and the goods, &c. 10 G. c. 10. Every house, in which coffee, tea, cocoa-nuts, or chocolate shall be sold, must have an inscription over the door, "dealer in coffee, tea, &c." on pain of 200*l.* And persons buying any of the said articles of a person not having such inscription over his door, shall forfeit 100*l.* Persons having such inscription without entry of their houses, shall forfeit 50*l.* over and above the penalties for selling or dealing without entry. 19 G. III. c. 69. Officers may enter houses, &c. where such articles are sold, to survey and weigh, and in weighing, be assisted by the owner, who shall keep just weights and scales, on pain of 100*l.* and forfeiture of the same. 10 G. c. 10. 10 G. III. c. 44. 28 G. III. c. 37. Deceiving or obstructing the officer incurs a forfeiture of 100*l.* 26 G. III. c. 77. If any person shall obstruct an officer searching for goods supposed to be concealed, he shall forfeit 100*l.*; and the seller or dealer concealing the said articles, shall forfeit the same, and treble value, with package, &c.; and the obstruction of an officer in seizing or removing the said goods incurs a forfeiture of 50*l.* 10 G. c. 10. No person shall mix with coffee, any butter or other materials, to increase the weight, and knowingly buy or sell any so mixed, under forfeiture of 100*l.* 11 G. c. 30. Roasting houses shall be appointed by the commissioners, with proper officers and persons skilled in roasting, and persons having paid the duties may have their coffee berries roasted for 8*s.* per. cwt.; or the sellers and dealers may find their own roasters, paying 3*s.* per cwt. By 48 G. III. c. 129. if any article, made to resemble coffee or cocoa, be found in the possession of any dealer, or called by him English or British coffee, &c. it shall be forfeited, and the dealer shall forfeit 100*l.* All sellers and dealers of coffee, &c. shall keep a daily account of all coffee, tea, chocolate, and cocoa-nuts sold in small quantities under 6 lbs.; and also an account of each parcel above 6 lbs. sold in each day, in books prepared by the commissioners, to be returned to the officer upon oath of the truth of the entries: and neglect of doing the same shall incur a forfeiture of 100*l.* 10 G. c. 10. The commissioners shall cause all coffee and tea seized in London and condemned, to be sold there; and if seized elsewhere, they shall cause it, after condemnation, to be brought and sold in London; or, after having been valued by sworn valuers, they may be sold where the commissioners shall think proper. 12 G. c. 28.

COFFEE-*Berries*, in *Natural History*. These are figured pyritæ found in the cliff of Shepey island, and thought to resemble the berries of the coffee-tree in their external form, by Mr. Jacob, who published an account thereof at the end of his "Plantæ Favershamenses."

COFFER, a long square box about three feet long, and one and a half broad, used for breaking in pieces tin ore in a stamping-mill.

COFFER, *Capsa*, in *Architecture*, a square depressure, or sinking, in each interval between the modillions of the Corinthian cornice; originally filled up with a rose, sometimes with a pomgranate, or other enrichment.

These sinkings, called also *panels*, are of different figures in the compartments of vaults and soffits.

COFFER, in French *Coffre*, in *Fortification*, a hollow lodgment, or little ditch made in the great ditch when it is dry, and has no fausse-bray. Coffers are made opposite to or before the flanks of the bastions, are from 15 to 20 feet wide, from six to seven feet deep, and are covered with planks and earth raised about two feet higher than the level of the bottom of the ditch, after the manner of a parapet, in order to have embrasures in them for small pieces of artillery to defend the faces of the opposite bastions, and to prevent the passing of the ditch. Inftead of coffers, caponiers are frequently made acrofs the ditch, oppofite to the middles of the tenailles or curtains, which are lodgments four or five feet deep, having on each fide a palifaded parapet about three feet high, as a double covered way, to cover the mufqueteers lodged in it, who fire through the meurtrieres, and pafs through fuch caponiers to get to the outworks. Thefe are alfo made often upon the *glacis* of the *efplanade*, to repel the enemy when he endeavours to take the covered way. Coffers are of ufe only to the befieged. The chamber of a mine is alfo called *coffre*.

Coffer, *Coffre a feu*, confifts of feveral coffers filled with fire-works, and other combuftible materials, which they conceal in places, by which they fuppofe or fufpect the enemy will fend fome foldiers to attempt an enterprife. They fet fire to it by means of a train of powder, or by a faucisfon.

Coffer *of a horfe*, denotes the hollow formed by the contour of the ribs. See Horse.

Coffer, or *Cradle*, in *Inland Navigation*, denotes a large wooden trunk or veffel open at top, with moveable ends, large enough to receive a barge or veffel from a canal, in order to its being hoifted into a higher pound of a canal, or let down from it. See fubftitutes for locks in our article Canal. See Canal and Lock.

COFFER-DAM, a term in *Enginery* for a circular double range of piles, with clay rammed between, formed round any entrance lock to a dock, bafon, or canal, where the fame cannot otherwife be laid dry for digging out and building the foundations. See our articles Canal and Lock.

Coffer-Dam, *Batardeau*, Fr.; an enclofure ufed in laying the foundations of bridges and other aquatic buildings. The earlieft mention of coffer-dams occurs in the writings of Alberti, cap. 6. lib. 2. "Make," fays he, "the foundations of your piers in autumn when the water is loweft, having firft raifed an enclofure to keep off the water, which may be done in this manner. Drive in a double row of ftakes, very clofe and thick fet, with their heads above the top of the water like a trench; then put hurdles within this double row of ftakes, clofe to that fide of the row which is next to the intended pier, and fill up the hollow between the two rows with rufhes and mud, ramming them together fo hard that no water can get through; then whatever you find within the enclofure, water, mud, fand, or whatever elfe is a hindrance to you, throw them out, and dig till you come to a folid foundation." This method recommended by Alberti, will anfwer for fhallow water, but the coffer-dams in deep and rapid rivers muft be conftructed with four or fix rows of ftrong piles connected together with ties, to form a framework of timber, and covered on each fide with a fheeting of planks; then the interftices of the frame are to be filled in with clay or chalk carefully rammed to make the whole ftaunch.

COFFERER *of the King's Houfehold*, a principal officer in the court, next under the comptroller; who, in the compting-houfe, and elfewhere at other times, has a fpecial charge and overfight of other officers of the houfe, for their good demeanour and carriage in their offices; to all whom he pays the wages. See Household.

COFFIN, in a general fenfe, a wooden box or trunk, into which the bodies of dead perfons are put, in order for burial.

Coffins, at various periods, have been made of very different materials. Coffins formed of a fingle ftone, hollowed with a chiffel, are attributed by Mr. Gough to the Romans. They were fometimes of marble. Some of them contained two or more bodies, others only one; in which cafe it was not unufual for them to be made to fit the body, with cavities for the reception of the head, arms, and other protuberances. The folid ftone, or marble coffin, often curioufly wrought, was in ufe among the firft Chriftians in England; who, in all probability, copied the cuftoms of the Romans, after the conquerors had quitted our ifland. The coffin, called "kiftvaen," found among ancient relics in this kingdom, was compofed of rough ftones, fet edgeways at the fides and ends, and covered with one or more flat ftones. Sometimes the ftones were cemented together fo that the joints were not difcernible, and fometimes they were compofed of baked clay or tiles. The leaden coffin was in ufe among the Romans, not only for the reception of the body, but, in many inftances, for the afhes and bones. It was adopted by the Chriftians, and continues in frequent ufe to the prefent time, efpecially among the more opulent. However, lead was not the only metal ufed for coffins. Alexander was buried in a golden coffin by his fucceffor Ptolemy; and Mr. Gough fays, that glafs coffins have been found in England. The moft ancient inftance of wooden coffins on record among us, is that of king Arthur, who was buried in an entire trunk of oak, hollowed. The monk of Glaftonbury calls it "Sarcophagus ligneus." On this fubject fee Gough's Sepulchral Monuments in Great Britain, part i. fol. 1786.

The great improvements which took place in the cafting of iron about 20 or 30 years ago, enabling large articles to be run much thinner than before, fuggefted the introduction of caft-iron coffins; thefe were caft at fome of the Yorkfhire founderies, of different fizes, extremely thin, and fo apportioned, that they packed one within another, after the manner of nefts of pill-boxes, for the convenience of carriage. From not having heard of thefe iron coffins of late, we apprehend that they were not found to anfwer in point of expence. The increafing practice of ftealing dead bodies out of church-yards and burying grounds, for the ufe of the anatomical fchools, and lecture rooms of the metropolis, having excited the alarms of a great number of perfons, on the 5th of July, 1796, Mr. Gabriel Aughtie took out a patent for an improved kind of coffin, which fhould render the ftealing of bodies therefrom very difficult, if not impoffible. Thefe patent coffins are made of wood, in the common way, except that no faw-curfs are made in the fides for facilitating their bending to the fhape, and by which the fides of common coffins are fo much weakened; the infide of the bottom, fides, end, and top, are fecured by iron plating, and with angle pieces, from being cut or forced open; on the under-fide of the lid are fixed eight double fpring-catches, and within the top of the fides, eight brafs fockets, exactly fitted to the catches, fo that when the coffin is to be finally clofed thefe fpring-catches enter the fockets, and by fpringing open when the lid is clofe put down, they effectually fecure the lid from being again removed, as no tool or inftrument can be introduced to contract the fprings again, and prepare them for being drawn back. Between thefe fpring-catches the patentee employs fcrews to further fecure the lid, fimilar to thofe ufed in common, except that each fcrew head has both halves of it filed away in a bevelled form, and in contrary directions, fo that the fcrew-driver has perfect hold for driving or fcrewing them in, but none for drawing or unfcrewing them again. For further fecurity, thefe patent fcrews have their heads let into the lid, and a plug of wood, which matches the grain of the wood in the lid, is fitted in upon them, fo as to conceal the places of thefe fcrews.

Coffin, in the *Manege*, the whole hoof of a horfe's foot, above the coronet; including the coffin-bone, the sole, and the frush.

COFFIN *bone*, is a small spongy bone, enclosed in the midst of the hoof, and possessing the whole form of the foot.

COFFIN-*joint*, is that where the lesser pastern joins the foot. A strain in this joint occasions a stiffness, which can only be removed by blistering and firing.

COFFIN, *in the Manufacture of China*. See CASSETTE.

COG, in *Mechanics*. See MILL and WHEEL.

COGA, in *Geography*, an island of Abyssinia, in the lake of Dembea.

COGÆONUM, in *Ancient Geography*, the name of a river and of a mountain, placed by Strabo in the country of the Getæ. He says, that Zamolxis customarily resided on this mountain, and that the Getæ, after having deified him, gave it the epithet of "Sacred."

COGAMUS, a river of Asia Minor, at the foot of mount Imolus, according to Pliny, l. v. c. 29.

COGARETO, in *Geography*, a town of Italy, in the state of Genoa; 9 miles E.N.E. of Savona.

COGEAD, a lake of North America, 50 miles long, and 10 broad. N. lat. 66°. W. long. 109°.

COGEDUS, or CONGEDUS, in *Ancient Geography*, a river of Spain, in Celtiberia, and in the vicinity of Bilbilis. It is thought to be the present "Rio de Codes," which runs into the Xalon.

COGGESHALL, in *Geography*, a town of England, in the county of Essex, with a weekly market on Thursdays; 9½ miles W. of Colchester, and 44 N.E. of London.

COGGESHALL'S *Sliding-rule*, an instrument used in gauging, so called from its inventor. See the description and use under SLIDING-RULE.

COGGIA, or COCIA, in *Geography*, a town of the island of Corsica; 6 miles S. of Vico.

COGGLE, or COG, a small fishing-boat upon the coasts of Yorkshire; and *cogs (cogones)* are a kind of little ships or vessels used in the rivers Ouse and Humber. Stat. 23 H. VIII. c. 18. *Præparatis* cogonibus, *galles, & aliis navibus, &c.* Mat. Paris, an. 1066. And hence the cogmen, boatmen, and seamen, who, after shipwreck or losses by sea, travelled and wandered about to defraud the people by begging and stealing; until they were restrained by divers good laws.

COGHAN, WILLIAM, in *Biography*, master of arts, and bachelor of physic (as he calls himself in the title to his work), was born in Somersetshire, about the middle of the 16th century. He received his academical education at the university of Oxford; was made bachelor of arts, and fellow of Oriel college in 1563, and bachelor in medicine in 1574. The year following he quitted Oxford, having been appointed master of the school at Manchester, where he also practised in his profession, to the time of his death, which happened in the year 1607. In the year 1584, he published "The Haven of Health," chiefly gathered for the comfort of students, amplified upon five words of Hippocrates, *viz.* "labor, cibus, potio, somnus, venus;" whereunto is added, "A Preservation from the Pestilence, with a short Censure of the late Sicknefs at Oxford." It is a very curious book, full of quotations from the classics, recommending temperance and exercise, as the best preservatives and restorers of health. Towards the end of the volume, he has given a brief historical account of the sweating sicknefs, and of the sicknefs which happened at Oxford in 1575. "It began," he says, "on the sixth day of July, from which day to the twelfth day of August next ensuing, there died five hundred and ten persons, all men and no women." As the author was there at the time, we are obliged to give credit to this strange circumstance, of which no parallel, as far as we know, is to be found. Coghan also published in 1602, "An Epitome of the familiar Epistles, and some of the Orations of Cicero," for the use, we presume, of his school. Wood's Athenæ Oxon.

COGHNAWAGA, in *Geography*. See CAGHNEWAJA.

COGITATION, the act or operation of thinking. See THINKING.

COGLIANO, in *Geography*, a town of Naples, in the province of Principato Citra; 13 miles N.N.W. of Can[illegible].

COGNABANDA, in *Ancient Geography*, a town of India, on this side of the Ganges, according to Ptolemy.

COGNABARA, or COGNANDAVA, a town of India, on this side the Ganges. Ptolemy.

COGNAC, in *Geography*, a town of France, and principal place of a district in the department of the Charente, seated on the river Charente, and having a sub-prefect and a court of justice. The town contains 2827, and the canton 11,358 inhabitants. The territory comprehends 235 kiliometres and 19 communes. The whole district includes 70 communes, 785 kiliometres, and a population amounting to 44,145 persons. It has four cantons, *viz.* Cognac, Chateauneuf, Jarnae-Charente, and Segonzac. The soil is very fertile, and produces in abundance corn, wine, and fruit. It has always been famous for its brandy; and carries on a considerable trade not only in brandy, but in wine, both red and white, spirit of wine, and linseed. It has also some manufactures of earthen ware. Cognac is 7 leagues W. of Angoulesme. N. lat. 45° 42′. W. long. 20° 28′.

COGNAC, a town of France, in the department of the Upper Vienne; 20 miles S.E. of Confolent.

COGNATION, in the *Civil Law*, the bond of relation between all the descendants of the same stock, both males and females; by which it is distinguished from *agnation*, which only comprehends the descendants of the male sex.

In France, for the succession of the crown, they follow *agnation*; in England, Spain, &c. *cognation*; women coming to the succession, according to the degree of proximity, in default of males, or their descendants from branch to branch.

In the *Roman Law*, the words *cognatio* and *cognati* are also taken in a more limited sense; *cognatio* signifying only the bond of relation between the descendants from the same stock by women; and *cognati* those between whom there was such a bond of relation subsisting.

COGNE, in *Geography*, a valley of Piedmont, belonging to the bishop of Aosta, so called from the small river which waters it. The mountains, by which it is surrounded, are rich in mines of iron and copper. It contains 13 villages, the chief of which is Cogne; 6 miles distant from Aosta.

COGNI, in *Ancient Geography*, a people of Germany, according to Ptolemy.

COGNI, or KONIEH, in *Geography*, a town of Asiatic Turkey, the capital of Caramania, the ordinary residence of a beglerbeg, situated in a beautiful and fertile country. It is very large, and its walls are supported by 108 square towers, at the distance of 40 paces from each other. It has two considerable fauxbourgs, into one of which the caravans and strangers retire. All the inhabitants are Turks, Armenians, Jews, and others, who come hither to trade, and lodge in the khans, where they are supplied with all necessaries. Cogni is the see of a bishop;

260 miles S.E. of Constantinople. N. lat. 38° 13′. E. long. 50° 45′.

COGNIOL, in *Ichthyology*, a name given by some to the *scomber colias*, a kind of mackarel, rather smaller than the common sort, and which has the body varied with fine green and blue. It is supposed to be the young of the common mackarel.

COGNISEE, or CONNUSEE, in *Law*, is the person to whom a fine of lands, &c. is acknowledged.

COGNISOR, or CONUSOR, is he that passeth, or acknowledgeth, a fine of lands and tenements to another. See FINE, and RECOGNIZANCE.

COGNITIVE is sometimes applied to that faculty or power of the human mind, by which we know any thing, or are enabled to distinguish truth from falsity.

Latin writers use the terms *facultas cognoscitiva* in the same sense.

Hobbes has made use of the terms *cognitive* power, for the power of knowing, or conceiving, in contradistinction to *motive* power, or appetite.

COGNITIONIBUS *mittendis*, in *Law*, a writ to any of the king's justices of the common pleas, who has the power of taking a fine, and who, having taken a fine, defers to certify it, commanding him to certify the same.

COGNIZANCE, or COGNISANCE, in *Heraldry*. See C....

COGNIZANCE, or CONUSANCE, in *Law*, is the acknowledgement of a fine; or the concession of a thing done. In which sense we say *cognoscens latro*, *a thief that confesses*.

COGNIZANCE is also used for a power, or jurisdiction. Thus, *cognizance of pleas* denotes an ability to call a plea out of another court; which no one but the king can do, unless he can show a particular charter for it. See FRANCHISE.

Before defence made, if at all, cognizance of the suit must be claimed or demanded; when any person or body corporate hath the franchise, not only of *holding pleas* within a particular limited jurisdiction, but also of the *cognizance of pleas*; and that, either *without* any words exclusive of other courts, which entitle the lord of the franchise, whenever any suit that belongs to his jurisdiction is commenced in the courts of Westminster to demand cognizance thereof; or *with* such exclusive words, which also entitle the defendant to plead to the jurisdiction of the court. 2 Lord-Raym. 836. 10 Mod. 126. Upon this claim of cognizance, if allowed, all proceedings shall cease in the superior court, and the plaintiff is left at liberty to pursue his remedy in the special jurisdiction. As, when a scholar, or other privileged person, of the universities of Oxford or Cambridge, is impleaded in the courts at Westminster, for any cause of action whatsoever, unless upon a question of freehold. In these cases, by the charter of these learned bodies, confirmed by act of parliament, the chancellor and vice-chancellor may put in "a claim of cognizance," which, if made in due time and form, and with due proof of the facts alleged, is regularly allowed by the courts. It must be demanded, before full defence is made or imparlance prayed; for these are a submission to the jurisdiction of the superior court, and the delay is a *laches* in the lord of the franchise: and it will not be allowed, if it occasions a failure of justice, or if an action be brought against the person himself, who claims the franchise, unless he hath also a power in such case of making another judge. 2 Ventr. 363. Hob. 87. Yearbook, M. 8. Hen. VI. 20. 3 Comm. 298. See *University* COURT.

COGNIZANCE, notice, power, or jurisdiction. In a *military* sense or acceptation, it denotes the investigation or trial, to which any person subject to martial law, or any act of his, is liable. During the suspension of civil authority, every offence is an object of military cognizance, is subject to martial law, and may be proceeded upon according to the summary spirit and nature of its regulations.—A drum-head court-martial for instance.

COGNIZANCE is sometimes used also for an audience, or hearing of a matter judicially. In which sense we say, *to take cognizance*, &c.

COGNIZANCE, again, is used for a badge on a waterman's, or servingman's sleeve, which is commonly the giver's crest, whereby he is discerned to belong to this or that nobleman, or gentleman.

COGNIZANCE, &c. *fine Sur*, &c. See FINE.

COGNIZANCE in *replevin*. See REPLEVIN.

COGNOMEN, in *Roman Antiquity*, a name that was peculiar to some family, or more properly to some branch of that family. The cognomen, which originally was often a kind of nick-name, or on the contrary an appellation of honour, distinguished the different branches of the same house, "in eadem gente;" as when Livy says (l. 9. c. 29.), that the house of the Potitii was divided into 12 families. See NAME.

COGNOVIT *actionem*, in *Law*, is where a defendant acknowledges or confesses the plaintiff's cause against him to be just and true; and before or after issue, suffers judgment to be entered against him without trial. Here the confession generally extends no farther than to what is contained in the declaration; but if the defendant will confess more, he may. 1 Rol. 929. Hob. 178. See JUDGMENT. But frequently the defendant confesses one part of the complaint, and traverses or denies the rest.

COGOLLA, in *Geography*, a river of Spain, which runs into the Nagarella, in the country of Rioja.

COGOLLUDO, a town of Spain, in New Castile; 20 miles W. of Siguença.

COGORETO, or COGURETO, a village of Italy, on the coast of Genoa, remarkable for being the native place of Christopher Columbus, the discoverer of America.

COGOXIMA. See CANGOXIMA.

COGS. See COGGLE.

COGWARE is said to be a sort of coarse cloths, made in divers parts of England, of which mention is made in 13 R. II. c. 10.

CO-HABITATION, implies a concubinage, copulation, or carnal knowledge, between two persons. It is rarely used, except in a criminal sense.

COHALA, in *Geography*, a stationary tribe of Arabs in Abyssinia, who do not live in tents, but are tributary to the mek, occupying different districts of Sennaar, near the river Rahad, and regularly paying all the taxes and exactions which are imposed by the government of Sennaar.

COHASSET, a township of America in the county of Norfolk, and state of Massachusetts, incorporated in 1770, and containing 817 inhabitants. It has a congregational church, and includes 126 houses, scattered in different forms. The dangerous rocks of this name lie off this place, about a league from the shore. It is distant about 25 miles S. E. from Boston, or in a straight line about half of this distance.

COHAUSEN, JOHN HENRY, in *Biography*, a learned and ingenious physician, was born at Hildesheim in Lower Saxony, towards the end of the seventeenth century. Being educated to the practice of medicine, after taking the degree of doctor, he went to Munster, where he soon distinguished himself, by his superior skill and abilities. His works, which are numerous, bear ample testimony to the vigour of his intellects, and of his application to letters. His last work, "Hermippus Redivivus," in which he professes to shew the practicability of prolonging the lives of elderly persons to 115 years, by receiving the breath, and transpirations of healthy young females, was written, or first published, when he was in his 77th year. This was translated into English, and published, with additions and improvements, by the late Dr. John Campbell, under the title of "Hermippus Redivivus, or the Sage's triumph over old Age and the Grave." A vein of humour runs through this, and indeed through most of the productions of this writer, which gave them great popularity when first published, though they are now little noticed, excepting, perhaps, the work just mentioned, in which the irony is extremely delicate, and his rhapsody, against the prevailing passion of taking snuff. He affects to consider a passion for taking snuff as a disease of the nostrils, similar to that affecting the stomach of girls in chlorosis, and therefore calls it the pica nasi. The title of this production is, "Dissertatio Satyrica, physico-medico-moralis, de Pica Nasi sive Tabaci sternutatorii moderno abusu, et noxa." Amstelodami, 1716, [illegible].

Ruysch, in the latter part of his life, imagined he had discovered a muscle at the fundus uteri, to which he delegated the office of expelling the placenta, and to which he thought the performance of that duty might be left. This our author has ridiculed in a little volume, to which he gave the title of "Lucina Ruyschiana, sive musculus uteri orbicularis a clarissimo, D. D. Ruyschio detectus," published at Amsterdam, 1731. The following is a specimen of the author's humour on the occasion:

"Vos obstetrices manum a placenta;
Nolite illam, si reluctetur, tangere.
Adest expulsor musculus,
Qui illam, mechanicis suis digitis, extrahet,
Et molem inutilem ejiciat, destinato tempore;
Si fata volent."
And further on,
"Vos obstetrices, si fætum extraxeritis,
Resistat autem placenta.
Ite nunc domum, haud anxiæ,
An mors, an alia symtomata illam retentam sequantur,
Modo utero vim nullam intuleritis.
Musculus orbicularis vestras vices
supplebit,
Et placentam indubitatò, ni fallimur, extrahet.
Quid ad vos, si hic suo officio
non fungatur?
Ovos, nunc tali invento musculo, felices!
Vos fæminæ decumanis laudibus mactate
Magnum Ruyschium,
Quod salutis vestræ mysterium non celarit, obstetrices."

He published the preceding year, "Archæus faber febrium et Medicus," and in 1716, "Neothea," written to shew the folly of sending to China for tea, when we have so many herbs at hand, as pleasant, and more healthy; but his wit was not powerful enough to make either the use of tea or tobacco unfashionable. For the titles of others of his works, see Boerhaave's Methodus Studii Medici. Cohausen died at Munster, July 18th, 1750, in the 85th year of his age.

COHÁWSY or Cæsaria, in *Geography*, a small river of North America, which rises in the county of Salem, in the state of New Jersey, and pursuing its course through Cumberland county, discharges itself into Delaware river, opposite to the upper end of Bombay Hook. It is about 30 miles in length, and is navigable for vessels of 100 tons to Bridgetown, at the distance of 20 miles from its mouth.

CO-HEIR, a person who shares an inheritance or estate with another heir.

COHEL, a name given in Egypt to a preparation of tin burnt with gall-nuts, which the Turkish women make use of to blacken, and lengthen their eye-brows.

COHERENCE, a school-term, applied to propositions, discourses, &c. which have a mutual connection, or dependance on one another.

COHESION, compounded of the particle *co*, with or together, and the verb *hærere*, to stick, in *Philosophy*, means that action or power, by which the homogeneous particles of bodies remain attached to each other, as if they were but one; thus the particles of gold, or of mercury, or even of water, &c. cohere together; nor can they be separated without employing a degree of force, which must be different not only in different bodies, but likewise in the same body under different circumstances. This same power of cohesion, between the homogeneous particles of matter, is called, by the chemists, the *attraction of aggregation*. The philosophical writers have generally annexed the same meaning to the words *adhesion* and *cohesion*; we have, however, for distinction sake, used the former in a sense somewhat different from the latter, and this difference has already been stated under the article Adhesion.

In contemplating the power of cohesion, two different particulars present themselves for our examination; namely, the facts which have been experimentally ascertained relatively to it, and the theories which have been offered in explanation of those facts.

The various bodies of the universe, when considered with respect to the connection of their particles, are distinguished into solids, fluids, and elastic fluids. The particles of the solids cohere with a very great power; whilst those of the elastic fluids, instead of cohering, repel each other. The fluids, like water or alcohol, are in an intermediate state, *viz.* their component particles slightly cohere, at the same time that, when exposed, they are continually evaporating, that is, assuming the elastic, or vaporous form.

Several bodies have been found to assume all the abovementioned states, according as they are more or less combined with caloric, or the matter of heat. Thus water is a solid below the temperature of 32°, is a fluid between the temperatures of 32° and 212°; and becomes an elastic fluid when heated beyond the last mentioned degree. Abstract the heat, and the vapour gradually becomes a fluid, and this fluid becomes a solid, *viz.* ice. The like transition of state has been observed in various other bodies; hence we are induced, from analogy, to conclude, that, were it in our power to deprive every substance of all its heat, the whole range of natural bodies, including even the aërial fluid, might be converted into solids.

Besides heat, there is another power which weakens the cohesion of the homogeneous particles of bodies, and this is the attraction between the particles of different sorts of matter. Thus, a solid salt, when put in water, is dissolved, *viz.* its particles are separated from each other, in virtue of the attraction between them and the particles of water. Remove the water by means of evaporation, and the particles of salt will again cohere into a solid form. This is called by the chemists, *the attraction of affinity*, and the very extensive series of chemical phenomena, depends principally, if not entirely, upon the various affinities of natural bodies. See Chemical Affinity.

It appears, therefore, that the homogeneous particles of every sort of matter, have a mutual tendency towards one another,

another, in consequence of which they cohere more or less powerfully, according as that power is counteracted in a lesser or greater degree, either by the interference of heat, or by the affinity to other bodies, namely, the chemical affinity. And the effect is much more remarkable when both those powers act at the same time. Strictly speaking, the action of heat ought to be included in the general name of chemical affinity.

Independent of the actual interference of the two abovementioned counteracting powers, the particles of the same kind of matter will cohere with various degrees of force, according as they have been permitted to descend from the soft, or fluid state, to the solid form, either gradually or abruptly; which clearly indicates a sort of polarity in the particles, that is, a tendency to arrange themselves in one particular manner, rather than in any other, in order to cohere more powerfully; and hence arise several qualities of the same solid, *viz.* tenacity, elasticity, rigidity, transparency, regularity of form, commonly called crystallization, &c. Thus, if the aqueous part of a saline solution, and the heat, be caused to escape suddenly, the salt will be left in a pulverized form, whose particles shew a slight adhesion, if any, to one another. But let the water and the heat escape very gradually, and the particles of the salt will arrange themselves, so as to form regular bodies, called crystals, of considerable size, hardness, and transparency. Thus likewise, if a piece of steel be made red hot, and be afterwards cooled gradually, it will remain pretty soft and pliable; but if it be cooled suddenly, as by plunging it in water, and especially in quicksilver, the piece of steel will afterwards be found very hard and brittle, so much so that a file will have no action upon it.

It is hardly necessary to add any proofs of the existence of the above-mentioned cohesive power, since common experience shows, how two drops of water, or of quicksilver, or of any other fluid, rush together when they are barely brought to touch in some small part of their surfaces; how a drop of a fluid endeavours to assume a globular form, in consequence of the mutual attraction of its particles; how the motion of a solid in a fluid is retarded by the cohesion between the particles of the latter; how difficult it is to break a metallic rod, or any other solid, &c.

Take two leaden bullets, such as are used for muskets, scrape off a part of each, so as to form two small plain and bright surfaces, apply these to each other, bringing the parts close by compression, and a little twist with your fingers. Now these bullets will be found to adhere very forcibly to each other, so as to require a strong power (equivalent sometimes to the weight of 5, or 6, or 8, or even more pounds), in order to separate them. When separated, the surfaces will no longer appear flat; for part of the metal of one bullet seems to be intimately fastened to the other. This experiment will not answer in the same manner when harder metallic bodies are employed.

The knowledge of the tenacity of bodies is of great consequence in civil economy, and especially in the mechanical arts; hence several experiments have been instituted for this purpose; yet it is to be wished that the performance of a greater variety of such experiments, under the various circumstances which affect the strength and tenacity of bodies, *viz.* the various temperature, size, and other qualities, were undertaken by persons of knowledge and ability, in order to render the use of natural bodies in mechanics, and other useful branches, more certain and determinate. Professor Muschenbroeck made and published a greater number of experiments, for determining the cohesion of various substances, than any other philosophical writer. They do not all relate to bodies of an homogeneous nature; for he tried likewise the cohesion, or strength of different sorts of wood, which are composed of earthy, saline, resinous, and various other particles. We shall, however, transcribe them all together, as they form a very useful collection of results, relative to the strength of various bodies.

P. Muschenbroeck, in order to try the cohesive power of two polished planes, took two lumps of the same substance, such as glass and glass, copper and copper, &c. he flattened and polished a part of each, and adapted those surfaces to each other, by the interposition of some soft substance which might exclude the air; then, having fastened one of those pieces to a firm stand, he appended weights to the other, until the planes were separated from each other, and noted the weights which effected the separation. When the polished planes were about two inches in diameter, the pieces were heated in boiling water, in order to melt a little grease that was interposed between the polished planes. Two lumps of glass, or brass, &c. thus prepared, were separated by the weights expressed in the following table:

	Cold grease.	Hot grease.
Planes of glass, -	130 lb. -	300 lb.
brass, -	150 -	800
copper, -	200 -	850
marble, -	225 -	600
silver, -	150 -	250
iron, -	300 -	950

When the brass planes were made to adhere by the interposition of other substances, the results were as follow:

With water, -	12 oz. to separate them.
oil, -	18
Venice turpentine,	24
candle tallow, -	800
resin, -	850
pitch, -	1400

To ascertain the absolute cohesion of solid pieces of wood, he used pieces in the shape of long square parallelopipedons, each of whose sides was 0.26 of an inch, and they were broken by the following weights, which were applied in the direction of their length:

Fir, -	600 lb.
Elm, -	950
Alder, -	1000
Linden-tree, -	1000
Oak, -	1150
Beech, -	1250
Ash, -	1250

He tried likewise wires of different metals, by appending weights in the direction of their length, until they parted. The diameter of each wire was equal to 0.1 of a Rhinland inch (equal to 0.09712 of an inch English). The result were as follows:

Lead -	29¼ lb.
Tin - -	40¼
Copper -	299¼
Yellow brass -	360
Silver - -	370
Iron - -	450
Gold -	500

In order to try the transverse cohesion of different sorts of wood, or when the force acted in a direction perpendicular to their length, he fixed one of the ends of the pieces, (which were similar to those mentioned above) into a square hole in a metal plate, and hung weights on the other end, sufficient

ficient to break each piece at the faid hole. The weights and diftances from the hole were as follow:

Pieces of Wood.	Diftances.	Weights.
Fir	9 inches.	40 oz.
Oak	$8\frac{1}{2}$	48
Elm	9	44
Pine	$9\frac{1}{2}$	$36\frac{1}{2}$
Alder	$9\frac{1}{2}$	48
Beech	7	$56\frac{1}{2}$

See Mufchenbroek's Introductio ad Cohærentiam Corporum firmorum apud Phyficæ Exper. et Geom. Differtationes; and Introductio ad Philof. Nat. 4to. ed. 1762. tom. i. cap. 21.

Mr. Emerfon likewife performed feveral experiments refpecting the fame fubject, to which he fubjoined fome judicious obfervations. See his Principles of Mechanics, the latter end of the 7th fection; where he expreffes himfelf in the following manner:

"The proportion of the ftrength of feveral forts of wood, and other bodies, that I have tried, will appear in the following table:

" Box, yew, plum tree, oak	11
Elm, afh	$8\frac{1}{2}$
Walnut, thorn	$7\frac{1}{2}$
Red fir, holly, elder, plane, crab tree, apple tree	7
Beech, cherry tree, hazle	$6\frac{2}{3}$
Alder, afp, birch, white fir, willow or faugh	6
Iron	107
Brafs	50
Bone	22
Lead	$6\frac{1}{2}$
Fine free ftone	1

"In this table I have put feveral forts of wood into one clafs together, which I found to be pretty nearly of the fame ftrength; as I found fometimes one fort to exceed in ftrength, and fometimes another; there being a great difference even in the fame fort of wood; and I don't doubt but other people that fhall make experiments, will find them as different and various as I have done, and perhaps, quite different from mine, juft according to the goodnefs or badnefs of the wood they ufe. But I have contented myfelf to fet down what I found from my own experience, as the refult of a great many trials, without any regard to what other people have done or may do. What I fhall further add is this:

"A cylindric rod of good clean fir, of an inch circumference, drawn in length, will bear at the extremity, 400lb.; and a fpear of fir two inches diameter, will bear about feven ton; but not more.

"A rod of good iron of an inch circumference, will bear near three ton weight.

"A good hempen rope of an inch circumference, will bear 1000lb. at the extremity.

"All this fuppofes thefe bodies to be found and good throughout, but none of thefe fhould be put to bear more than a third or fourth part of that weight, efpecially for any length of time."

The late Dr. Crawford, a gentleman well known for his excellent publication on elementary heat, once undertook a feries of experiments for the purpofe of determining the various degrees of force requifite to break metallic wires in different degrees of temperature; but his premature death prevented the accomplifhment of his experiments; nor does it appear, that the refult of thofe few which he lived to perform, was ever made public. He heated the wires in a cylindrical veffel full of oil.

Having ftated the particulars that have been afcertained experimentally concerning the power of cohefion; we fhall now make a fhort excurfion into the region of fuppofition and hypothefis; briefly mentioning fome of the ideas that have been entertained refpecting the caufes of thofe phenomena. The abfurdity of moft of thofe fuppofitions, and the infufficiency of others, render them undeferving of any ferious confideration. Amongft the moft enlightened philofophers who have confidered the fubject, fome have attributed the cohefion of the particles, &c. to an immaterial power; others, with J. Bernoulli at their head, have attributed it to the external preffure of the aërial, or an etherial, atmofphere. (See J. Bernouilli De Gravitate Ætheris.) The firft of thefe fuppofitions is utterly unintelligible; the fecond, when brought to the teft of experiment and computation, is found to be utterly inadequate to the effect. Sir Ifaac Newton, without attempting to inveftigate the nature of the power, judicioufly contents himfelf with calling it a mutual attraction peculiar to the particles of matter. His words are as follow:

"The particles of all hard homogeneous bodies, which touch one another, cohere with a good force; to account for which fome philofophers have recourfe to a kind of hooked atoms, which, in effect, is nothing elfe but to beg the thing in queftion. Others imagine, that the particles of bodies are connected by reft, *i. e.* in effect, by nothing at all; and others by confpiring motions, *i. e.* by a relative reft among themfelves. For myfelf, it rather appears to me, that the particles of bodies cohere by an attractive force, whereby they tend mutually towards each other; which force, in the very point of contact, is very great; at little diftances is lefs; and at a little farther diftance is quite infenfible."

But what fort of attraction can this be, which decreafes and vanifhes at diftances fo very fmall?—Break a glafs rod, then apply the parts to each other as clofe as you will, fo that the fracture can hardly be difcerned; yet the adhefion is infenfible. Defaguliers, without giving any proof of the fact, conjectures, that the cohefive power decreafes in the ratio of the fourth power of the increafed diftance; fo that at twice the diftance, it acts 16 times weaker; at three times the diftance it acts 81 times weaker, and fo forth. That a power (like the attraction of gravitation,) fhould decreafe according to the fquares of the diftances, may be eafily comprehended; it being demonftratively true, that all powers or emanations, which proceed from a centre, and expand always fpherically, muft become more and more rare, in the proportion of the fquares of the diftances from the centre of emanation. But it is extremely difficult to form any idea of a power that decreafes in the ratio of the fourth, or any higher power of the diftances.

When every thing is duly confidered, it appears much more rational to fuppofe, that each particle of matter is endowed with a polarity analogous to that of a magnet, *viz.* that with one of its fides or ends, a particle of matter can attract the fame end of another particle, but that it will repel it with its oppofite fide or end. This, as has been obferved above, feems to be indicated by a variety of phenomena; and it may be eafily illuftrated by a magnetic experiment. Take, for inftance, four or fix magnetic bars, or needles, place them fo that all their poles of the fame name may lie on one fide, and you will find, that inftead of attracting, they will repel each other; fecondly, place them fo that two or three north poles may be together with one fouth pole, on one fide, and the attraction between the bars will be flight or partial. Laftly, place them in regular order, fo that the north pole of one bar may be contiguous to the fouth pole of the next, and that to the north pole of a third bar, and fo forth; and you

you will find that the bars cohere with confiderable force. Upon this hypothefis, the above-mentioned experiment of the broken glafs rod may be explained in a more fatisfactory manner; for though the fractured parts may appear to be replaced in their original fituation; yet it is fcarcely poffible to attain that immenfe accuracy, which is required to difpofe the friendly poles or ends of the minute particles contiguous to each other. The leaft abrafion of furface, the leaft interpofition of any matter, deranges the whole. Upon this hypothefis it is alfo eafy to comprehend how the different hardnefs and configuration of the fame kind of body are produced; for when the particles are fuddenly depofited from any folution, or fuffer a quick tranfition from the foft to the hard ftate, they have no time to arrange themfelves in the proper order; confequently the aggregate becomes lefs compact and irregular, than when by a flow depofition, or gradual tranfition from the foft to the hard ftate, fufficient time is allowed for the particles of matter to place themfelves in their proper fituations.

COHIBUS, fo called by Tacitus, but by Arrian *Chôbus*, in *Ancient Geography*, a river of Afia near the Euxine fea.

COHOBATION, in *Chemiftry*, is the repeated expofure of any fubftance to the chemical action of a liquid, either by returning the latter when driven off by diftillation, or by fupplying a frefh quantity after the action of the firft has been exhaufted.

CO-HONG, in *Geography*, a town of Afia in Thibet; 20 miles S.W. of Tfien-tfang.

COHONGORONTO, the name of the American river Potowmack, before it breaks through the Blue Ridge in N. lat. 39° 45'. Its whole length to this place is about 160 miles.

COHORN, MEMNON, in *Biography*, a celebrated engineer in Holland, the ftrong places of which are generally indebted to him for their fortifications. At the fiege of Namur, he defended a fort, named after himfelf, againft the attack of Vauban. Cohorn refufed to furrender till he had received a wound, which was deemed mortal at the time, but from the effects of which he recovered. In 1703, the elector of Cologne, efpoufing the caufe of France, admitted a French garrifon into Bonn; Cohorn attacked the place with fo much vigour, that the commandant furrendered in three days. He died the following year at the Hague, leaving behind him a treatife on his method of fortification. Nouv. Hift. Dict. Du Frefnoy.

COHORS *equitata*, in old infcriptions, has perplexed feveral antiquaries, who have been taught to confider the *cohorts* as appropriated to the foot fervice, as the *alæ* and *turmæ* were to the horfe. Mr. Horfeley, in particular, imagines, the *cohors prima Claudia equitata*, which he had met with, was intended to intimate that this cohort had been promoted from the horfe fervice; but when, by another infcription, he was led to confider that corps as confifting of a thoufand horfe, his difficulty is increafed to that degree, that he knows not what to affirm upon it. But the learned Dr. Taylor thinks there is an eafy folution of this difficulty.

The auxiliary, or provincial cohorts, were either entirely, or purely foot, like the legionary, or ordinary *cohorts*; or elfe they had a mixture of both kinds of militia, as appears from Gruter, Dlxxiv. 5. This latter fort, as they could not properly be ranked under either denomination of horfe, or foot, being made up of both, feem to have appropriated to themfelves the diftinguifhing title of *cohortes equitatæ*, corps of infantry with a mixture of horfe. And of this term we find frequent mention in infcriptions.

Hyginus alfo, "De Caftrametatione," gives us a full and decifive proof of this denomination, and of the number of which fuch cohorts confifted. Thefe troops confifted of a thoufand men, part horfe, and part foot, and were hence called *milliariæ*. The proportion of the horfe to the foot was 240 to 760. His words are, "Habet *cohors equitata* milliaria pedites feptingentos fexaginta, centurias decem, equites ducentos quadraginta, turmas decem." Vid. Phil. Tranf. N° 482. fect. 3.

COHORS *milliaria*. See above COHORS *equitata*.

COHORT, COHORS, in *Roman Antiquity*, a body of infantry, confifting of five or fix hundred men; anfwering in moft refpects to our *battalion*.

The cohort was divided into three manipules, or companies; the manipule into two centuries; and the century into an hundred men.

The firft centurion in the firft cohort was called *primipilus*; and had the charge of the eagle or ftandard of the legion. —A legion confifted of ten cohorts. The firft cohort, which always claimed the poft of honour, was formed of 1105 foldiers, the moft approved for valour and fidelity. The remaining nine cohorts confifted each of 555. See LEGION.

When the army was ranged in order of battle, the cohorts were difpofed in the following manner: The firft cohort took up the right of the firft line, as the companies of grenadiers do in our regiments; the reft followed in their natural order; fo that the third was in the centre of the firft line of the legion, and the fifth on the left; the fecond between the firft and third; and the fourth between the third and fifth. The five remaining cohorts formed a fecond line in their natural order: thus the fixth was behind the firft, and fo of the reft.

The firft, third, and fifth cohorts were efteemed the beft; at leaft it appears fo from the pofts they took up, which were looked on by the Romans as the moft important.

Marius is by fome faid to have been the firft who divided the Roman forces into cohorts: which opinion feems confirmed by Rofinus; "Non enim in tota Livii hiftoria cohortium fit mentio. Ideoque docti viri fentiunt a C. Mario primum cohortes effe inftitutas." But yet this is a great miftake; for the cohorts are often mentioned in Livy, and particularly, lib. xxvii.; c. 13. "Marcellus—cohortibus quæ figna amiferant hordeum dari juffit: centurionefque manipulorum quorum figna amiffa fuerant diftrictis gladiis diftinctos deftituit." This happened A. U. C. 543, and confequently feveral years before Marius was born. *Cohorts* were diftinguifhed according to their appointment and office, into *auxiliary*, which were fent by allies; *equitata*; fee above; *peditata*, which confifted of foot-foldiers only; *prætorian*, which was formed of the beft foldiers, and ferved to guard the *prætor* or general. This cohort was inftituted by Publius Pofthumus, the dictator. Auguftus likewife formed a cohort under this appellation, confifting of nine thoufand men: which was afterwards increafed by Septimius Severus. There were alfo the *cohors togata*, a kind of militia, which guarded the ftreets of Rome; the *cohors vigilum*, inftituted by Auguftus, which ferved on occafion of fires; and the *cohors urbana*, eftablifhed by Auguftus, to guard the city.

COHOZ, or COHOES, in *Geography*, a fmall village of North America, near which is the remarkable fall of the Mohawk river, about three miles from its mouth, by which it difembogues itfelf into the Hudfon or North river, about ten miles above Albany. The breadth of the river is 300 yards; a ledge of rocks extends quite acrofs, and from the top of them the water falls about 50 feet perpendicular, or, as fome fay, between 70 and 80 feet; the line of the fall from one fide of the river to the other being nearly ftraight. The appearance of this fall or cafcade is very different, according to the quantity of water; when the river

river is full, the water descends in an unbroken sheet from one bank to the other, whilst, at other times, the greater part of the rocks is left uncovered. The rocks are of a very dark colour, as is also the earth on the banks, which rise to a great height on either side. A bridge, 1100 feet long, and 24 feet wide, resting on 13 piers, was erected, at the expence of 12,000 dollars, in 1794, about three quarters of a mile below the cataract, from which it exhibits a grand view to the spectator; though the most romantic appearance is observed from Lansinburgh-hill, about five miles to the east of it.

COHUAGIUM, in *Antiquity*, a tribute paid by those who meet promiscuously in a market, or fair; *cohua* signifying a promiscuous multitude of men in a fair or market, probably from the French *cohue*.

COHUIXCAS, in *Geography*, a country of New Spain, in which there is a considerable mountain of loadstone, between Tcoiltylan and Chilapan.

COIBA, or QUIBO, a small island in the Pacific ocean, near the coast of Veragua. N. lat. 8°. W. long 82° 26′.

COIF, the badge of a serjeant at law; who is hence also called serjeant of the coif.

The coif is of lawn, and is worn on the head, under the cap, when they are created, and ever after.

The use of the coif was to cover the *tonsura clericalis*, or clerical crown; because the crown of the head was originally close shaved, and only a border of hair left around the lower part, which gave it the appearance of a crown. We have an example of its antiquity in M. Paris's "History of England," A. D. 1259, when one William de Bussy claimed the benefit of his clergy, and hence sir H. Spelman conjectures (Gloss. 355.) that coifs were introduced to hide the tonsure of such renegade clerks, as were still tempted to remain in the secular courts in the quality of advocates or judges, notwithstanding their prohibition by canon. See TONSURE, &c.

COIFFE-JAUNE, in *Ornithology*, the name given by Buffon to the *oriolus icterocephalus*.

COIFFE-*Noir*, of Buffon, is the hooded tanager; *Tanagra pileata*, Linn.

COIFFY-LA-VILLE, in *Geography*, a town of France, in the department of the Upper Marne; three miles S.W. of Bourbonne.

COIGNET, GILLES, in *Biography*, called likewise *Giles of Antwerp*, from the place of his nativity, was born in 1530, and in his youth received employment for some time in the house of Antonio Palermo, a picture merchant of that city. He afterwards travelled through the greater part of Italy and Sicily, and in many places left specimens of his abilities, as well in fresco as in oil. At Terni, a small town in the Papal territory, he painted a room entirely with whimsical grotesques, and likewise an altar picture; in this last, however, he was assisted by a scholar of his, named Stella, who afterwards died in Rome. From Italy he repaired to Amsterdam, where he painted many works highly creditable to his talents, and at last settled at Hamburgh, where he died in the year 1600. Coignet is described as an universal artist, sufficiently skilled in history, landscape, and indeed every department of painting; but his excellence was most remarkable in his small pictures of conflagrations, or where his figures were illumined by the moon, or by torches, lanthorns, or other artificial flame. He not unfrequently worked upon the copies made by his scholars, and, by means of a few masterly touches of his pencil, gave them, at first sight, so much the appearance of originals, that many were deceived. Many of the back grounds and architectural parts of Cornelius Molinaer's pictures were painted by him. Baldinucci.

COIL, denotes a rope laid in regular folds for the convenience of stowage, and hanging upon cleats, to prevent its being entangled. See QUOIL.

COILANTHA, in *Botany*. Renal. Sp. See GENTIANA *purpurea*.

COILON, in *Antiquity*. See CAVEA.

COILOPHYLLUM, in *Botany*, Moris. See SARRACENIA *purpurea*.

COILOTAPALUS, Brown. See CECROPIA *peltata*.

COILPETTA, in *Geography*, a town of Hindoostan in the Carnatic; 54 miles S.W. of Madura, and 18 N. of Palamcotta.

COIMBETORE, a province of Hindoostan, in the Mysore, and in the southern part of the territories formerly belonging to Tippoo Sultan. This country is separated from Calicut and Cochin towards the west by a ridge of lofty mountains named the "Gauts," a continuation of which bounds it on the north; on the east it is bounded by the Carnatic; and on the south by the province of Dindigul. In the continuity of the ridge of mountains on the west, opposite to Paniany, there is a break about 16 miles wide, which appears to border on what d'Anville calls "Annamally," or the "Elephant Mountains," and is occupied chiefly by a forest of timber trees, having the fort of Annamally on the east, and Palicaudcherry on the west. The valley or opening extends 14 or 15 miles between the termination of the Northern Gauts, and the commencement of the Southern ones; before it opens finally into the low country on the Malabar coast. It is well known, says major Rennell, that ships which navigate the Malabar coast during the N.E. monsoon, commonly experience a stronger gale in the neighbourhood of Paniany than elsewhere; and he is of opinion, that this opening in the Gauts is a very sufficient cause of such an effect. The major has also been told, that the lower part of the Coimbetore country partakes of the rainy, or S.W. monsoon of the Malabar coast, which may be referred to the same cause. The river of Paniany takes its course from the Coimbetore country, through this opening; and is said to be navigable in the rainy season for small boats, to the foot of the Gauts. This circumstance, together with the inundated state of the country at that season, may serve to show, that the country, west of the Gauts, has no great declivity, in a course of near 60 miles. Coimbetore is a fertile country, and well watered by several rivers; its principal towns are Coimbetore, Erroad, Carroor, and Daraporam.

COIMBETORE, a town of Hindoostan, and capital of the province to which it gives name, situated at the foot of the western Gauts, on the river Noyel. This town was taken possession of by general Meadows in July 1790, after having been evacuated by Tippoo Sultan, who left behind him a quantity of grain and military stores. The mud fort by which it was defended was incapable of making any long resistance. Tippoo retook it in the following year, and it was confirmed to him by the peace; but by the partition treaty, made by marquis Wellesley in 1799, Coimbetore, and also Sattimungalum, Erroad, Perentory, Oudcul, Showoor, Chingery, Cangiam, Carroor, Vizimungle, and Daraporam, were annexed to the British possessions. N. lat. 10° 58′. E. long. 77° 7′.

COIMBRA, a large, handsome, and celebrated city of Portugal, the capital of the province of Beira, situated on a mountain near the river Mondego, in a country abounding with vineyards, olive-trees, and fruits. It was built by the

Romans about 300 years before Chriſt. It is a biſhop's ſee, ſuffragan of Liſbon, and has an ancient univerſity, containing, according to Link, about 800 ſtudents, a cathedral, and fountains that are very magnificent. N. lat. 40° 18′. W. long. 8° 30′.

COIN, *Matrice*, in the manufacture of money, medals, and counters, is a piece of ſteel well tempered, four or five inches deep, ſquare at bottom, and round at top; whereon are engraved, dent-wiſe, with puncheons, and other inſtruments, the ſeveral figures, marks, &c. to be ſtruck on the moneys, &c. See COINAGE.

For the manner of engraving coins, ſee ENGRAVING *on ſteel*.

COIN is more generally uſed for a piece of metal, ſtamped with certain impreſſions, which are intended to give it a legal and current value; and alſo to ſerve as a guarantee for its weight and purity.

According to L. Coke, the term *coin* is French, ſignifying a corner, and hence has its name; becauſe in ancient times money was ſquare, with corners. 1 Inſt. 297. Others derive it, by a kind of forced analogy, from the Greek κοινος, *common*, becauſe money is the common medium or inſtrument of commerce. Others again deduce it from *cuneus*, a wedge, tracing its origin either to the form of a wedge, ingot, or lingot (linguetta), in which bullion has been tranſported from the remoteſt ages; or to the wedge, or chiſſel, an inſtrument with which theſe lingots were occaſionally cut to the weight required, as they do at this day in the Eaſt Indies with ſheers.

Coins conſtitute the ſtandard or ſcale, by which the prices of all things bought and ſold are aſcertained. See MONEY, CURRENCY, and COMMERCE.

Coin differs from money, as the ſpecies from the genus. Money is any matter to which public authority has affixed a value, and which ſerves as a circulating medium, whether it be metal, paper, leather, ſhells, &c.; but coin is a particular ſpecies of money, always made of metal, and ſtruck according to a certain proceſs. See COINAGE.

The origin of coins, like that of moſt other uſeful things, is involved in great obſcurity. Whether coins be of equal antiquity with money, may admit of ſome doubt; eſpecially as moſt of the ancient writers are ſo frequent and expreſs in their mention of leathern money, paper money, wooden money, &c. Some, however, notwithſtanding all this, are of opinion, that the firſt moneys were of metal; the reaſons they give are the firmneſs, neatneſs, cleanlineſs, durableneſs, and univerſality of metals; which, however, do rather conclude, that they ought to have been ſo, than they actually were ſo.

In effect, the very commodities themſelves were the firſt moneys, *i. e.* they were current for one another by way of exchange; and it was the difficulty of cutting, or dividing certain commodities, and the impoſſibility of doing it without great loſs, that firſt put men on the expedient of a general medium.

Indeed, thus much may be ſaid in behalf of coins, that, on this view, it was natural for men to have their firſt recourſe to metals, as being almoſt the only things whoſe goodneſs, and as it were integrity, is not diminiſhed by partition; beſides the advantages above expreſſed, and the conveniences of melting, and returning them again into a maſs of any ſize or weight.

It was probably, then, this property of metals which firſt accuſtomed people, who trafficked together, to account them in lieu of quantities of other merchandizes in their exchanges, and at length to ſubſtitute them wholly in their ſtead; and thus aroſe money; as it was their other property to preſerve any mark or impreſſion a long time, which confirmed them in the right; and thus was the firſt riſe of coins.

In the firſt ages, it is probable, that each perſon cut his metal into pieces of different ſizes and forms, according to the quantity to be given for any merchandize, or according to the demand of the ſeller, or the quantity ſtipulated between them; to this end they went to market, loaden with metal, in proportion to the purchaſe to be made, and furniſhed with inſtruments for proportioning it, and with ſcales for dealing it out, according as occaſion required.

By degrees it was found more commodious to have pieces ready weighed; and as there were different weights required, according to the value of the different wares, all thoſe of the ſame weight began to be diſtinguiſhed by the ſame mark, or figure; thus were coins carried one ſtep further.

At length, the growing commerce of money beginning to be diſturbed with frauds, both in the weights and the matter, the public authority interpoſed; and hence aroſe the firſt ſtamps or impreſſions of money; to which ſucceeded the names of the moneyers, and at length the effigy of the prince, the date, legend, and other precautions to prevent the alterations of the ſpecies; and thus were coins completed.

Herodotus aſcribes the invention of coins to the Lydians, and Pliny attributes it to Bacchus; but it is evidently too remote to be traced to any authentic ſource. Lycurgus ordered that iron money only ſhould be uſed at Sparta, which ſeems to imply, that a better kind had been known; and the introduction of copper coin into Italy, is aſcribed to Janus, or Saturn. We learn, however, from Pliny, and other good authorities, that ſilver was not coined at Rome until about the year 480 of the city, nor gold until about the year 640.

We do not find in Scripture that any coins were ſtruck by the Jews, until the time of the Maccabees; their money, before that period, being pieces of ſilver, of certain weights, ſuch as ſhekels, talents, and drams; a practice ſtill retained in China, and other countries; and which appears to have been univerſal in ancient commerce. It may be, therefore, preſumed, that when thoſe weights became altered and diſturbed by fraud, the neceſſity of ſtamping them with certain impreſſions became obvious; and hence may be ſuppoſed the origin of coins, with their effigies, legends, dates, &c. for which ſee MEDALS.

Coins have been generally made in all civilized nations, either of gold, ſilver, or copper, and frequently of all three: theſe metals have been found by long experience the fitteſt materials for money, particularly the two former, which we ſhall chiefly notice in the preſent article.

Gold and ſilver are each perfectly homogeneous, from whatever mines they may have been taken. Theſe metals are likewiſe malleable, and diviſible, into the moſt accurate proportions; from their ſcarcity and price, they are not too bulky for the common purpoſes of commerce; and, from their durability, they are leſs ſubject to decay than moſt other articles of value.

Gold and ſilver, in their pure or unmixed ſtate, are too flexible to make coins ſufficiently firm for general uſe; and hence the neceſſity of mixing with them a certain proportion of ſome harder metal; and this mixture is called the *alloy*. The quantity or proportion of alloy is various in different countries, and has varied conſiderably in different ages. Arbuthnot (ch. 6.) ſtates, that the ancient coins, particularly of gold, had very little alloy, in ſome not above a fiftieth part. The Romans, according to Paucton, were the firſt who taught the world the criminal art, as he calls it, of debaſing the purity of metals intended for coins, (ſee "Metrologie," p. 329.) Pliny informs us (lib. xxxiii. ch. 3.) that the Romans mixed an eighth part of alloy with their

 ſilver

ſilver coin. "Livius Druſus in tribunatu plebis octavam partem æris argento miſcuit." The ſame author thus notices their illegal debaſement of money: "Miſcuit denario triumvir Antonius ferrum. Miſcuit æri falſæ monetæ." (lib. xxxiii. c. 9.)

The quality of alloy has been always conſidered of importance with reſpect to the durability of coins. The moſt common ſort is copper; and ſometimes for gold a mixture of ſilver and copper. In order to aſcertain the beſt kind of alloy for gold coins, a chemical proceſs was inſtituted in London in 1798, under the management of Henry Cavendiſh, eſq. F.R.S., and Charles Hatchet, eſq. F.R.S.; and the reſult of their experiments was, that gold coins are not ſo likely to wear by abraſion and friction, if they are alloyed with ſilver and copper, as with copper only; but that the difference between them, provided the copper be very pure, is ſo little, that there is no ſufficient reaſon for altering the preſent alloy, conſiſting alone of copper. The report of this ingenious and elaborate proceſs, may be ſeen in the Philoſophical Tranſactions for 1803.

In all well regulated governments, there has been a ſtandard for coins, fixed by law; that is, a certain proportion between the quantity of pure metal and its alloy. In England the ſtandard for gold is $\frac{11}{12}$, that is 11 parts of pure metal, and one part of alloy. The fineneſs of gold is moſtly expreſſed in carats; thus the whole weight is ſuppoſed to be divided into 24 equal parts, called carats, and the ſtandard for gold is ſaid to be 22 carats fine, that is to contain 22 parts of pure gold, and 2 of alloy, which gives $\frac{22}{24}$. or $\frac{11}{12}$. The Engliſh carat is divided into 4 parts, called grains.

The ſtandard for ſilver is $\frac{37}{40}$, that is, 11 oz. 2 dwts. of pure ſilver, and 18 dwts. of alloy, making together 1 lb. troy, which may be thus expreſſed, $\frac{222}{240} = \frac{37}{40}$. This proportion for ſilver is ſaid to have been fixed in the reign of Richard I., by certain perſons from the eaſtern parts of Germany, called *eaſterlings;* and hence the word *ſterling*, which was afterwards the name given to the ſilver penny, and which is now applied to all lawful money of Great Britain.

From the legal weight and fineneſs of coins, there is a certain allowance for deviation or error, according to the mint regulations of moſt countries; and this allowance is called the *remedy of the mint*. In England, the remedy for gold is the ſixth part of a carat, that is, the piece coined may fall the 144th part ſhort of its ſtandard weight and fineneſs; and the remedy for ſilver is 2 dwts. in the pound, that is, the 120th part of the ſtandard. In ſome countries, a certain remedy is allowed in the weight, and another in the fineneſs; and this allowance is often made a ſource of profit, beſides the ſeigneurage; but, according to our mint indentures, the remedy is only an allowance for accidental error; and, therefore, no account is taken of it in calculating the value of our coins. It may be here obſerved, that in England there is no ſeigneurage, or other advantage, derived from the privilege of coining, the whole expence of the mint being defrayed by the public. On the propriety, however, of this regulation, the ableſt politicians have differed; and there is a probability, that in the new coinage which is now in contemplation, a ſeigneurage will be eſtabliſhed, particularly in the ſilver and copper coins, which chiefly regard our internal traffic; but as foreign bills of exchange ſhould be always paid in gold coin of full value, no great change is likely to take place in this reſpect.

According to our preſent mint regulations, whoever takes a quantity of ſtandard bullion to the tower, whether gold or ſilver, will receive in return his full weight in new coins, in the following proportions: For every pound troy of ſtandard gold, he will receive $44\frac{1}{2}$ guineas; and for every pound troy of ſtandard ſilver, 62 ſhillings. This regulation for ſilver, commenced in the reign of queen Elizabeth; and that for gold in the reign of Charles II.; the ſhilling always paſſed for 12 pence; but when the guinea was firſt ſtruck, it paſſed for about 20 ſhillings; but its value was not abſolutely fixed, being left to find its level, according to the market price of gold; and thus the guinea continued to fluctuate between 20 and 21 ſhillings, until the year 1728, when it was ordered to paſs current in all payments for 21 ſhillings; and this law had the effect of making gold a ſtandard, or meaſure of value, as well as ſilver.

From the foregoing regulation, it is obvious that the mint price of gold is 3*l.* 17*s.* 10*d.*$\frac{1}{2}$ per ounce, and the mint price of ſilver 62*d.* per ounce: for

As 12 *oz.* : 46*l.* 14*s.* 6*d.* :: 1 *oz.* : 3*l.* 17*s.* 10*d.*$\frac{1}{2}$; and
As 12 *oz.* : 62*s.* :: 1 *oz.* : 62*d.*

It alſo follows that the guinea ſhould weigh $129\frac{30}{89}$ grains of ſtandard gold, or $118\frac{58}{89}$ grains of pure gold; and that the ſhilling ſhould weigh $92\frac{28}{31}$ grains of ſtandard ſilver, or $85\frac{29}{31}$ grains of pure ſilver; for

As $44\frac{1}{2}$ grains : 1 *lb.* :: 1 *guinea* : $129\frac{30}{89}$ grains.
And as 24 carats : 22 carats :: $129\frac{30}{89}$: $118\frac{58}{89}$.
And for ſilver
As 62*s.* : 1 *lb.* :: 1*s.* : $92\frac{28}{31}$ grains.
And as 40 : 37 :: $92\frac{28}{31}$: $85\frac{29}{31}$.

From theſe proportions it appears, that the relative value between pure gold and pure ſilver is as $15\frac{2859}{13640}$ to 1, or as $15\frac{13}{62}$ to 1 nearly: for as $118\frac{58}{89}$: $85\frac{29}{31} \times 21$ :: 1 : $15\frac{2859}{13640}$. But the relative proportion of theſe two metals, according to the average market price for the laſt five years, is only as $14\frac{1}{2}$ to 1, as will be ſeen by the ſtatement of the prices of gold and ſilver here given.

The comparative value of gold and ſilver has fluctuated conſiderably in different ages, and in different countries. The earlieſt account we have of it is given by Herodotus, (lib. iii. p. 95.) where he ſtates the proportion to have been in Perſia, in the time of Darius, the ſon of Hyſtaſpes, as 13 to 1. Other hiſtorians ſtate, that it was as 12 to 1 in Greece, in the early periods of her hiſtory; but that about the time of Alexander the Great, it was only as 10 to 1. And this was the proportion in Rome at that period, where it continued nearly the ſame until the reign of Julius Cæſar, when, on account of the quantity of gold brought from conquered countries, it was to ſilver only as $7\frac{1}{2}$ to 1, a proportion, however, which was but temporary.

In England, from the time of the Saxons to the diſcovery of America, the relative value of gold and ſilver was about 11 to 1. In the reign of queen Elizabeth it was 13 to 1. In China and Japan in 1717, it was 9 or 10 to 1, (according to ſir Iſaac Newton's repreſentation to the lords of the treaſury at that period.) In Spain and Portugal it is, at preſent, as 16 to 1, and in moſt other parts of Europe, ſomething more than 15 to 1. Thus the extremes of fluctuation in the relative value of gold and ſilver, in all ages, may be comprehended within the limits of 17 and 7 to 1.

On a view of the Hiſtory of Coins, it appears that there has been, in general, a progreſſive reduction in their value, and that few inſtances have occurred of any advancement. The depreciation of money, in England, from the conqueſt to the beginning of the reign of Elizabeth, was occaſioned partly by the debaſement of the coin, and partly by the gradual increaſe of gold and ſilver from the mines of Europe; for the increaſe of the precious metals, like that of all other articles, tends only to diminiſh their value. From this period to the revolution a conſiderable reduction in the value of coins was occaſioned by the influx of gold and ſilver from the mines of America;

America; and from the revolution to the present time, the depreciation may be afcribed both to the increafe of the precious metals, and to the extenfive ufe of paper as a circulating medium.

The following ftatement will fhew the depreciation of our filver coin from the conqueft to the end of the reign of queen Elizabeth. But in order to make the fubject clear, it will be proper to obferve, that troy-weight was not ufed in the Englifh mint until the reign of Henry VIII. Before that period, gold and filver were weighed with what was called the Tower pound, or the moneyer's pound, which had been ufed by the Saxons, and which was lighter than the pound troy by $\frac{3}{4}$ of an ounce troy weight.

The Tower pound was coined

in the year		*s.*	*d.*		*s.*	*d.*
1066	into	20	0			
1300		20	3			
1344		22	2			
1346		22	6			
[illegible]		25	0			
1412		30	0			
1464		37	6			
1527		42	$2\frac{1}{4}$	pound troy	45	0
1560		56	3		60	0
1601		58	$1\frac{1}{2}$		62	0

The coinage of William the Conqueror was on the following fimple plan. The pound in weight and the pound in tale (*i. e.* in reckoning) were the fame. The pound in tale was divided into 20 fhillings, and each fhilling into 12 pence or fterlings; and the pound weight was divided into 12 ounces, and each ounce into 20 dwts. Thus the weight of each penny or fterling was one penny-weight, or 24 grains. This plan of coinage is faid to have been firft adopted by Charlemagne, in France, in the eighth century.

The firft Englifh gold coin of which there is any account, was ftruck in the year 1257, by order of Henry III. It was of pure gold, weighing two-pence, or fterlings of filver, and was to pafs for 20 pence. This gold pennie, as it was called, was nearly the weight of a feven fhilling piece of the prefent time, and it is faid, that "the king tried this expedient of coining gold through neceffity;" and alfo, "that the city of London made a reprefentation againft the meafure." Snelling, on Gold Coins, p. 2.

The next gold coinage was in the year 1344, when the gold florin was ftruck, which took its name from Florence, where it had firft been coined, in 1252. It was afterwards minted in moft of the countries in Europe. In Germany it was called the gulden, on account of its quality; and in Holland the guilder. The florin, however, has been long a filver coin, and in many places it is adopted as the unit in keeping accounts under an imaginary value: this, as well as all imaginary monies, had their origin in real coins, like the florin and the pound fterling.

Coin has been already defined the ftandard by which the prices of all things bought and fold are afcertained; but coin is, befides, an equivalent for which goods are exchanged; and, in this refpect, it fails as a proper ftandard, being liable to variations.

A ftandard for weight or meafures is fuppofed to be fixed; but coin, as a metal, is fubject to fluctuation in its value, like every other faleable article.

Perhaps there is no fubject of political economy fo difficult, both in theory and practice, as the proper regulation of coins. For, befides the fluctuation in price, and in the comparative value of the precious metals, coins are expofed to many other imperfections and diforders; fuch as filing, fabrication, melting, and unavoidable wear.

The imperfection arifing from the rivalfhip of gold and filver, might, it is thought, be removed, by making one metal only the meafure of property. Sir William Petty, Mr. Locke, Mr. Harris, lord Liverpool, and other writers of high authority, concur in opinion, that the coin which is the principal meafure of property, ought to be made of one metal only. But thefe authors do not agree whether it fhould be gold or filver. Mr. Locke argues that it fhould be filver, while lord Liverpool maintains, that gold has latterly conftituted the ftandard value. Thefe different opinions may be, however, in fome meafure reconciled. When Mr. Locke wrote on the fubject, filver was certainly the legal meafure of value; but in 1728, when the guinea was eftablifhed as a legal tender, gold became a meafure, and, of late years, the principal one, particularly in large payments. Indeed, while mankind continue to fet fo high a value on both metals, it is not likely that either will be exclufively adopted as a meafure of value. For the payment of bills of exchange, gold is preferred in moft countries. In Leghorn, and other parts of Italy, it has been of late years made the legal money of exchange. In fhort gold feems to be the meafure of value in great concerns, and filver in the inferior departments of bufinefs; gold may, therefore, be confidered as the integer, and filver the fraction.

It is worthy of obfervation, that the progrefs of metals, as reprefentatives of property, feems to have kept pace with the increafe of wealth and commerce. Iron, brafs, and copper, firft anfwered the purpofes of money; filver next followed; and, as property increafed, gold fucceeded. But the great increafe of riches and trade in modern times, has rendered even gold infufficient as a circulating medium, and reprefentative of property. Paper has been, therefore, fubftituted, and it is generally found the moft convenient. Where credit cannot be given, coins are neceffary; but where well founded confidence exifts, paper is certainly preferable. It is exempt from moft of the imperfections and diforders of coin; and, in many other refpects, it greatly facilitates the operations of commerce.

Among the imperfections of coin, the difference which frequently exifts between the mint and market prices of the precious metals, deferves particular notice. It has been already fhewn, that the mint price of gold is 3*l.* 17*s.* 10*d.* $\frac{1}{2}$ per ounce, and of filver 62*d.* per ounce; but the following ftatement will fhew how much the market prices have varied from thefe prices fince the year 1792, and it fhould be obferved, that for many years before that period, gold was frequently above, and feldom below, the mint price; while filver was almoft conftantly above the mint price, and higher in proportion than gold.

MARKET PRICES *of* STANDARD GOLD *and* SILVER.

	Gold.			*Silver.*	
1792	4*l.*	1*s.*	0*d.*	5*s.*	5*d.* per ounce.
1793	3	17	6	5	1
1794	3	17	6	5	1
1795	4	0	0	5	3
1796	3	17	6	5	4
1797	3	17	6	5	1
1798	3	17	9	5	0
1799	4	0	0	5	7
[illegible]	4	5	0	5	9
1801	4	6	0	6	0
1802	4	3	0	5	6
1803	4	0	0	5	7

MARKET

MARKET PRICES *of* STANDARD GOLD *and* SILVER
(continued.)

		Gold.	*Silver.*
	1804	4*l.* 0*s.* 0*d.*	5*s.* 6*d.*
	1805	4 0 0	5 6
	1806	4 0 0	5 8
January	1807	4 0 0	5 7
June	1807	4 0 0	5 8

From the above ftatement, it appears that, for the laft five years, the precious metals have varied very little in their value, and probably this average price will be made a rate, or rule, for the new coinage. We find here that gold has continued, during that period, at 4*l.* per ounce, which is about $2\frac{3}{4}$ per cent. above the mint price, and filver has been at an average of 5*s.* 7*d.* per ounce, which is about 8 per cent. above the mint price. It is alfo obfervable, that in the years 1800 and 1801, gold was 12 per cent., and filver 16 per cent. higher than the mint price.

While fuch a difparity exifts between the mint and market prices of the precious metals, it is manifeft that, notwithftanding the illegality of melting our coin, many of thofe which are of full weight and finenefs will be converted into bullion, when fo confiderable a profit is to be derived from the practice. Experience has too frequently fhewn that, during the excefs of the market above the mint price, our coins have difappeared; and as various inconveniencies and difficulties were occafioned by fuch fcarcity, attempts have been made to reduce the coins, particularly thofe of filver, to a deterioration adequate to the market price; and to this may, in fome meafure, be afcribed the prefent deficiency of our filver coins.

Attempts have been likewife made to reduce the gold coins, but without any confiderable effect; a laudable attention having been always paid to their weight; but it has been found impracticable to pay the fame attention to filver money; for whenever a fcarcity of it prevails, great inconvenience is experienced, in all the inferior departments of bufinefs. The public offices, therefore, and the bank, have generally connived at the debafement of our filver coins. The following was their reduced ftate in 1798, as reported by certain officers of the mint, who had been appointed to take the fame into confideration.

Deficiency	of crowns -	3 per cent.
	of half-crowns -	9 per cent.
	of fhillings -	24 per cent.
	of fixpences -	38 per cent.

Since the above period, a ftill greater deterioration has taken place, infomuch, that it is generally fuppofed our inferior filver coins at prefent are worth very little more than half their nominal value.

Among the caufes which have contributed to the depreciation of our coin, and to the advanced prices of bullion, fome reckon the reftriction, laid on the Bank of England, from paying in fpecie; a meafure which took place by order of government in 1797, and which, however, has hitherto proved falutary. But when and in what manner payment will be refumed, is a queftion of fome difficulty, as well as importance. It is obvious, from what has been already ftated, that good coins cannot be fafely iffued to any large amount, until a new rate of coinage fhall have taken place; and the prefent political ftate of Europe is another caufe that renders the continuance of the reftriction neceffary.

In the year 1798, his majefty appointed a committee of certain members of the privy council, to take into confideration the ftate of the coins of the kingdom, and the eftablifhment and conftitution of the mint, and to propofe fuch improvements, in both thefe refpects, as might to them appear neceffary. At the head of this committee, was lord Liverpool, whofe talents for bufinefs have been long acknowledged.

In 1805, his lordfhip publifhed a "Treatife on the Coins of the Realm, in a Letter to the King," a work of great intelligence and refearch, and which contains a very accurate hiftory of the Britifh coins, from the conqueft to the prefent time; and alfo a learned and interefting difquifition on the monetary regulations of the ancients.

Among the new principles which this publication is intended to eftablifh, are the following on coinage:

That the coins, which are the principal meafure of property, fhould be compofed of one metal only.—That this metal fhould be gold.—And that the expences of fabrication (*i. e.* the mint expences) fhould be taken out of the filver and copper coins.

Thefe principles, as well as various other important queftions in lord Liverpool's work, are ably inveftigated by Mr. Wheatly in a recent publication, entitled "An Effay on the Theory of Money, and the Principles of Commerce." But as the plan of the new coinage is not yet finally fettled, or, at leaft, not made known to the public, we want data to proceed on the fubject. We fhall therefore clofe the prefent article with the following tables of the principal coins now in circulation; and when our work arrives at the articles MINT and MONEY, we propofe to give an account of whatever new coinages may have then taken place in England and elfewhere, and alfo to give full and accurate tables of all the real and imaginary monies of the Univerfe.

A TABLE

A TABLE of the principal Gold Coins now current, containing their Weight, Finenefs, Pure Contents, Current Value, and Intrinfic Value in Sterling, according to the Mint Price.

		Weight	Finenefs.		Contents in pure Gold.	Current Value.	Value in Sterling.		
		Grs.	Carats.	Grs	Grs.			s.	d.
Austrian Dominions,	Souverain, fingle	85.50	22		78.37	6 florins 40 creutzers		13	10
	Ducat Kremnitz or Hungarian	53.85	23	3	53.29	4 florins 30 creutzers		9	5¼
Bavaria,	Carolin d'or	150.32	18	2⅚	117.18	10 florins 42 creutzers	1	0	9
	Max d'or	10[illegible].21	18	2⅚	78.12	7 florins 8 creutzers		13	10
Brunswick,	Carl d'or	102.[illegible]6	21	3	92.76	5 rix-dollars		16	5¼
Bern,	Ducat	54.[illegible]1	23	2	53.18	7 livres 4 fous		9	5
Denmark,	Ducat current	4[illegible].21	21	0⅓	42.35	12 marks Danifh		7	6
East Indies,	Mohur, or gold rupee	17[illegible].[illegible]0	23		169.15	15 filver rupees	1	9	11¼
	Star pagoda	5[illegible].75	19	2	42.86	3¾ filver rupees		7	7
England,	Guinea	129.44	22		118.65	21 fhillings	1	1	0
	Half guinea	64.72	22		59.32	10½ fhillings		10	6
	Seven fhilling piece	43.15	22		39.55	7 fhillings		7	0
Flanders,	See Auftrian Dominions.								
France,	Louis d'or, old, (coined before 1786)	12[illegible].51	21	2½	113.09	24 livres		19	11¾
	Louis d'or, new, (coined fince 1786)	117.66	21	2½	106.02	24 livres		18	9¼
	Napoleon, or piece of 40 francs, (new coins)	199.25	21	0⅘	179.33	40 francs	1	11	8¾
Geneva,	Piftole	87.[illegible]8	22		79.82	10 livres		14	1½
Genoa,	Sequin	[illegible]	23	3¼	53.62	13 lire 10 foldi		9	5¾
	Genovina d'oro	434.20	21	3½	396.74	100 lire	3	10	2½
	New piece of 96 lire	[illegible]90.	21	3¼	354.45	96 lire	3	2	9
Germany,	Ducat *ad legem Imperii*	53.85	23	2⅓	53.10	varies in different places		9	4¾
Hamburgh,	See Germany.								
Hanover,	George d'or	103.0[illegible]	21	3	93.37	5 rix-dollars		16	6¼
	Gold gulden	50.11	18		37.58	2 rix-dollars		6	8
Holland,	Ryder	15[illegible].55	22		140.75	14 florins	1	4	11
	Ducat	53.[illegible]5	23	2⅓	52.91	5 florins 5 ftivers		9	4½
Malta,	Louis d'or, double	2[illegible]2.24	20	2	222.25	20 fcudi current, or 13⅓ fcudi filver	1	19	5
Milan,	Doppia or piftole	96.8[illegible]	21	3⅓	88.13	25 lire 3 foldi		15	7
Naples	Double ounce, or fix ducat piece	135.78	21		118.81	6 ducats	1	1	3
Piedmont,	Doppia or piftole, old, (coined before 1785)	148.56	21	3	134.63	24 lire	1	3	9¾
	Ditto new (coined fince 1785)	140.80	21	3	127.61	24 lire	1	2	7
	Sequin	[illegible]	23	3½	53.22	9 lire 15 foldi		9	5¼
Poland,	Ducat, fee Germany.								
Portugal,	Joanefe	[illegible]	22		202.95	6400 rees	1	15	11
	New crufade	15.7[illegible]	21	3½	14.30	480 rees		2	6
Prussia,	Frederick d'or.	[illegible]	21	3	93.37	5 rix-dollars 8 gros		16	6¼
Rome,	Sequin	[illegible]	[illegible]	2¼	51.94	21½ paoli		9	2½
	Doppia	[illegible]	[illegible]	2¾	76.32	31½ paoli		13	5¾
Russia,	Imperial of the coinage of 1763	[illegible]	22		185.33	10 rubles	1	12	9½
	Ditto of the coinage of 1801	[illegible]	23	2½	185.33	10 rubles	1	12	9½
Saxony,	Augufte d'or	[illegible]	21	2⅓	91.83	5 rix-dollars		16	3½
Sicily,	Ounce	68.75	21	0½	60.34	30 turi		10	8½
Spain,	Doubloon or piftole, fingle coined before 1772)	104.0[illegible]	22		95.90	80 reals 10 maravedis		16	11¼
	Ditto (coined fince 1772)	[illegible]	21	2	93.72	80 reals vellon		16	7
Sweden,	Ducat	53.7[illegible]	2[illegible]	2⅓	52.95	1 rix-dollar 46 fhillings		9	4
Turkey,	Sequin Funducli of 1764	[illegible]	23		51.89	Thefe pieces pafs for a greater or lefs number of piaftres, according to the frequent changes and degradations of the Turkifh coins.		9	2¼
	Mahbub of 1781	[illegible]	[illegible]	1	32.57			5	9
	Nisfie of 1781	[illegible]	[illegible]	1	16.28			2	10½
	Roubbie do.	10.15	19	1	8.14			1	5¼
Tuscany,	Rufpono	[illegible]	23	3½	160.71	40 lire	1	8	6
	Sequin gigliato	[illegible]	23	3½	53.57	13⅓ lire		9	6
Venice,	Sequin	54.	23	3½	53.72	22 lire piccole		9	6
United States of America,	Eagle	270.	22		247.50	10 dollars	2	3	8

A TABLE of the principal Silver Coins now Current, containing their Weight, Finenefs, Pure Contents, Current Value, and Intrinfic Value in Sterling, according to the Mint Price of Silver.

		Weight.	Finenefs.		Contents in pure Silver.	Current Value.	Value in Sterling.	
		Grs.	Ozs.	Dwts	Grs.		s.	d.
Aix-la-Chapelle,	Rathfpruefentger	95.68	7	1	56.22	16 marks current	0	7¼
Austria,	See Germany, (convention coins)							
Basil,	Rix-dollar (coined fince 1764)	360.40	10	2½	304.10	30 batzes	3	6¼
Bavaria,	See Germany.							
Bern,	Patacon	417.63	10	8	362.95	3 livres 10 fous	4	2½
	10 Batzes piece	125.43	10	2½	105.84	20 fous	1	2¼
	5 Batzes piece	69.27	9	3⅓	52.91	10 fous	0	7
Bologna,	See Rome.							
Denmark,	Rix-dollar, fpecie	447.90	10	10	391.91	7 marks, 6 fhillings current	4	6¾
	Krohn, or crown, fingle	344.	8	1	230.77	4 marks, 4 fhillings current	2	8¼
England,	Crown	464.50	11	2	429.66	5 fhillings	5	
	Half crown	232.25	11	2	214.83	2½ fhillings	2	6
	Shilling	92.90	11	2	85.93	12 pence	1	
East Indies,	Rupee Sicca	179.55	11	15⅕	175.96	16 annas	2	0½
	Do. Bombay	178.31	11	14⅚	174.48	Do.	2	0¼
	Do. Surat	178.	11	2	164.65	Do.	1	11
	Do. Arcot	176.20	11	12	170.33	10 fanams	1	11¾
	Do. Madras	178.31	11	14⅚	174.48	Do.	2	0¼
Flanders,	Ducatoon	513.47	10	8¾	446.42	3 florins 11 ftivers current	5	2¼
	Crown	456.91	10	8¾	397.43	3 florins 3 ftivers current	4	7½
France,	Ecu, or crown	451.62	10	17½	409.29	6 livres	4	9¼
	5 franc piece, (new coin)	386.18	10	16	347.56	5 francs	4	0½
Geneva,	Ecu, or patagon	416.87	10		347.39	3 livres	4	0½
Genoa,	Scudo d'argento, or Genovina (full weight)	594.54	11	10	569.77	10 lire	6	7½
	Do. light	547.	11	10	524.21	9 lire 12 foldi	6	1¼
	Scudo di St. Giambatifta	316.45	11	1	291.39	5 lire 4 foldi	3	4½
	Giorgino	87.30	10	6⅔	75.17	26 foldi	0	10½
	Madonnina	70.24	10	2	59.11	1 lira, or 20 foldi	0	8¼
	New piece of 8 lire, of 1789	500.	11		458.33	8 lire	5	4
Germany,	Rix-dollar, conftitution, (coined after the rate of 1766.)	450.90	10	13⅓	400.81	These coins bear an agio	4	8
	Florin, ditto	225.45	10	13⅓	200.40	againft the convention coins	2	4
	Rix-dollar, convention, (coined after the rate of 1753)	432.93	10		360.78	2 florins	4	2
	Florin, or piece of ½ do.	216.46	10		180.39	60 creutzers	2	1
	Copftück	103.70	7		60.49	20 creutzers	0	8½
Hamburgh,	Rix-dollar, banco	444.30	10	12	340.63	3 marks banco	4	6¾
	Mark, current	141.50	9		106.13	16 fhillings current	1	2¾
Hanover,	See Germany, (conftitution coins.)							
Holland,	Ducatoon	504.20	11	5	472.69	63 ftivers	5	6
	Three gilder piece	486.40	11		445.87	60 ftivers	5	2¼
	Daalder	243.20	11		222.93	1½ florin	2	7
	Albert's dollar	433.17	10	8⅓	376.62	50 ftivers	4	4½
	Gilder, or florin	162.70	10	18¾	148.29	20 ftivers	1	8¼
	Rix-dollar, fpecie or banco	443.80	10	11⅔	391.88	52 ftivers	4	6½
	Lewendaler, or Lyondollar	422.70	8	17½	312.63	42 ftivers	3	9¼
	Goldgilder	301.90	8	5	207.56	28 ftivers	2	8½
Lubeck,	Rix-dollar, current	424.20	9		318.15	3 marks	3	8½
Luneburg,	Fine piece of two thirds	201.70	11	15½	197.92	24 mariengrofchen	2	3¾
Mecklenburg,	See Hamburgh, mark current.							
Malta,	Ounce	458.70	10		382.25	2½ fcudi current	4	5½
	Scudo	183.48	10		152.90	12 tari	1	9¼
Milan,	Filippo	430.	11	6⅔	406.11	7 lire 10 foldi	4	8¾
Naples,	Ducat	338.60	10	17½	306.85	10 carlini	3	7
Piedmont,	Scudo	543.05	10	17½	492.15	6 lire or livres	5	8¾

A TABLE of Silver Coins, &c.—*(continued.)*

		Weight.	Fineneſs.		Contents in pure Silver.	Current Value.	Value in Sterling.	
		Grs.	Ozs.	Dwts.	Grs.		s.	d.
Poland, -	Rix-dollar (coined ſince 1787)	424.47	9	15	345.60	8 florins, Poliſh	4	$0\frac{1}{4}$
	Double florin, Poliſh, id.	142.90	7		83.61	60 Poliſh groſchen	0	$11\frac{3}{4}$
	Single florin, do. id.	81.31	6	$7\frac{1}{2}$	43.20	30 Poliſh groſchen	0	6
Portugal, -	New cruſade, (coined ſince 1750)	265.68	10	16	239.11	480 rees	2	$9\frac{1}{4}$
Prussia, -	Rix-dollar -	343.40	9		257.55	24 good groſchen	3	
Rome, - -	Scudo - -	413.24	10	$19\frac{1}{6}$	378.83	10 paoli, or 5 lire	4	$4\frac{1}{2}$
Russia, -	Ruble of the coinage of 1764	369.88	9		277.41	out of currency	3	3
	Do. of the coinage of 1801	277.55	10	8	240.54	100 copecks	2	$9\frac{1}{2}$
	Livoneſe of 1757 -	406.50	9		304.88	out of currency, it was originally worth 96 copecks	3	$6\frac{1}{4}$
Saxony, -	See Germany. -							
Sicily, -	Ounce - -	1045.85	10	14	932.55	30 tari	10	10
	Scudo - -	418.34	10	14	373.02	12 tari	4	4
Spain, -	Dollar (coined before 1772)	418.47	11		383.60	20 reals vellon	4	$5\frac{1}{2}$
	Do. (coined ſince 1772)	418.47	10	15	374.78	Do.	4	$4\frac{1}{2}$
Sweden, -	Rix-dollar, ſpecie -	451.67	10	$10\frac{5}{6}$	396.78	48 ſhillings	4	$7\frac{1}{2}$
St. Gall, -	Rix-dollar - -	430.70	10	$7\frac{1}{2}$	372.64	2 florins	4	4
Tuscany, -	Franceſcone, or Leopoldone	426.14	10	$18\frac{1}{3}$	389.17	10 paoli or $6\frac{2}{3}$ lire	4	6
	Tallaro, or Scudo -	418.55	10	$18\frac{1}{3}$	381.26	9 paoli, or 6 lire	4	5
Turkey, -	Piaſtre of 1780 -	277.	6		138.50	40 paras	1	$7\frac{1}{4}$
	Do. of 1801 -	198.	5	16	95.70	Do.	1	$1\frac{1}{8}$
United States,	Dollar - -	416.	10	14	370.93	1 dollar	4	$3\frac{3}{4}$
Venice, -	Scudo della croce -	490.62	11		449.66	12 lire 8 ſoldi piccole	5	3
	Giuſtina - -	431.48	11		395.52	11 lire piccole	4	$7\frac{1}{4}$
	Ducat - -	351.58	9	$18\frac{1}{3}$	291.04	8 lire piccole	3	$4\frac{1}{2}$
Zurich, -	Ecu, or rix-dollar -	436.90	10	7	376.83	2 florins	4	$4\frac{1}{2}$

In the foregoing tables, double pieces, and the fractional parts of coins are generally omitted, eſpecially where they are of the ſame ſtandard, and of the due proportional weight. Thus, double and half Louis-d'ors are omitted, as their weight and value may be found from the ſingle Louis-d'or. The ſame may be obſerved of the Souverain, the Frederick, the Eagle, the Italian and Spaniſh piſtoles; the Portugal and Italian gold coins, and the ſilver coins of moſt countries. In ſome places, however, the inferior pieces are of inferior ſtandard; and ſuch are noticed in the table.

It ſhould be alſo obſerved that the fineneſs of gold and ſilver, in the foregoing tables, is expreſſed in the Engliſh manner; although a difference prevails in this reſpect in moſt countries.

Some nations expreſs the fineneſs of gold, like the Engliſh, by ſuppoſing the whole weight to be divided into 24 equal parts, or carats; but the diviſions of the carat vary. In America, Turkey, Spain, and Portugal, the carat is divided, as in England, into 4 grains; in Holland, Germany, Sweden, and Denmark, it is divided into 12 grains; in Genoa and Leghorn, it is divided into 8; in Rome, Milan, and other parts of Italy, into 24 parts; and in the old ſyſtem of France the carat was divided into 32 parts; but in all the above places, the number of carats is 24.

The fineneſs of ſilver in Holland, Portugal, Spain, and moſt parts of Italy, is expreſſed by dividing the unit or pound into 12 parts, called deniers, denari, or penny-weights; in Genoa, the pound of fine ſilver is divided into 12 ounces, and the ounce into 24 denari; in Germany, Switzerland, Denmark, and Sweden, the mark is divided into 16 loths, and the loth into 18 grains. In Turkey they reckon, for ſilver, 100 carats, and each carat is 4 grains.

In ſome countries, the expreſſion of fineneſs, both of gold and ſilver, is the ſame. Thus, in France, according to the new ſyſtem, any quantity of either metal is ſuppoſed to be divided into 1000 equal parts, called millieme's. In Ruſſia, they reckon the pound of each metal at 96 ſolotnicks; in Venice, at 1152 carats. In China, and the Eaſt Indies, pure gold or ſilver is ſaid to be 100 touch, and the degrees of fineneſs are expreſſed by the 100th parts; thus 90 touch means 90 parts of pure metal, and 10 of alloy, that is $\frac{9}{10}$ths fine.

It may alſo be uſeful to know that the aſſayers of gold and ſilver in England, in their reports, do not expreſs the fineneſs (as it is in theſe tables) by the whole proportion of pure metal, and its alloy; but by the quantity in which it differs from the Engliſh ſtandard. Thus, a Dutch ducat is ſtated to be 1 carat, 2 grains, B. that is, better than Engliſh ſtandard, which means that it is 23 carats, 2 grains fine; and a French ſilver piece of 5 francs is ſtated to be 7 dwts. W. that is, worſe than Engliſh ſtandard.

As the value of the coins in the foregoing tables is only computed at the Engliſh mint price; it will be proper to ſhew how their value may be found at any other price. Suppoſe, for example, it is required to find the value of a Portugal Joaneſe at 4 *l.* per oz. The weight, per table, being 221.4 grs. and the fineneſs 22 carats.

Here the fineneſs being the ſame as the Engliſh ſtandard, the value of the price may be found by a ſingle ſtating: thus,

As 1 oz. or 480 grs. : 80 *s.* :: 221.4. grs. : 36 *s.* $10\frac{4}{5}$*d.* the value required.

But if it be required to find the value of a Spaniſh dollar, of the weight of 418.47 grs. and 10 oz. 15 dwts. fine, the market price of ſtandard ſilver being 5 *s.* 8 *d.* per oz.

Here

Here the finenefs muft be firft reduced to the Englifh ftandard; thus,

As 11 oz. 2 dwts. : 10 oz. 15 dwts. or as 222 : 215 :: 418.47 grs. : 405.275 grs.; the quantity of ftandard filver contained in the dollar.

Then, as 480 grs. : 405.275 grs. :: 68 *d.* : 4 *s.* $9\frac{1}{2}$ *d.* the value required; which agrees with the prefent market price of new dollars, that is, 5 *s.* 6 *d.* per oz. for as 405.275 grs. : 4 *s.* $9\frac{1}{2}$ *d.* :: 1 oz. : 5 *s.* 6 *d.*

Suppofe it were required to find the value in fterling of a French 5 franc piece, from the following report of the affayer, weight 16 dwts. 1 gr.—Finenefs 7 dwts. W. Here 11 oz. 2 dwts. — 7 dwts. = 10 oz. 15 dwts.; then fay,

As 11 oz. 2 dwts. : 10 oz. 15 dwts. or as 222 : 215 :: 385 grs. : 372.9 grs.; the quantity of ftandard filver contained in the piece.

Then as 1 oz. or 480 grs. : 372.9 grs. :: 62 *d.* : 48.17 *d.* or 4 *s.* $0\frac{1}{4}$ *d.* nearly, the value of the piece according to the mint price; but according to the prefent market price, 5 *s.* 8 *d.*, it is worth 4 *s.* $4\frac{3}{4}$ *d.*

The following are the principal writers on coins. Arbuthnot on ancient coins. Locke, Lowndes, Snelling, Folkes, and lord Liverpool on Englifh coins. Simon on Irifh coins. Le Blanc, and Bouteroue on French. Benaven on Italian. Bircherod on Danifh, and Brenner on Swedifh coins. The following authors have written on coins in general, Kraufe of Hamburgh. Ricard of Amfterdam. Gerhart of Berlin. Marien of Spain. Richbourg and Bonneville of France, and Du Boft of London. A general treatife on coins, including exchanges, weights, and meafures, is now in the prefs, and will fhortly be publifhed, under the title of the "Univerfal Cambift," from the manufcript of which the prefent article has been extracted.

Coin, *Laws relating to.* The coining of money is in all ftates the act of the fovereign power, that its value may be thus known on infpection: and with refpect to coinage in general, there are three fubjects of confideration, *viz.* the materials, the impreffion, and the denomination.

With regard to the materials, fir Edward Coke lays it down (2 Inft. 577), that the money of England muft be either of gold or filver; and none other was ever iffued by the royal authority till 1672, when copper farthings and half-pence were coined by king Charles II., and ordered by proclamation to be current in all payments under the value of fix-pence, and not otherwife. But this copper-coin is not upon the fame footing with the other in many refpects, particularly with regard to the offence of counterfeiting it. And, as to the filver coin, it is enacted by ftatute 14 Geo. III. c. 42, that no tender of payment in filver money, exceeding 25 pounds at one time, fhall be a fufficient tender in law, for more than its value by weight, at the rate of 5 *s.* 2 *d.* an ounce.

As to the impreffion, the ftamping of it is the unqueftionable prerogative of the crown; for, though divers bifhops and monafteries had formerly the privilege of coining money, yet, as fir Matthew Hale obferves (1 Hal. P. C. 191), this was ufually done by fpecial grant from the king, or by prefcription, which fuppofes one; and, therefore, was derived from, and not in derogation of, the royal prerogative. Befides that they had only the profit of the coinage, and not the power of inftituting either the impreffion or the denomination; but had ufually the ftamp fent them from the exchequer.

The denomination, or the value for which the coin is to pafs current, belongs likewife to the king's prerogative; and, if any unufual pieces are coined, that value muft be afcertained by proclamation. In order to fix the value, the weight and finenefs of the metal are to be jointly confidered. When a given weight of gold or filver is of a given finenefs, it is then of the true ftandard, and called eafterling, or fterling metal. (See Coin *fupra.*) And of this fterling metal, all the coin of the kingdom muft be made, by ftat. 25 Edw. III. c. 13. So that the king's prerogative, as judge Blackftone obferves, feemeth not to extend to the debafing or inhancing the value of the coin, below or above the fterling value (2 Inft. 577.); though fir Matthew Hale (1 Hal. P. C. 194.) appears to be of another opinion. The king may alfo, by his proclamation, legitimate foreign coin, and make it current here; declaring at what value it fhall be taken in payments. (Ibid. 197.) But this, Blackftone apprehends, ought to be by comparifon with the ftandard of our own coin; otherwife the confent of parliament will be neceffary. There is at prefent no fuch legitimated money; Portugal coin being only current by private confent, fo that every one who pleafes may refufe to take it in payment. The king may alfo at any time decry, or cry down, any coin of the kingdom, and make it no longer current. (1 Hal. P. C. 197.)

Two offences refpecting the coin are made treafon by the ftatute 25 Edw. III. c. 2. Thefe are the actual counterfeiting of the gold and filver coin of this kingdom, or the importing of fuch counterfeit money with an intent to utter it, knowing it to be falfe. The crime itfelf is made a fpecies of high treafon; as being a breach of allegiance by infringing the king's prerogative, and affuming one of the attributes of the fovereign, to whom alone it belongs to fet the value and denomination of coin made at home, or to fix the currency of foreign money; and, befides, as all money, which bears the ftamp of the kingdom, is fent into the world upon the public faith, as containing metal of a particular weight and ftandard, whoever falfifies this is an offender againft the ftate, by contributing to render that public faith fufpected. Upon the fame reafons, by a law of the emperor Conftantine (C. 29. 24. 2. Cod. Theod. de falfa Moneta, l. 9.), falfe coiners were declared guilty of high treafon, and were condemned to be burnt alive; as, by the laws of Athens (Potter, Antiq. B. i. c. 26.), all counterfeiters, debafers, and diminifhers of the current coin were fubjected to capital punifhment. This method of reafoning, however, fays judge Blackftone, is a little overftrained; counterfeiting or debafing the coin being ufually practifed, rather for the fake of private and unlawful lucre, than out of any difaffection to the fovereign. And therefore, both this and its kindred fpecies of treafon, that of counterfeiting the feals of the crown, or other royal fignatures, feem better denominated by the later civilians a branch of the "crimen falfi," or forgery, (in which they are followed by Glanvil (l. 14. c. 7.), Bracton (l. iii c. 3. § 1 and 2.), and Fleta (l. 1. c. 22.), than by Conftantine and our Edward III. a fpecies of the "crimen læfæ majeftatis," or high treafon. For this confounds the diftinction and proportion of offences; and, by affixing the fame ideas of guilt upon the man who coins a leaden groat, and him who affaffinates his fovereign, takes off from that horror which ought to attend the very mention of the crime of high treafon, and makes it more familiar to the fubject. Before the ftatute 25 Edw. III., the offence of counterfeiting the coin was held to be only a fpecies of petit treafon (1 Hal. P. C. 224.); but fubfequent acts in their new extenfions of the offence have followed the example of that ftatute, and have made it equally high treafon with an endeavour to fubvert the government, though not quite equal in its punifhment. In confequence of the principle thus adopted, the ftatute 1 Mar. c. 1, having at one ftroke repealed all intermediate treafons created fince the 25 Edw. III., it was

 thought

thought expedient by ſtat. 1 Mar. ſt. 2. c. 6. to revive two ſpecies thereof, *viz.* 1. That if any perſon falſely forge or counterfeit any ſuch kind of coin of gold or ſilver, as is not the proper coin of this realm, but ſhall be current within this realm by conſent of the crown; or, 2. Shall falſely forge or counterfeit the ſign manual, privy ſignet, or privy ſeal; ſuch offences ſhall be deemed high treaſon. And by ſtatute 1 and 2 P. and M. c. 11., if any perſons do bring into this realm ſuch falſe or counterfeit foreign money, being current here, knowing the ſame to be falſe, with intent to utter the ſame in payment, they ſhall be deemed offenders in high treaſon. The money referred to in theſe ſtatutes muſt be ſuch as is abſolutely current here, in all payments, by the king's proclamation; of which there is none at preſent, Portugal money being only taken by conſent, as approaching the neareſt to our ſtandard, and falling in well enough with our diviſions of money into pounds and ſhillings; therefore, to counterfeit it is not high treaſon, but another inferior offence.

Clipping or defacing the genuine coin was not hitherto included in theſe ſtatutes; though an offence equally pernicious to trade, and an equal inſult upon the prerogative, as well as perſonal affront to the ſovereign; whoſe very image ought to be had in reverence by all loyal ſubjects. And, therefore, among the Romans, (Ff. 48. 4. 6.), defacing or even melting down the emperor's ſtatues was made treaſon by the Julian law; together with other offences of the like ſort, according to that vague concluſion, "aliudve quid ſimile ſi admiſerint." And now, in England, by ſtatute 5 Eliz. c. 11, clipping, waſhing, rounding, or filing, for wicked gain's ſake, any of the money of this realm, or other money ſuffered to be current here, ſhall be adjudged high treaſon; and by ſtatute 18 Eliz. c. 1, the ſame ſpecies of offence is deſcribed in other more general words, *viz.* impairing, diminiſhing, falſifying, ſcaling, and lightening, and made liable to the ſame penalties. By ſtat. 8 and 9 W. III. c. 26, made perpetual by 7 Ann. c. 25, whoever, without proper authority, ſhall knowingly make or mend, or aſſiſt in ſo doing, or ſhall buy, ſell, conceal, hide, or knowingly have in his poſſeſſion, any implements of coinage ſpecified in the act, or other tools or inſtruments proper only for the coinage of money; or ſhall convey the ſame out of the king's mint; he, together with his counſellors, procurers, aiders, and abettors, ſhall be guilty of high treaſon. The ſtatute proceeds to enact, that to mark any coin on the edges with letters, or otherwiſe, in imitation of thoſe uſed in the mint; or to colour, gild, or caſe over any coin reſembling the current coin, and even round blanks of baſe metal, ſhall be conſtrued high treaſon. But all proſecutions on this act are to be commenced within *three* months after the commiſſion of the offence; except thoſe for making or mending any coining tool or inſtrument, or for marking money round the edges; which are directed to be commenced within *ſix* months after the offence committed. (Stat. 7 Ann. c. 25.) And, laſtly, by ſtatute 15 and 16 Geo. II. c. 28, if any perſon colours or alters any ſhilling or ſix-pence, either lawful or counterfeit, to make them reſpectively reſemble a guinea or half-guinea; or any half-penny or farthing to make them reſpectively reſemble a ſhilling or ſix-pence; this is alſo high treaſon; but the offender ſhall be pardoned in caſe (being out of priſon) he diſcovers and convicts two other offenders of the ſame kind. For the puniſhment of this ſpecies of treaſon; ſee TREASON.

Offences relating to the coin, not amounting to treaſon, to which claſs we may refer ſome inferior miſdemeanors that do not amount to felony, are thus declared by a ſeries of ſtatutes, which we ſhall recite in the order of time. By ſtat. 27 Edw. I. c. 3. none ſhall bring pollards and crockards, which were foreign coins of baſe metal, into the realm, on pain of forfeiture of life and goods. But by ſtat. 9 Edw. III. ſt. 2. no ſterling money ſhall be melted down, upon pain of forfeiture thereof. By ſtat. 17 Edw. III. none ſhall be ſo hardy as to bring falſe and ill money into the realm, on pain of forfeiture of life and member by the perſons importing, and the ſearcher permitting ſuch importation. By ſtat. 3 Hen. V. ſt. 1. to make, coin, buy, or bring into the realm, any gally-halfpence, ſuſkins, or dotkins, in order to utter them, is felony; and knowingly to receive or pay either them or blanks, (ſt. 2 Hen. VI. c. 9.) is forfeiture of 100*s*. By ſtat. 14 Eliz. c. 3. ſuch as forge any foreign coin, although it be not made current here by proclamation, ſhall (with their aiders and abettors) be guilty of miſpriſion of treaſon. By ſtat. 13 and 14 Car. II. c. 31. the offence of melting down any current ſilver money ſhall be puniſhed with forfeiture of the ſame, and alſo the double value; and the offender, if a freeman of any town, ſhall be disfranchiſed; if not, ſhall ſuffer ſix months' impriſonment. By ſtat. 6 and 7 Will. III. c. 17. if any perſon buys or ſells, or knowingly has in his cuſtody, any clippings or filings of the coin, he ſhall forfeit the ſame, and 500*l.*; one moiety to the king, and the other to the informer; and be branded in the cheek with the letter R. (See *Benefit of* CLERGY.) By ſtat. 8 and 9 Will. III. c. 26. if any perſon ſhall blanch or whiten copper for ſale, (which makes it reſemble ſilver), or buy or ſell, or offer for ſale, any malleable compoſition, which ſhall be heavier than ſilver, and look, touch, and wear like gold, but be beneath the ſtandard; or if any perſon ſhall receive or pay at a leſs rate than it imports to be of, (which demonſtrates a conſciouſneſs of its baſeneſs, and a fraudulent deſign), any counterfeit or diminiſhed milled money of this kingdom, not being cut in pieces, an operation which is expreſsly directed to be performed when any ſuch money ſhall be produced in evidence, and which any perſon, to whom any gold or ſilver money is tendered, is empowered, by ſtats. 9 and 10 Will. III. c. 21. 13 Geo. III. c. 71. and 14 Geo. III. c. 70. to perform at his own hazard, and the officers of the exchequer, and receivers-general of the taxes, are particularly required to perform; all ſuch perſons ſhall be guilty of felony, and may be proſecuted for the ſame at any time within three months after the offence committed.

But theſe precautions not being found ſufficient to prevent the uttering of falſe or diminiſhed money, which was only a miſdemeanor at common law, it is enacted by ſtatute 15 and 16 Geo. II. c. 28. that if any perſon ſhall utter or tender in payment, any counterfeit coin, (give in exchange, pay, or put off, 37 Geo. III. c. 126.) knowing it ſo to be, he ſhall, for the firſt offence, be impriſoned ſix months, and find ſecurity for his good behaviour for ſix months more; for the ſecond offence, ſhall be impriſoned two years, and find ſureties for two years longer; and, for the third offence, ſhall be guilty of felony without benefit of clergy. By the ſame ſtatute it is alſo enacted, that if any perſon counterfeits the copper coin, he ſhall ſuffer two years impriſonment, and find ſureties for two years more. By ſtat. 11 Geo. III. c. 40, perſons counterfeiting copper half-pence or farthings, with their abettors, or buying, ſelling, receiving, or putting off any counterfeit copper money (not being cut in pieces, or melted down) at a leſs value than it imports to be of, ſhall be guilty of a ſingle felony. This ſtatute alſo enacts, that one juſtice, on complaint upon oath that there is juſt cauſe for ſuſpicion againſt any perſons being concerned in counterfeiting the copper monies of this realm, may, by his warrant, cauſe the dwelling-houſe, &c. of ſuch ſuſpected perſon

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ſon to be ſearched for coining tools and inſtruments; and if they be found, they ſhall be ſeized and produced in evidence againſt the proſecuted perſon, and afterwards defaced or deſtroyed, or diſpoſed of at the pleaſure of the court or juſtice. By 14 Geo. III. c. 42. which act was at firſt temporary, and was ſuffered to expire, but revived and made perpetual by 39 Geo. III. c. 75. if any quantity of money, exceeding the ſum of five pounds, being or purporting to be the ſilver coin of this realm, but below the ſtandard of the mint in weight or fineneſs, ſhall be imported into Great Britain or Ireland, the ſame ſhall be forfeited, and proſecuted in any court of record at Weſtminſter; but if it do not amount in value to 20*l.*, the ſame may be proſecuted in a ſummary way before two juſtices, at the election of the commiſſioners of the cuſtoms; and after condemnation, melted down or otherwiſe defaced, and ſhall be divided in equal moieties to the crown and proſecutor. By 37 Geo. III. c. 126. ſo much of the above-mentioned acts of 15 Geo. II. c. 28. and 11 Geo. III. c. 40. and all other acts concerning the copper monies, called an half-penny and a farthing, or any other copper money of this realm, ſhall extend to all copper money which ſhall be coined and iſſued by order of his majeſty. By the ſame ſtatute, if any perſon ſhall make, coin, or counterfeit any coin, not the proper coin of this realm, nor permitted to be current in it, but reſembling, or made with intent to reſemble any gold or ſilver coins of any foreign ſtate, or to paſs as ſuch, or if any perſon ſhall bring into this realm any falſe or counterfeit foreign coin, knowing the ſame to be ſo, with the intent of uttering the ſame within this realm; he ſhall, in either caſe, be guilty of felony, and may be tranſported for a term not exceeding ſeven years. By the ſame ſtatute, if any perſon ſhall have in his cuſtody, without lawful excuſe, more than five pieces of any falſe or counterfeit foreign coin, or made with intent to reſemble or paſs as ſuch foreign coin, he ſhall, upon conviction, on the oath of one witneſs, before one juſtice, forfeit the ſame, which ſhall be cut in pieces and deſtroyed by order of ſuch juſtice, and ſhall alſo forfeit not exceeding 5*l.* nor leſs than 40*s.* for every piece found in his cuſtody; half to the informer, and half to the poor; and if not forthwith paid, ſuch offender may be committed to the gaol, or houſe of correction to hard labour, for three calendar months, or till ſuch penalty ſhall be paid. By 43 Geo. III. c. 139. the counterfeiting of foreign coin is a miſdemeanor and breach of the peace; and the perſon that is convicted, ſhall, for the firſt offence, be impriſoned not exceeding a year, and for the ſecond offence be tranſported for ſeven years. The ſame ſtatute enacts penalties on perſons having more than five pieces of ſuch coin in their poſſeſſion, and directs the houſes of ſuſpected perſons to be ſearched, and counterfeit coin ſeized, &c. &c. By the ſame ſtatute, amending ſo much of ſeveral acts of 6 and 7, 7 and 8 Will. as relates to the exportation of ſilver bullion, the treaſury may grant licences for the exportation of molten ſilver and bullion; and perſons ſo licenſed may export ſuch bullion without the uſual certificates. But if any bullion is entered to be exported, otherwiſe than in the name of the true owner or importer, the exporter ſhall forfeit the ſame, or value, half to the king, and half to him who ſhall ſeize or diſcover the ſame.

By 3 Edw. I. c. 15. perſons taken for falſe money are not bailable by juſtices of the peace. It is not neceſſary there ſhould be two witneſſes in caſes of counterfeiting the coin, as it is in other high treaſons; but perſons may be convicted according to the courſe of the common law, by one witneſs only. The reward for apprehending and convicting an offender againſt the ſtatutes relating to gold and ſilver coin, is 40*l.* in order to obtain which, the judge ſhall give a certificate of the conviction, and the ſheriff, on its being tendered, ſhall pay the ſame without fee, within one month after tender and demand, on pain of forfeiting to the party, double the ſum with treble coſts: and the ſheriff ſhall be repaid out of the treaſury, 6 and 7 W. c. 17. 15 Geo. II. c. 28. In like manner, a reward of 10*l.* ſhall be paid for apprehending and convicting one who counterfeits the copper money. 15 Geo. II. c. 28. The commiſſioners of the treaſury may iſſue a ſum not exceeding 600*l.* yearly, for the charge and expences of the officers, and others employed in the proſecution of offences of this kind. 7 Ann. c. 24. 15 Geo. II. c. 28.

In Scotland, by the articles of the Union, it is appointed, that all the coins be reduced to the Engliſh, and the ſame accompts obſerved throughout. Till that period the Scots had their pounds, ſhillings, and pence, as in England; but their pound was twenty pence Engliſh, and the others were in proportion: accordingly, their mark was $13\frac{1}{3}$*s.* Scots, current in England at $13\frac{1}{2}$*d.* their noble in proportion. Beſides theſe, they had their Turnorer pence, and half-pence; their penny, one twelfth of that of England; beſides baſe money of achiſons, baubees, and placks: the boddle, one ſixth of the penny, one fourth of the achiſon, one third of the baubee, and one half of the plack.

In Ireland, the coins are as in England; viz. ſhillings, pence, &c. with this difference, that their ſhilling or harper, is but equal to $11\frac{3}{10}$*d.* ſterling; or a ſhilling Engliſh is equal to twenty-ſix half-pence: whence their pound is only 18*s.* $4\frac{1}{2}$*d.* of Engliſh money. For an account of the coins of different parts of the world, with their proportions or values, we refer to the article MONEY. See alſo COIN *Supra*.

COINS, *Shells current for*.—Theſe ſerve in many places for money; and are brought from the Maldives, and called in the Indies *cowries*: on the coaſts of Africa, they change their names, and are called *bouges*.

In America they take a third name, *viz. porcelains*. Indeed thoſe laſt do come from the Maldives; there being ſhells found in the Weſt Indies much like thoſe of the Eaſt.

In the knigdom of Congo there is another kind of ſhells, called *zimbi*; though ſome will have them the ſame with the cowries. Cowries, coris, or bouges, are white ſhells, current particularly in the ſtates of the Great Mogul: ſixty-five are uſually reckoned equivalent to the done, a ſmall copper coin, worth about a halfpenny ſterling; which brings each cowry to $\frac{1}{130}$th of a penny ſterling.

Porcelains are nearly on the ſame footing with the cowries. See PORCELAIN.

Zimbi are current, particularly in the kingdoms of Angola and Congo. Two thouſand zimbis make what the negroes call a *maciute*, or *macoute*; which is no real money, whereof there is none in this part of Africa, but only a manner of reckoning: thus, two Flemiſh knives they eſteem a macoute; a copper baſon, two pounds weight, and twelve inches diameter, three macoutes; a fuſee ten, &c.

COINS, *Fruits current for*.—There are kinds of fruits current for coins; two in America, particularly among the Mexicans, which are the cacao and maiſe: the other in the Eaſt Indies, *viz.* almonds, brought thither from Lar, and growing in the deſarts of Arabia.

Cacao, fifteen of theſe are eſteemed equivalent to a Spaniſh rial, or ſeven-pence ſterling. See CACAO.

Maiſe has ceaſed to be a common money ſince the diſcovery of America by the Europeans.

Almonds are chiefly uſed where the cauris are not current. As the year proves more or leſs favourable to this fruit, the

value

value of the money is higher or lower: in a common year, forty almonds are set againſt a percha, or halfpenny ſterling; which brings each almond to $\frac{1}{20}$th of a farthing.

Coins, *Ancient*, are thoſe chiefly which have been current among the Greeks, Jews, and Romans.

For Jewiſh Coins, *their Values and Proportions ſtand thus:*

				(Sterling.)	*l.*	*s.*	*d.*
				Gerah	0	0	$1\frac{50}{160}$
10				Bekah,	0	1	$1\frac{11}{16}$
20	2			Shekel,	0	2	$3\frac{3}{8}$
1200	120	50		Maneh, Mina Hebraica,	5	14	$0\frac{3}{4}$
[illegible]	[illegible]	[illegible]	[illegible]	Talent,	342	3	9
Solidus aureus, or ſextula, worth					0	12	$0\frac{1}{2}$
Siclus aureus, worth					1	16	6
A talent of gold, worth					5475	0	0

Value and Proportion of the ancient Grecian Coins.

									(Sterling.)	*s.*	*d.*	*qrs.*
									Lepton,	0	0	$0\frac{31}{330}$
7									Chalcus,	0	0	$0\frac{31}{48}$
14	2								Dichalcus,	0	0	$1\frac{7}{24}$
28	4	2							Hemiobolum,	0	0	$2\frac{7}{12}$
56	8	4	2						Obolus,	0	1	$1\frac{1}{6}$
112	16	8	4	2					Diobolum,	0	2	$2\frac{1}{2}$
224	32	16	8	4	2				Tetr oolum,	0	5	$0\frac{2}{3}$
336	48	24	12	6	3	$1\frac{1}{2}$			Drachma,	0	7	3
662	96	48	24	12	6	3	2		Didrachmon,	1	3	2
1324	112	96	48	24	12	6	4	2	Tetradrach-ſtater,	2	7	0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Pentadr.	3	2	3

Note. Of theſe the drachma, didrachma, were of ſilver, the reſt, for the moſt part, of braſs. The other parts, as tridrachm, triobolus, &c. were ſometimes coined.

Note alſo, the drachma is here, with the generality of authors, ſuppoſed equal to the denarius: though there is reaſon to believe, the drachma was ſomewhat the weightier. See Drachma and Denarius.

(Sterling.)	*l.*	*s.*	*d.*
The Grecian gold coin was the ſtater aureus, weighing two Attic drachms, or half of the ſtater argenteus; and exchanging uſually for 25 Attic drachms of ſilver; in our money,	0	16	$1\frac{3}{4}$
According to our proportion of gold to ſilver	1	0	9
There were likewiſe the ſtater Cyzicenus, exchanging for 28 Attic drachms, or Stater Philippicus, and ſtater Alexandrinus, of the ſame value.	0	18	1
Stater Daricus, according to Joſephus, worth 50 Attic drachms, or Stater Crœſius, of the ſame value.	1	12	$3\frac{1}{2}$

Value and Proportion of the Roman Coins.

					(Sterling.)	*s.*	*d.*	*qrs.*
					Teruncius,	0	0	$0\frac{775}{1000}$
2					Sembella,	0	0	$1\frac{55}{100}$
4	2				Libella, As,	0	0	$3\frac{1}{10}$
10	5	$2\frac{1}{2}$			Seſtertius,	0	1	$3\frac{3}{4}$
[illegible]	[illegible]	[illegible]	[illegible]		Quinarius, Victoriatus,	0	3	$3\frac{1}{2}$
40	20	10	4	2	Denarius,	0	7	3

Note: Of theſe the denarius, victoriatus, ſeſtertius, and ſometimes the as, were of ſilver, the reſt of braſs.

There were ſometimes alſo coined of braſs the triens, ſextans, uncia, ſextula, and dupondius.

(Sterling.)	*l.*	*s.*	*d.*
The Roman gold coin was the aureus, which weighed generally double the denarius; the value of which, according to the firſt proportion of coinage, mentioned by Pliny, was,	1	4	$3\frac{3}{4}$
According to the proportion that obtains now amongſt us, worth,	1	0	9
According to the decuple proportion mentioned by Livy and Julius Pollux, worth,	0	12	11
According to the proportion mentioned by Tacitus, and which afterwards obtained, whereby the aureus exchanged for 25 denarii, its value,	0	16	$1\frac{3}{4}$

Theſe tables are formed on the ſuppoſition that ſilver is worth five ſhillings, and gold four pounds an ounce. See Arbuthnot's Tables of Ancient Coins. See alſo on this ſubject an excellent paper by M. Raper, eſq. intitled "An Enquiry into the Value of the Ancient Greek and Roman Money, in the Phil. Tranſ. vol. lxi. part ii. art. 48. p. 462. See Denarius and Drachm. For a more particular and ample account of ancient coins and coinage; ſee the article Medal. See alſo Money.

Coin, in *Architecture*, a kind of dye, cut diagonal-wiſe, after the manner of the flight of a ſtair-caſe; ſerving at bottom to ſupport columns in a level; and at top to correct the inclination of an entablature, ſupporting a vault.

Theſe coins have alſo the ſame effect with round baluſters, which are not inclined according to any flight.

Coin *d'Artilleur.* Coins in gunnery are wedges which artilleriſts lay under the breeches of guns, for the purpoſe of raiſing or depreſſing and pointing them. They are commonly notched at the ſides, that they may the more eaſily be puſhed forward or drawn back.

Coin *de Manœuvre Militaire*, a certain diſpoſition or arrangement of troops, which the ancients made uſe of for penetrating into and breaking an enemy's line. It conſiſted of a corps, or body of troops, formed with a conſiderable depth, and very ſmall extent of front.

Coin is alſo uſed for a ſolid angle, compoſed of two ſurfaces

faces inclined towards each other; whether that angle be exterior, as the coin of a wall, a tree, &c. or interior, as the coin of a chamber, or chimney: from the word *cuneus*, wedge. See Quoin.

Coins, on board a man of war. See Quoins.

Coin-*moulds*. See Moulds.

Coins, *Canting*, on board a ſhip, little ſhort pieces of wood, or billets, cut wedge-like, to lie betwixt the caſks.

Coins, *Standing*, on board a ſhip, billets, or pipe-ſtaves, to keep the caſks from ſtirring, or giving way.

Standing-coins are made of barrel boards, about four inches broad, and of a fit length to be driven in between the ends of a caſk, about two or three hoops from the chine hoops, to keep the butts from jogging.

COINAGE, or Coining, or the art of making money, has hitherto been chiefly performed either by the hammer or the mill. The firſt method is now, and has, indeed, been long generally diſuſed, though it was the only one known till the reign of Henry II. of France, when the coining-mill was invented by Antoine Brucher, a French engraver, and the firſt money was ſtruck with it in that kingdom in the year 1553. The uſe of it continued there till 1585, when, in the 12th year of Henry III. it was laid aſide, on account of its great expence in compariſon of the coinage with the hammer; nor was it revived till the year 1645, when, by an edict of Louis XIV., it was eſtabliſhed for perpetuity. Queen Elizabeth had milled money, ſtruck in England ſo early as the year 1562; but it did not continue for more than 10 years; and the hammer was again adopted as leſs expenſive. This example was ſoon followed in France, till the ſubſequent ſucceſs of the mill in England was probably the cauſe of its re-eſtabliſhment in that kingdom, in 1645. Briot, a French artiſt, failing to induce the government of France to adopt the uſe of the mill, came to England in 1623.

Thus, this machine, like moſt new inventions, met at firſt with various fate, it being ſometimes uſed, and at others laid aſide; but in the 14th year of Charles II., that is, in the year 1662, the uſe of the mill and ſcrew (hereafter to be deſcribed) was finally eſtabliſhed in the mint of this kingdom.

Soon after the revival of the mill in this kingdom by Briot, the coinage of England arrived at a degree of perfection to which it had never before attained. This was owing in a great degree to the ingenuity of Thomas Simon, ſuppoſed to be a native of Yorkſhire, who, upon the return of Briot to France in 1646, ſucceeded him as chief engraver at the mint.

It was at this period, alſo, that graining was firſt placed on the edges of all our coins, and ſuch confidence was then placed in this new device, that it was deemed impoſſible for the coins of this kingdom to be injured by clipping or wearing. Experience, however, in a very ſhort time, proved that milled money, either of gold or ſilver, could be diminiſhed with great facility and expedition. This fraudulent practice was well known and carried on in the reign of king William.

In coining, either by the hammer or mill, the pieces of metal are ſtamped, or ſtruck, with puncheons or dyes, in which are engraved the ſovereign's effigies, with arms, legend, &c.

The ancients uſed neither the puncheon nor the matrice, but merely cut the impreſſion upon a ſteel dye; both are now uſed. The puncheon is a high-tempered piece of ſteel, upon which the coin is engraven in relievo, and then ſtamped upon the matrice, which is a piece of ſteel four or five inches long, ſquare at the bottom, and round at the top. The moulding of the border, and letters, are added on the matrice, with ſmall, ſharp, ſteel puncheons. When thus completed, it is called a dye. The puncheon thus ſaves much labour in repeatedly engraving the ſubject of the coin; for a dye will ſometimes break with ſtriking one coin, the neceſſary force being ſo great.

It is not certain when this improvement commenced. It is believed that Simon, already mentioned, firſt introduced the idea of marking the crown and half-crown with a legend on the edge, as an ornament and protection to the coin; but the original inventor of this art is unknown. The firſt piece, yet known as an inſtance of it, is a ſilver "piedfort" of Charles IX. of France, dated 1573. The firſt medal is one in ſilver, of George Frederic, marquis of Brandenburg, dated 1589. Briot gave the firſt ſpecimen of it in Great Britain upon his Scottiſh coronation medal in 1633; and Simon, as we have juſt mentioned, introduced it into the larger coin, with great propriety, as it is both ornamental and preſerves ſuch pieces from being clipped. This operation is performed, ſince the year 1685, by means of a very ſimple, but ingenious machine, invented by M. Caſtaing, and then introduced into the French mint; and ſince that time into all the mints of Europe. It is deſcribed in the ſequel of this article.

The firſt operations are, the mixing and melting of the metal, becauſe there is no ſpecies of coin of pure gold or ſilver, but always a quantity of alloy of copper is mixed with them, or for the gold coin, the alloy is a mixture of ſilver and copper, as ſilver alone would make the coin too pale, and copper would give too high a colour. The alloy is uſed to render the coins harder, and leſs liable to be diminiſhed by art. See Alloy and Coin.

When the gold and ſilver are completely melted and mixed, they are poured into moulds, or frames, for caſting them into long flat bars: the method of doing this is preciſely the ſame with that uſed by founders, in ſand; both with regard to the frame, the manner of working the earth, and that of ranging the models, or patterns. Theſe patterns are flat plates of copper, about fifteen inches long, and nearly of the thickneſs of the ſpecies to be ſtruck. The only difference between caſting the bars of gold, and thoſe of other metals, conſiſts in this: that the latter are taken out of the crucibles with ladles, and poured into the aperture of the mould; and that for gold, the crucible is taken off from the fire with a pair of tongs, made for the purpoſe, and the metal is thence poured into the mould.

In coining by the mill, or milled money, the bars are taken out of the moulds, and ſcraped and bruſhed; they are then flattened in a mill, and brought to the proper thickneſs of the ſpecies to be coined. There is, however, this difference, that the plates of gold are heated again in a furnace, and quenched in water, before they undergo the operation of the mill; but the plates of ſilver are paſſed through the mill without any additional heating. The plates, whether of gold, ſilver, or copper, thus reduced as nearly as poſſible to their proper thickneſs, are cut into round pieces, called blanks, or planchets, with an inſtrument faſtened to the lower extremity of an arbor, whoſe upper end is formed into a ſcrew, which being turned by an iron handle, turns the arbor, and lets the ſteel, well ſharpened, in form of a punch cutter, fall on the plates; and thus a piece is punched out. See *Plate* (*Coinage*) *fig.* 1.

The pieces are now to be brought to the ſtandard weight by filing or raſping, and what remains of the plate between the circles is melted again, under the denomination of ſizel.

The

The pieces are now weighed in a very accurate balance, and thofe that prove too light are remelted, but thofe that are too heavy are filed to the ftandard weight. When the blanks are adjufted, they are carried to the blanching-houfe, that is, the place where the gold blanks are brought to their proper colour, and the filver ones are whitened; which operation is performed by heating them in a furnace, and when cooled, boiling them fucceffively in two copper veffels, with water, common falt, and tartar, and after that fcouring them well with fand, and wafhing them with clear water, drying them over a wood fire, in a copper fieve, in which they are put when taken out of the boiler. Formerly the planchets, as foon as blanched, were carried to the prefs to be ftruck, and receive their impreffions; but now they are firft milled. The machine ufed for this purpofe confifts of two plates of fteel in form of rulers, on which the edging is engraved, half on the one, and half on the other. One of thefe plates is immoveable, being ftrongly bound with fcrews to a copper plate on a board or table; the other is moveable, and flides on the copper plate by means of a handle, and a wheel, or pinion, of iron, the teeth of which catch in other teeth, on the furface of the fliding plate. The planchet, being placed horizontally between thefe two plates, is carried along by the motion of the moveable one; fo as by the time that it has made half a turn, it is found marked all round. See *fig.* 2. Laftly, the planchets, being thus edged, are to be ftamped: that is, the impreffion is to be given them in the mill, (fee *fig.* 3,) by the French denominated *balancier*. The chief parts of this machine are, a beam, fcrew, arbor, &c. all contained within the body of it, except the firft, which is a long iron bar, with a heavy ball of lead at each end, and rings, to which are faftened cords to give it motion. This bar is placed horizontally over the body of the machine; in the middle of the beam is faftened a fcrew, which, by turning the beam, ferves to prefs the arbor underneath it; to the lower extremity of the arbor, placed perpendicularly, is faftened the dye or matrix, of the reverfe or arm fide, in a kind of box, or cafe, in which it is retained by fcrews: and under this is a box containing the dye of the image fide, firmly fixed to the lower part of the engine. See *fig.* 4. When the planchet is to be ftamped, it is laid on the image-matrix, upon which two men draw one of the ropes of the beam, and turn the fcrew faftened in it; which, by this motion, lowers the arbor to which the dye of the arms is faftened: thus the metal, being in the middle, at once receives an impreffion on each fide, and becomes money, but they have not currency till they have been weighed and examined. For the coining of medals, the procefs is nearly the fame with that of money. The principal difference confifts in this: that money, having but a fmall relievo, receives its impreffion at a fingle ftroke of the engine; whereas for medals, the height of their relievo makes feveral ftrokes neceffary. For this purpofe, the piece is taken out from between the dyes, heated, and returned again; which procefs, in medallions, is fometimes repeated as many as fifteen or twenty times, before the full impreffion is given. Medallions, and medals of high relievo, are ufually firft caft in fand, and then put in the prefs to perfect them. Medals, therefore, receive their form and impreffion by degrees; money all at once.

In coining with the hammer, the bars of metal being taken out of the moulds, are heated and ftretched on an anvil; they are then cut to pieces, farther ftretched, and rounded with fheers; thus, by cutting and rounding they are reduced to the ftandard weight, and to the fize of the fpecies to be coined. The blanks, or planchets, thus formed, are carried to the blanching-houfe, where they undergo the fame preparation as the milled money defcribed above, and are fent to the minter to be ftamped with the hammer. For this laft operation, two puncheons, or matrices, are ufed: the one called the *pile*, and the other the *trufs*, or *quiver*; each engraven dent-wife; the pile bearing the arms, and the trufs the image; both their legend, date, &c. The pile, which is about eight inches high, has a kind of talon or heel in the middle, and ends in a point; this kind of figure was given, for the fake of being more eafily funk, and more firmly faftened to the block on which the money is ftruck. The minter, then, laying the planchet horizontally on the pile, and covering it with the trufs, which he holds fteadily in his left hand, gives feveral fmart blows on the trufs with an iron mallet held in the right; more or lefs, as the graving of the dyes is more or lefs deep. Thus the coinage is finifhed, and the blanks converted into money, which, after they have been examined, become current.

We have now given a brief account of the modes of coining hitherto adopted in this country.

About 16 or 17 years ago the ingenious Meffrs. Boulton and Watt of Birmingham began to apply the power of their fteam-engine at the Soho manufactory, to the operations of coining, and have fince coined a large quantity of two-penny, and penny pieces, of copper, and half-pence and farthings, for government, which are in general circulation; a few years ago, alfo, on the appearance of fcarcity in the circulating medium, thefe gentlemen re-coined a large quantity of Spanifh dollars for the Bank of England, without their being firft melted, or the Spanifh impreffion obliterated, by rolling, or otherwife. The Danifh government being defirous of introducing the approved coining apparatus of Boulton and Watt, at the royal mint at Copenhagen, fent over Olaus Warberg, one of the profeffors in the univerfity of that city, to contract for, and fuperintend the making of, and to learn the ufe of a complete fet of fteam-wrought coining apparatus; under the authority of a fpecial act of parliament for that purpofe, Meffrs. Boulton and Watt have almoft completed the apparatus for the Danifh mint; and ere long it is expected to be fhipped off for its deftination. A plan has been adopted by the Britifh government, for removing the royal mint out of the confined and inconvenient apartments in the Tower, where it has for fuch a length of time been carrried on, to an entire new edifice erected for the purpofe, on the fcite of what was formerly the victualling office, and fince the tobacco warehoufes, on the eaft fide of Tower-hill. The erections for the engines and apparatus, to be conftructed by Boulton and Watt, on their moft improved plan, have been begun upon a large fcale, and the whole will, when finifhed, prefent a fpectacle worthy of the nation. A great fecret has hitherto been made of the operations in the Soho mint, the motives for which we profefs not fully to underftand; it cannot, we think, arife, as fome have imagined, from the idea of preventing the clandeftine counterfeiting of the coin of the kingdom; becaufe, large and expenfive engines and apparatus like thefe, are not likely to be erected or ufed in a private manner; and, granting the poffibility of counterfeitors accomplifhing this, under cover of fome other mechanic art or trade, then we conceive, that men of fufficient fkill and ingenuity to carry fuch a work into effect, would not long be at a lofs to find out the principles of action adopted at Soho, from a ftudy of the impreffions on the coin in circulation. To us, it appears, from fuch an examination, that the impreffion is not given by a blow, or by the accelerated motion of a fcrew, as in the common methods, but by the fimple and powerful action of a crank, worked by the fteam-engine, and that the milling on the edge is done by the threads of an endlefs revolving fcrew, againft which the coin rolls; the rolling, or flatting and punching (or perhaps rolling) out the round pieces or blanks for coining, is probably effected by methods well known in other branches of the metallic arts.

This machinery works the fcrew-preffes for cutting out the circular pieces of copper, and coins both the faces and edges of the money at the fame time, with fuch fuperior excellence and cheapnefs of workmanfhip, as well as with marks of fuch powerful machinery, as muft totally prevent clandeftine imitation. By this machinery, four boys are capable of ftriking 30,000 pieces of money in an hour; and the machine acts at the fame time as a regifter, and keeps an unerring account of the number of pieces ftruck.

By the time that our work has advanced to the word Mint, we hope to be allowed to give an account of the new national mint, which will then probably be in action, or to obtain fufficient information thereof, for the gratification of our curious readers.

To this grand invention, the earl of Liverpool refers in his letter to the king, with furprife that it has not been already introduced into the practice of coining in this country: "But the new machinery," fays his lordfhip, "now employed in the manufactory of every fort of metal, in which the mechanics of this country far furpafs thofe of any other, has not in general been admitted into your majefty's mint. It is an acknowledged principle, that machines that act with a given force, can work with more truth and accuracy than the arm of man, the force of which neceffarily varies occafionally, from feveral caufes; another practice has been invented, that of ftriking coins in a fteel collar, fo as to make them perfectly round, and all precifely of the fame diameter, an improvement which certainly contributes to the beauty of the coin; new modes of putting what is called the grainery on the edges of the coins, have alfo been invented, which, at the fame time that they protect the coins from being filed, equally with the prefent mode, do not occafion thofe rough edges which expofe them to wear by abrafion or friction. For thefe, and many other valuable improvements, the public are indebted to the ingenuity of Mr. Boulton of Soho, near Birmingham. It is fingular, that though the manufacturers of England have greatly profited by thefe inventions, the officers of your majefty's mint have never, or not fufficiently, availed themfelves of them; the mints in foreign countries are in fearch of them, and their governments, in more than one inftance, have employed Mr. Boulton in erecting mints on his new principle; and parliament has authorifed the fame." Earl of Liverpool's "Treatife on the Coins of the Realm." Martin Folkes, efq. "On Englifh Coins." Darwin's "Bot. Garden."

The coinage of England is now performed wholly in the Tower of London; where there is a corporation for it, under the title of the *mint*.

Formerly there were here, as there are ftill in other countries, what we call the *rights of feignorage and braffage;* but fince the eighteenth year of king Charles II. there is nothing taken, either for the king, or for the expences of coining; it having been fettled by act of parliament, that all money fhould be ftruck at the public expence; fo that weight is returned for weight, to all perfons who carry their gold and filver to the Tower. See Coin.

There is a duty of ten fhillings per ton on wine, beer, and brandy imported, called the coinage duty, granted for defraying the expence of the king's coinage, but not to exceed 3000*l.* per annum, by ftat. 18. Car. II. cap. 5. and continued and advanced by fubfequent ftatutes, 4 and 5 Anne, cap. 22 1 Geo. I. cap. 43. 4 Geo. II. cap. 12 1 Geo. III. cap. 16, &c. By ftatute 27 Geo. II. c. 11. (explained by ftat. 27. Geo. III. c. 13. f. 64.) the treafury is to apply 15,000 *l.* a year to the expences of the mints in England and Scotland. The ftatute 14 Geo. III. c. 92. regulates the ftamping of money-weights, the fees for which are fettled by ftat. 15 Geo. III. c. 30. at 1 *d.* for every 12 weights.

The fpecies coined in England are efteemed contraband goods, and not to be exported; all foreign fpecies are allowed by act of parliament, made in 1673, to be fent out of the realm; as well as gold and filver in bars, ingots, duft, &c.

Coinage *of Fez and Tunis* is not under any difcipline; each goldfmith, Jew, and even every private perfon, undertaking it at pleafure; which renders their money exceedingly bad, and their commerce very unfafe. See Morocco.

Coinage, *Mufcovite.*—The czar Ivan Vaffilievitch inftituted the firft regular coinage, towards the middle of the fixteenth century, and fet up a mint at Mofcow. In the reign of this prince the Ruffian coinage began to acquire a new form, and coins of different denominations were ftruck after a certain alloy and weight. Peter I. made various alterations in the coinage. All mints were abolifhed, except thofe at Mofcow. A mint was afterwards fet up at Peterfburg. and this is at prefent the only one where gold and filver coins are ftruck. At this time there are in Ruffia one mint for filver, and fix for copper coin. See Russia.

Coinage, *Perfian.*—All the money made in Perfia is ftruck with the hammer; and the fame may be underftood of the reft of Afia and America, and the coafts of Africa, and even Mufcovy; the invention of the mill not being yet gone out of Europe, nor even eftablifhed in every part of it. The king's duty, in Perfia, is feven and a half per cent. for all the monies coined; which are now reduced to filver and copper; there being no gold coined there, except a kind of medals at the acceffion of a new fophi.

Coinage, *the Spanifh,* is efteemed one of the leaft perfect in Europe; it is fettled at Seville and Segovia, the only cities where gold and filver are ftruck. It is true, there are brought from Mexico, Peru, and other provinces of the Spanifh America, fuch vaft quantities of pieces of eight, and other fpecies both of gold and filver, that, in this refpect, it muft be owned, there is no ftate in the world where fo much money is coined, as in that of the king of Spain. See Spain.

To take the reprefentation of a coin on paper, card, or pafteboard. See Medal.

CO-INDICATIONS, in *Medicine,* figns which do not indicate by themfelves alone, but together with other circumftances, &c. help the phyfician to form a judgment.

COINING, in the *Tin-works,* is the marking of the tin, when caft into blocks, or flabs, with the figure of the lion rampant. This is done by the king's officer. The king's cuftom is four fhillings for every hundred weight.

COINTE, Charles Le, in *Biography,* was born at Troyes in the year 1611. After having received a good education, he was employed in inftructing others in grammar, the claffics, and rhetoric. He had not devoted many years to this occupation before he was called to affift in diplomatic affairs, and in 1643, he rendered his country confiderable fervice, in conjunction with M. Servien, at Munfter, in fettling the preliminaries of peace. For his zeal and fidelity in this bufinefs he was rewarded with a penfion, which enabled him to devote his whole time to theological ftudies. Between the years 1665, and 1679, he publifhed his great work, entitled "Annales Ecclefiaftici Francorum," in eight folio volumes. This vaft compilation contains almoft every thing

thing that relates to the Gallican church, previoufly to the period in which he wrote. He died at Paris, where he had [illegible] the laft thirty years of his life, in the year 1681, regretted by his numerous friends, as well for the excellence of his character, as for his talents, which, though not of the [illegible]r, he had rendered ufeful to his country and the in[illegible]. Nouv. Dict. Hift. Du Frefnoy.

COIPATLIS, in *Botany*, Hernand. See CALEA *oppofitifolia.*

COIR, in the *Manufactures*, the Afiatic name of a ftrong vegetable fibre, prepared from the hufks of the cocoa-nut, and much ufed in the Eaft Indies in the manufacture of cables and cordage. Dr. William Roxburgh, a correfponding member of the Society of Arts, London, refiding at Calcutta, in 1801, [illegible]mitted to that learned body, the detail of his experiments on hemp, and twenty other different forts of vegetable fibre, with the view of afcertaining their relative ftrength, when white, when tanned, and when tarred; thefe will be found in the 22d volume of their Tranfactions. In 1805, the fame ingenious gentleman tranfmitted to the fociety the refults of his further experiments, on the above mentioned 21 vegetable fibres, in the three ftates above named, both when frefh, and after 116 days maceration in water, during the hot feafon; thefe were for afcertaining the effects of tanning and tarring ropes made of thefe fubftances, both as the fame affected their ftrength at firft, and preferved them from decay by wet. See Tranf. Soc. Arts xxiv. 143.

COIRE, or CHUR, in *Geography*, a town of Swifferland, in the department of the Grifons, fituated at the foot of the Alps, in a rich plain between two and three miles wide. This town lies partly in the plain, and partly upon the fteep fide of a rock, and is furrounded with ancient brick walls, ftrengthened with fquare and round towers, according to the ftyle of fortification before the invention of gun-powder; the ftreets are narrow and dirty; it contains about 3000 perfons. It probably owes its origin to the emperor Conftantius, who, in the 355th year of the Chriftian era, penetrated into Rhætia, and fixed his ftation for fome time near the fcite of this town, which was conftructed near the camp, and deriving from the imperial refidence the name of Curia, its appellation was afterwards changed into Coira and Coire. The remains of two or three towers, evidently of Roman conftruction, atteft its antiquity, and ferve to eftablifh the truth of the above-mentioned conjecture concerning its origin. Coire was formerly a city of the German empire, fubject to its own courts, and in the ninth century became fubject to the dominion of the bifhop. Like many other cities of Germany, it obtained confiderable privileges from the different emperors; and the inhabitants, having gradually circumfcribed the authority of the bifhop, at length eftablifhed an independent republic. The government of Coire is arifto-democratical; the fupreme legiflative authority refides in the citizens, whofe number amounts to 294, divided into five tribes. The executive power is entrufted to the council of 70, compofed of 14 members annually elected from each tribe. This council is divided into feveral leffer departments, the chief of which is the fenate, or council of fifteen, who have the principal direction of affairs, either folely or conjointly with other members of the fovereign council. The chiefs of Coire are two burgomafters, taken from the members of the fenate, who continue in office for life, though liable to a removal. They enjoy the fupreme dignity by rotation, each for a year. The criminal tribunal is compofed of the fenate and 15 other members of the fovereign council. The prifoners are examined and the procefs drawn up by a fecret council, formed of the feven eldeft members of the fenate, the majority of whom muft concur to order the infliction of torture. After the conviction, procefs is laid before the criminal tribunal, which ultimately paffes fentence, and all offences, excepting great crimes, are commonly punifhed by fines. Coire fends two deputies to the general diet of the Grifons, held here every three years. Thefe are generally the two burgomafters. Upon the higheft part of the town ftands the bifhop's palace, the cathedral, and the houfe belonging to the chapter.

The bifhopric of Coire was probably erected foon after the firft eftablifhment of Chriftianity in thefe parts, under Conftantine, or his fon. The diocefe once extended over the whole Roman province of Rhætia, which comprehended the prefent country of the Grifons, the Valteline, Chiavenna, and Bormio, together with the eaftern diftrict of Swifferland as far as the lake of Conftance, and part of Tyrol; the bifhop's territorial poffeffions were alfo confiderable, and his revenues by no means inadequate to his power and dignity. The principal diminution of his power was occafioned by the formation of the league of God's Houfe, and the limitation of his prerogatives in 1527. The introduction of the Proteftant religion gave the final blow to his power; for his revenue fuftained great diminution by the lofs of the tythes, which were feized by the reformed communities. The bifhop is fuffragan of Mentz, and prince of the Roman empire, which dignity was annexed to the fee in 1170 by the emperor Frederic I., and he is ftyled lord of Furftenberg and Furftenau. His annual revenues, which amount to about 2,000*l.*, arife chiefly from eftates near Coire, and in the Tyrol; he receives alfo the annual fum of about 70*l.* from the cuftoms of Chiavenna, in return for having ceded his claims over the Valteline, Chiavenna, and Bormio, to the republic of the Three Leagues. The only prerogatives remaining are the right of coining money, and an abfolute jurifdiction both in civil and criminal affairs within the fmall diftrict in which his palace and the chapter are fituated. The bifhop is chofen by the chapter. The epifcopal diftrict is only a few hundred paces in circumference, and is furrounded by high walls; the greater part of the palace is modern, except a fquare tower, fuppofed to have been conftructed by the Romans. The chapter confifts of twenty-four canons, fix of whom are refident; the inhabitants of this diftrict are all Catholics. Above the palace, and at the higheft extremity of the town, is the convent of St. Lucius, deriving its name from a fmall chapel dedicated to that faint, who, according to the legends of the Romifh church, was a king in Britain towards the latter end of the fecond century. After embracing Chriftianity he is faid to have quitted his throne, and, wandering in thefe parts, to have built an hermitage upon the fpot where the chapel now ftands; and by his preaching and example, to have converted numbers to the Chriftian faith. He is ftyled the apoftle of the Grifons, and held in high veneration as a faint by the Catholics; while the Proteftants of the town pay him not the leaft veneration.

There is a Latin feminary at Coire for the children of the burghers, and another, inftituted in 1763, for the education of perfons intended for the church; thefe eftablifhments, though poorly endowed, have been of fome literary advantage to the country. Coire has alfo a typographical fociety for Latin, German, and Romanfh.

The environs of Coire are delightful; the plain is richly diverfified with corn and pafture, the hills gradually floping to the foot of the mountains are covered with vines, which yield wine of a pleafant flavour, but not ftrong. The Rhine, which flows rapidly through the plain, begins here to be navigable by rafts, and merchandize is tranfported towards Lindau and Zuric. N. lat. 46° 54'. E. long. 9° 29'.

COISLANS, a Dutch factory on the coaſt of Malabar; 23 leagues N.W. of Cape Comorin.

COISLIN'S MSS., *Codices Coiſlini* [illegible] take their name from Coiſlin, biſhop of Metz, to whom they were bequeathed by the celebrated chancellor Seguier, who died in 1672. They are preſerved at preſent in the Benedictine library of St. Germain des Prez, and are deſcribed in the following ſcarce work, *viz.* "Bibliotheca Coiſliniana, olim Seguieriana, ſeu MStorum omnium Græcorum, quæ in ea continentur, accurata deſcriptio, ubi operum ſingularum notitia datur, ætas cujuſque MSti indicatur, vetuſtiorum ſpecimina exhibentur, aliaque multa annotantur quæ ad palæographiam Græcam pertinent, Studio et opera B. de Montfaucon, Pariſiis. 1715. fol." They are likewiſe enumerated in Montfaucon's "Bibliotheca bibliothecarum," tom. ii. One of theſe MSS. is referred by Montfaucon and Wetſtein to the 7th century; others of them were written in the 11th, 12th, and 13th centuries; and moſt of them were brought from mount Athos. One of them contains a part of the O. T. without any proper reference to the N.; five contain the four Goſpels; others contain the Acts of the Apoſtles, and the Catholic Epiſtles; various commentaries on St. Matthew and St. Mark; commentaries on the Acts of the Apoſtles; the Epiſtles of St. Paul, with commentaries; the whole N. T.; the N. T., except the book of Revelations; the Acts, Epiſtles, and Revelations; fragments of the Epiſtle of St. Paul; and the Acts, Epiſtles, and Revelations. From 14 of theſe MSS. Wetſtein, in his N. T. has made extracts. See Marſh's Michaelis, Introd. to the N. T., vol. ii. and iii.

COITER, Koyter, Volcher, in *Biography*, a celebrated phyſician, ſurgeon, and anatomiſt at Groningen, where he was born in the year 1534; ſhewing early a diſpoſition to the ſtudy of medicine, he was ſent by his father to Padua, and placed under the direction of Fallopius, by whom he was initiated into the knowledge of anatomy, in which he was further improved by Euſtachius, during a reſidence of ſome months at Rome. He then went to Bologna, and was introduced to the celebrated naturaliſt, Aldrovandus, with whom he continued his ſtudies. Not ſatisfied with his attainments, he went to Montpellier, and afterwards, with the view of obtaining a greater number of human ſubjects for diſſection, for he had hitherto operated principally on brute animals, he accepted the poſt of one of the phyſicians to the army of the king of France, which he attended through a campaign. The numerous obſervations he made on the effects or alterations produced by certain diſeaſes, in the ſtructure of the viſcera, ſhew how well he was qualified for this poſt. On quitting the army, he went to Nuremburg, where he ſettled and continued to the time of his death, which happened about the year 1576.

Though his life was ſhort, yet, from the activity and powers of his mind, he was enabled to make conſiderable improvements, both in anatomy and ſurgery; among the former are to be noted, his obſervations on the brain, the motion of which, he found, was occaſioned by the motion of the arteries. He alſo diſcovered that the brain was not abſolutely neceſſary to life, which in ſome animals remained after it was taken away. He firſt deſcribed the corpora lutea, in the ovaria; alſo the order in which the parts of the chick are unfolded in the egg; and in the heart he obſerved, that the contraction of the ventricle preceded that of the auricle. He deſcribed the frontal ſinuſes; and though he did not diſcover any of the parts of the organ of hearing, that had not been before noticed, they are more accurately deſcribed by him, Douglas obſerves, than they had been by any preceding writer. He added two muſcles to the face, which are called by anatomiſts corrugators of the eye-lids, but from their uſe, Douglas ſays, they might more properly be called depreſſores ſuperciliorum; alſo two muſcles performing a ſimilar office for the lips. Among his chirurgical obſervations, are, that wounds or hurts of the brain are more dangerous when the dura mater remains entire than when it is ruptured; in theſe caſes, he boldly opened that membrane, to give vent to the effuſed humour. When fungi from the brain ariſe, they may be ſafely, he ſays, pared down. He cured a patient of a wound in the brain, extending to the ventricle but the patient was ever after afflicted with alienation of his mind. The works in which theſe, and numerous other valuable obſervations are contained, are "De cartilaginibus tabulæ quinque," fol. Bononiæ, 1566. "Externarum et internarum principalium corporis humani partium, tabulæ atque anatomicæ exercitationes, obſervationeſque variæ novis et artificioſiſſimis figuris illuſtratæ," Norib. 1573, fol. In the introduction he gives a brief hiſtory of anatomy, and traces the order in which it ſhould be ſtudied. He here firſt gave a complete ſet of plates, depicting the ſkeleton of a fœtus. "Diverſorum animalium ſceletorum explicationes, cum lectionibus Fallopii de partibus ſimilaribus," Norib. 1575, fol. containing well depicted ſkeletons of various quadrupeds, birds, and amphibious animals. Boerh. Math. Studii Med. Douglas Bib. Anat. Haller Bib. Anat., &c.

COITION, the intercourſe between male and female in the act of generation. It is obſerved that frogs are forty days in the act of coition. Bartholine, &c. relate that butterflies make an hundred and thirty vibrations of the wings in one act of coition.

Coition is alſo ſometimes uſed for that mutual attraction, or tendency toward each other, which is found between iron and the magnet.

COIT-MOSS-Colliery. This mine is ſituated near the borders of Cheſhire, and to that ſingular mountain Axe Edge, in the neighbourhood of Buxton, in Devonſhire, which is formed by the weſtern edge of the ſilicious grit rock, covering the lime-ſtone, in this diſlocated part of the country. The ſurface, for a conſiderable diſtance round the pit, is moſs or bog, and which extends ſeveral feet beneath the ſurface; the coal lies from 30 to 40 fathoms deep, and is covered by a ferruginous clay ſchiſt, which decompoſes on expoſure to the air. This mine is drained by a ſough of conſiderable length, in an eaſterly direction.

COJUMERO, in *Zoology*, the name given by ſome to the manati. See Trichechus *manatus*.

COIX, in *Botany*, (Κοιξ, Gr. a name given by Theophraſtus to one of his Καλαμοφυλλοι, or reed-leaved plants, allied to the palms.) Linn. Gen. 1045. Schreb. 1405. Willd. 1638. Juſſ. 34. Vent. 2. 112. (Lachryma Job. Tourn. 306. Lithagroſtis. Gært. Larmille. Encyc.) Claſs and order, *monœcia triandria*. Nat. Ord. *Gramineæ*, Linn. Juſſ. Vent.

Obſ. Gærtner objects to the Linnæan name, as not denoting the plant intended by Theophraſtus and other ancient writers.

Gen. Ch. *Male flowers* in a looſe ſpike. *Cal.* Glume two-flowered, two-valved; valves oblong-egg-ſhaped, obtuſe, awnleſs; the outer one thicker. *Cor.* two valved, valves ovate-lanceolate, nearly the length of the calyx, thin, awnleſs. *Stam.* Filaments three, capillary; anthers oblong. *Female flowers* few, ſituated below the male ſpike. *Cal.* Glume two-flowered, two-valved; valves rounded, thick, ſhining, hard; the outer one larger, ſhining. Linn. Schreb. Mart. Glume one-flowered, one-leafed, ovate-conical, open at its ſummit, fummit, thick, coriaceous, fhining; compofed of two valves, which are united the greateft part of their length. Lam. Glume one-flowered, three-valved; exterior valve larger, thick, coriaceous, fhining; calyx two-valved, fmaller. Juff. Vent. Female flowers two, one conftantly abortive; inclofed in a one-leafed, permanent involucrum, which, as the feed ripens, becomes hard as ftone. Gært. *Cor.* Glume two-valved; outer valve egg-fhaped; inner one narrower, fmaller; both awnlefs. *Pift.* Germ egg-fhaped, very fmall; ftyle fhort, two-cleft; ftigmas two, horned, much longer than the flower, pubefcent. *Peric.* none, except the outer glume of the calyx, which falls off with the feed without opening. *Seed* folitary, roundifh.

Eff. Ch. Male flowers in loofe fpikes. Calyx and corolla awnlefs. Female flowers, calyx and corolla awnlefs. Style two-cleft. Seed covered by the offified calyx.

Sp. 1. C. *lacryma.* Job's tears. Linn. Sp. Pl. Mart. 1. Lam. 1. Willd. 1. Lam. Illuft. tab. 750. (Lacryma Jobi. Cluf. Hift. 2. p. 216. Tourn. 306. J. Bauh. 2. p. 449. Dod. Pemp. 506. Lob. Ic. 44. Lithofpermum arundinaceum forte Diofcoridis et Plinii. Bauh. Pin. 258. Moris. Hift. 3. p. 249. Salee. Rumph. Amb. 5. tab. 75. fig. 2. Catrieonda. Rheed. Mal. 12. tab 70. Lithagroftis lacryma Jobi. Gært. tab. 1. fig. 10.) "Seeds egg-fhaped." Linn. "Spikes axillary, feveral, peduncled." Lam. "Culm femicylindrical above, obtufe; flowers naked; fruit egg-fhaped." Willd. *Root* fibrous, annual, at leaft in our climate. *Stems* two or three feet high, leafy. *Leaves* more than an inch broad, alternate, arundinaceous, fheathing, fmooth, with a white midrib. *Flowers* from the fheaths of the upper leaves, in feveral fafcicled unequal racemes, which are fhorter than their refpective leaves. *Seeds* blueifh white, rounded at the bafe, fomewhat pointed at the fummit, very hard, even-furfaced, fhining like pearls. A native of the Eaft Indies, cultivated in Spain and Portugal, where, in times of fcarcity, a coarfe kind of bread is made of its feeds, and eaten by the poor. It is applied to the fame purpofe in the Levant, and in China. Its feeds are fometimes bored and threaded for necklaces, and other female ornaments. 2. C. *angulata.* Linn. Hort. Cliff. 438. Mart. 2. (C. arundinacea. Lam. 2. Lacryma Jobi Americana altiffima, arundinis folio et facie. Plum. Cat. Lithofpermum arundinaceum alium. Hern. Mex. p. 282. the inner figure?) "Seeds angular." Linn. "Spikes axillary, folitary, nearly feffile." Lam. *Root* perennial. *Stems* feven or eight feet high, hard, branched. Nearly allied to the preceding, perhaps only a variety. 3. C. *agreftis.* Mart. 3. Willd. 2. Lour. Cochin. 551. (Sale-Utan. Rumph. Amb. 6. 22. tab. 9 fig. 1. Lacryma Jobi paludofa minor; Burm. Zeyl. 138.) "Culm quite fimple; leaves even-furfaced; feeds roundifh." Lour. "Culm cylindrical; flowers naked; feeds roundifh." Willd. *Root* perennial, creeping. *Culms* three feet high, cefpitofe, folid, jointed. *Leaves* lanceolate-linear, acuminate, alternate, fheathing. *Peduncles* long, three or four together from the fame axil, erect, many-flowered. *Seeds* brown, fhining, fmall. A native of moift places in Ceylon, Amboina, and Cochin-china. 4. C. *arundinacea.* Willd. 4. Koenig. "Culm femicylindrical above, acute; flowers involucred; feeds elliptical." Willd. *Root* perennial. *Stem* very lofty, branched. *Leaves* aculeate-ferrated. *Peduncles* in pairs, furrounded by inverfely egg-fhaped obtufe involucres, which are linear-cufpidate at the tip. *Fruit* four times fmaller than that of C. lacryma, white, fhining. A native of the Eaft Indies, near Tranfchaur, but very rare.

Propagation and Culture. The feeds of C. lacryma may be procured from Portugal, and fhould be fown in a moderate hot-bed in the fpring: they may afterwards be tranfplanted into a warm border, two feet at leaft diftant from each other, and will require no farther trouble. C. angulata will not bear the open air in England, but muft be plunged into the bark-bed, where it will produce ripe feeds the fecond year.

COKE, Sir Edward, in *Biography*, a lawyer of great celebrity in the fixteenth and feventeenth centuries, was the only fon of Robert Coke, efq. of Mileham, in Norfolk, a barrifter of confiderable practice. He was born in 1550, and received the early part of his education at the free fchool of Norwich; after which he completed his academical ftudies at Trinity College, Cambridge. From Cambridge he went to Clifford's Inn; and in the following year he entered as ftudent in the Inner Temple. He foon difcovered great penetration, and a folid judgment in cafes that belonged to his profeffion; and we are told by himfelf, that he pleaded his firft caufe in the court of King's Bench, in Trinity-term, 1578. About the fame time, he was appointed reader of Lyon's Inn, an office which he held for three years, during which his lectures were much reforted to; his reputation increafed, and his bufinefs as a barrifter found him ample employment for the exercife of his great talents. In a few years he married the daughter and co-heirefs of John Pafton, efq. with whom he had a large fortune; and by means of her connections, in conjunction with his own abilities, he made the moft rapid advances in his profeffion. He was chofen recorder of the cities of Norwich and Coventry; he was engaged in almoft every caufe of importance at Weftminfter Hall; and was frequently confulted in the affairs of the crown. His property and influence in Norfolk pointed him out as a fit reprefentative of the county; he was accordingly elected member; and, in the 35th year of Elizabeth, was chofen fpeaker of the Houfe of Commons, being at the fame time folicitor-general to the queen; an office which he fhortly exchanged for that of attorney-general.

As fpeaker of the houfe, in the year 1593, he made the three ufual requefts, of freedom from arrefts, of accefs to the royal perfon, and of liberty of fpeech; to which the queen replied, that liberty of fpeech was granted to the commons, but they muft know what liberty they were entitled to; not a liberty for every one to fpeak what he liketh, or what cometh in his brain to utter; their privilege extended no farther than a liberty of *aye* and *no*. That fhe would not impeach the freedom of their perfons; and that fhe would not refufe them accefs to her perfon, provided it were upon urgent and weighty caufes, and at times convenient, when fhe might have leifure from other important affairs.

The death of Mr. Coke's lady, by whom he had ten children, afforded him an opportunity of augmenting the number of his alliances, by a fecond marriage with lady Hatton, the widow of fir Chriftopher, and fifter to lord Burleigh, afterwards earl of Exeter. The marriage ceremony, in this inftance, having been performed with fome irregularities, he was profecuted in the archbifhop's court, and obliged to make the requifite fubmiffion, in order that he might efcape excommunication, and the penalties attached to it.

It has been remarked, that few reigns have produced fo many and able lawyers as that of queen Elizabeth; yet of them all, no one was fo much diftinguifhed as Mr. Coke, whom minifters confulted in all points of difficulty; and who, it is faid, never failed to furnifh them with legal colours for all their proceedings; which, though many of them were very extraordinary, yet being fo guarded, were beheld by the people as juft and honourable.

One of the moft interefting profecutions, which was affigned

affigned to him as attorney-general, was that of the earl of Effex, who, with the earl of Southampton, were indicted for the crime of high-treafon. The attorney-general, "Coke," fays Mr. Hume, "opened the caufe againft him, and treated him with the cruelty and infolence which that great lawyer ufually exercifed againft the unfortunate." At the conclufion of his fpeech he faid that, "by the juft judgment of God, he of his earldom fhould be Robert the Laft, that of a kingdom thought to be Robert the Firft." Almoft immediately after the acceffion of James to the throne, Mr. Coke received the honour of knighthood; and in the July following, fir Walter Raleigh was accufed and profecuted for a fuppofed plot againft government. Sir Edward Coke managed this trial entirely, and difplayed fo much rancour againft the prifoner, as may be deemed not only a great reflection, on his own memory, but even on the manners of the age. Traitor, monfter, fpider of hell, are terms which he employed againft an illuftrious character, who was under trial for life and fortune, and who defended himfelf with an even temper and heroical courage. Nor was the attorney-general lefs blameable with refpect to the high court before whom he ftood; his arrogance was fo confpicuous, that lord Cecil demanded, *if he came thither to direct them?* Upon which he fat down, and refufed to utter another word, till he was folicited by all the commiffioners, when he rofe, and recapitulating his arguments, fir Walter was found guilty.

On the difcovery of the gun-powder plot, fir Edward Coke obtained great credit for the fagacity and vigilance which he fhewed in unravelling the facts relating to that extraordinary affair. Upon one of the trials a high compliment was paffed upon him by lord Cecil, who faid, "that the evidence had been fo well diftributed, and opened by the attorney-general, that he never heard fuch a mafs of matter, better contracted, or made more intelligible to a jury." It was in reward for his fignal fervices on this occafion, that he was raifed to be chief juftice of the court of Common Pleas, an office which he appears to have filled with high reputation and honour. In 1613, he was made chief juftice of the King's Bench, and one of the members of the privy council, but without enjoying any confiderable portion of the king's confidence. He had already chofen as his motto, "lex tutiffima caffis;" and it was a maxim to which he determined to adhere; he was, therefore, ill fitted to ferve the high prerogative notions of James; he alfo fhewed marks of indignation, when his fovereign, through the attorney-general, undertook to find out his opinion of a caufe likely to be brought before him as judge; declaring, that it was a principle from which he would not depart, "that he was a judge in a court, and not in a chamber." As his temper had nothing in it that was conciliating, and as he felt the dignity of his high office, which he confidered as held for the benefit of the people, rather than for the pleafure of the crown, he involved himfelf not unfrequently with a court governed by favourites, and fond of a higher degree of power than was allowed by the conftitution. When the earl of Somerfet's guilt in the murder of fir Thomas Overbury was difcovered, the king fent to the chief juftice, fir Edward Coke, and earneftly recommended to him the moft rigorous and unbiaffed fcrutiny; an injunction which he executed with the greateft induftry and feverity. With the fmall clue given him, he unravelled moft carefully the whole labyrinth of their guilt; but his zeal on the trials of the perfons concerned in this affair, was mingled with a bitternefs and fury that feem to have ill accorded with the decorum and dignity of a judge. On the trial of Mrs. Turner, Coke fcrupled not to affirm that fhe was guilty of the feven deadly fins; fhe was a whore, bawd, a forcerer, a witch, a papift, a felon, and a murderer. In the fummer of 1616, he was fufpended from his office, and from his feat at the council board, the occafion of which was owing to fome difference with the new favourite, Villiers, afterwards duke of Buckingham; but in little more than a year, he was received at court, and reinftated in the privy council. He now took an active part in profecuting various perfons for corruption in office, and other offences, by which means many heavy fines were levied, and the treafury replenifhed. In this he feemed to favour the interefts of the crown; but in parliament, of which he was a diftinguifhed member, he maintained the rights and privileges of the commons, againft the proclamations of the fovereign; and was, on that account, in the year 1621, committed to the Tower, and his papers feized. He did not long remain a prifoner, though he was again expelled from the privy council, and ftigmatized by the king, as "being the fitteft inftrument for a tyrant that ever was in England;" a character to which he had no juft title, nor would it have been applied to him by James had he become fuch an inftrument in his own hands.

In the fucceeding reign he was nominated fheriff of Buckinghamfhire, to prevent him from being chofen member of the houfe of commons; he was, however, elected to reprefent that county in the parliament which met in the year 1628, and was diftinguifhed for his zeal in attempting to redrefs the grievances, and fupport the rights and liberties of the people. The moft important fervice which he rendered to his fellow citizens, was in framing and propofing the "petition of rights;" this was the laft of his public acts, and was juftly efteemed the moft explicit declaration of Englifh liberty which had, at that time, appeared. Parliament was in a very fhort time after diffolved, and fir Edward Coke retired to his feat in Buckinghamfhire, where he ended his days in tranquillity, and in high eftimation and refpect. He died September 3, 1634, in the eighty-fifth year of his age, leaving behind him a numerous family, and a very large eftate. In his laft moments he exhibited the utmoft refignation to the divine will, and finifhed his courfe with uttering the words, "thy will be done."

The character of this great lawyer has been varioufly reprefented; but it cannot be denied that he was at once a zealous and faithful fervant of the crown, maintaining its juft prerogatives; and as a fenator, he exhibited a laudable zeal for correcting abufes, from which nothing could ever deter him. His works are, "Reports," in 13 parts, folio. "A Book of entries." "Inftitutes of the Laws of England;" confifting of, (1.) a tranflation and a comment upon fir Thomas Littleton's Tenures; which is his moft celebrated work, and contains an immenfe body of legal erudition: (2.) Magna Charta, and other felect ftatutes, with a comment: (3.) The Criminal Law, or Pleas of the crown: (4.) An account of the jurifdiction of all the courts in the kingdom. "A Treatife of Bail and Mainprize." "Reading on the State of Fines, 27 Ed. i." Complete copyholder. Biog. Brit. Hume.

Coke, or *Coak*, denotes pit-coal or fea-coal charred. For the exciting of intenfe heat, as for the fmelting of iron-ore, and for operations where fmoak would be detrimental, as the drying of malt, foffil coals are previoufly charred, or reduced to coaks, that is, they are made to undergo an operation almoft fimilar to that by which charcoal is made. By this procefs coals are deprived of their volatile parts, nothing remaining except the carbon and earthy impurities. The great quantities of coal duft, or fmall coal, collected at the numerous pits in the neighbourhood of Newcaftle, would foon become a great incumbrance, were it not that an admirable method has been difcovered, not only to prevent the inconvenience,

venience, but to turn it, with a little modification, into an article of commerce and advantage, by preparations as simple as they are ingenious. Coal, in this pulverized state, is not proper for chamber fires, because it falls through the bars of the grates, or extinguishes the fire by falling upon the ignited cinders, in such masses that no air can get between to assist the [illegible] is small coal is, therefore, proper in this [illegible] or some purposes in glass-houses, lime or brick [illegible]. The consumption for these purposes is [illegible]rable, but is not nearly equal to the quan[illegible] the pits, notwithstanding the great care [illegible]o keep the coal in large pieces; besides, some [illegible] to crumble into small-coal upon receiving the least shock: m[illegible]ns have, therefore, been sought to render this coal proper for oth[illegible]rposes. That property, which belongs to the best coal, of agglutinating and forming a single mass, when in a state of combustion, naturally suggested the idea of endeavouring to consolidate considerable quantities of this coal dust, or small-coal, by means of a great fire. To effect this it is put into a kiln, in a great degree similar to a lime-kiln, which is previously well heated with large pieces of coal. The small-coal then runs together, and forms a mass, without losing any large portion of its valuable qualities. When the ignited mass is completely red, large pieces of it are pulled out with iron rakes (such as are used in the copperas works), and laid separately on the ground, where they are very soon extinguished; these pieces are firm, though porous, and are excellently adapted for smelting iron, and other ores, in high furnaces. This simple and ingenious contrivance has given birth to several new branches of industry and commerce. The coal, thus prepared, is used in a great number of manufactories, where a draft or blast is used, as a substitute for charcoal, to which it is in most instances superior, as it produces a stronger, more equal, and longer continued heat. Such is the method of coak-making at Newcastle, and other places. That pursued in the great iron-works at Carron, near Falkirk, in Scotland, being so completely different, our readers will excuse our giving an account of this also. The business is conducted there in the open air, and in the most simple manner; a quantity of large coal is placed on the ground in a round heap, of from 12 to 15 feet in diameter, and about two feet in height; as many as possible of the large pieces are placed on their ends, to form passages for the air; above them are thrown the smaller pieces and coal dust, and in the midst of this circular heap, is left a vacancy of a foot wide, where a few faggots are deposited to kindle it. Four or five apertures of this kind are formed round the ring, particularly on the side exposed to the wind; there is, however, seldom occasion to light it with wood, for other masses being generally on fire, the workmen most frequently use a few shovels of coal already burning, which acts more rapidly than wood, and soon kindles the surrounding pile; as the fire spreads the mass increases in bulk, puffs up, becomes spongy and light, cakes into one body, and at length loses its volatile parts, and emits no more smoke. It then acquires an uniform red colour, inclining a little to white, in which state it begins to break into gaps and chinks, and to assume the appearance of the under part of a mushroom; at this moment the heap must be quickly covered with ashes, of which there is always a sufficient provision around the numerous fires, where the coak is prepared. This method of throwing a large quantity of ashes on the fire, to deprive it of the approach of air, is similar to that used in making charcoal, which is covered over with earth; the result is also pretty much the same, the pit-coal thus prepared being light and porous, and producing the same effect in high furnaces as charcoal. This is a quality of extreme value: since, by means of charred pit-coal, founderies may easily be established, in places where the want of wood for charcoal, would otherwise render it necessary to abandon even the richest mines of iron.

The simple method above described being found to consume much of the best qualities of the coke, owing to the too free access of air during the process; many years ago a method was introduced, of distilling, or charring coals in close vessels, by the heat of another fire externally applied, and by which also the liquid bituminous matter, or coal-tar, was separated and condensed; the value of which, as a substitute for paint in rough works, contributed to render this a profitable mode of preparing strong cokes, for the smelting of metals, and other purposes in the arts, where, with greater plenty of wood, charcoal formerly was used; and which coke, from its superior inflammability, could be used in common grates and stoves, where the draft or influx of air is insufficient to burn the common coke. On the 13th of November, 1800, Mr. David Mushet of Glasgow took out a patent for various improvements in metallurgy, and, among others, for an improved coking furnace, built of fire-brick, or iron-plates, and made to exclude the external air from the coals to be coked while they are heated to incandescence, by a fire underneath with flues enveloping the coking vessel. In his specification (see Repertory of Arts, xiv. 182.), different constructions of these furnaces are described, some to condense the tar and soot, or lamp-black, and some for letting these escape, if their condensation should not be found advantageous. On the 18th May, 1804, Mr. Frederick Albert Winsor took out a patent for combining the saving and purifying of the inflammable gas (for producing light and heat), the ammonia, tar, and other products of pit-coal, with the manufacture of a superior kind of coke (see Repertory, 2d Series, v. 172). And, lately, the same gentleman has taken out a second patent, for further improvements in these processes, but this specification not being yet filed (June 1807), we are unable here to describe minutely, and give drawings of the oven, or carbonizing furnace, as we wished to do, which he uses for preparing his patent coke, of a superior quality, as the residuum of the gas, ammonial liquor, and oil-tar, separated in his processes (see GAS *lights*, and TAR *coal*), in which 300 yards in length of the wall of Carlton-House gardens, next to the Mall in St. James's Park, were, on his majesty's birth-day evening last, lighted up with gas-lamps, and burners, of various constructions, and with transparencies, and other devices, illuminated by brilliant gas-lights. This patent coke, from the experiments which we have seen, seems perfectly applicable to burning in our rooms and apartments; making a lively and pleasant fire, with a very small degree of draught up the chimney, and producing no smoke. Two pecks of coals, weighing 36 lb. coked in one of Mr. Winsor's small carbonizing furnaces, produced $24\frac{1}{2}$ lb. of coke (or 67 per cent.), which, when broke into moderate sized pieces, measured three pecks. Dr. Watson obtained 58, Mr. Jars 63, and M. Hielm 73 per cent. of the weight of coals, in similar experiments.

In the smelting of ores in Silesia, it was found (1. Bergm. Journ. 1790. p. 320.) that 92 lb., or one measure of cokes, were equivalent to 180 lb., or three measures of charcoal; and, in another place (ibid. 1792. p. 60.), one measure of cokes is said to equal the effects of five measures of charcoal, or three of pit-coal.

From the experiments of M. Lavoisier, in the Stockholm Memoirs, 1781, p. 187, it appears, that the heats produced, as measured by the evaporation of equal quantities of water, under equal surfaces, and the times of consumption, to produce

duce the same effect by four different kinds of fuel, were as follow, *viz*

Combustibles.	Weight.	Measure.	Duration.
Pit-coal,	600 lbs.	10 cubic feet.	20 hours.
Cokes,	403	17	$12\frac{1}{2}$
Charcoal,	600	40	5
Oak wood.	1089	33	4.4

Whence it appears, that if coal produces a certain quantity of heat in a given time, coke, in a much smaller quantity, will produce the same effect in little more than half the time; an equal weight of charcoal in one-fourth of that time; and oak wood, of nearly double the weight of coal, in about one-fifth of that time.

The coke-ovens, mentioned in a former part of this article, began about 30 or 40 years ago to be applied to other purposes besides the making of coke. About the year 1780, we remember to have seen a coke-oven, opening with a door almost like a large baker's oven, applied to heating the boilers of the steam-engines of the Chelsea or Pimlico water-works, but which has long since been disused. On the 23d June 1789, the right honourable Henry Seymour Conway took out a patent (see Repertory of Arts, iii. 75.) for improved methods of conveying and adapting the heat of coke ovens to the working of steam engines, baking of bread, calcining and fusing of metals and ores, &c. We are told in this specification, that three biscuit-ovens were erected and worked from the fire of one coke-oven thus constructed, the heat from it being regulated by openings and registers, with perfect success. See Oven. Others of these coke-ovens were adapted for heating boilers, and for working stills.

The earl of Dundonald's method of making cokes, or cinders, after he had extracted the coal-tar from coals, for which he obtained a patent, 30th April, 1781, and the time of which was afterwards extended by act of parliament to the 1st of June 1806, required the admitting of the external air into his furnace, in sufficient quantities to carry on the combustion of the coals operated upon (see Repertory of Arts, i. 145.), by which the necessity of a second, or external fire, for heating the furnace was avoided; but the cokes, produced by this means, are inferior in quality to those produced in close vessels, as in the processes of Muthet, Winser, &c. above mentioned.

COKER, in *Geography*, a river of England, in the county of Lancaster, which runs into the Irish sea, 5 miles N.W. of Garstang.

CO-KIANG, a town of China, of the third rank, in the province of Se-tchuen; 20 miles E.S.E. of Tche-li-keou.

CO-KING, a city of China, of the first rank, in the province of Yun-nan; 1160 miles S.S.W. of Pekin. N. lat. 26° 35′. E. long. 99° 16′.

COKZIM. See Choczim.

COL, or Coll, one of the western islands of Scotland, about 13 miles long, and 3 broad. Col, says Dr. Johnson, is one continued rock, of a surface much diversified with protuberances, and covered with a thin layer of earth, which is often broken, and discovers the stone. Such a soil is not adapted to plants that strike deep roots, nor do they rise to any great height. The uncultivated parts are cloathed with heath, among which industry has interspersed spots of grass and corn; but no attempt has yet been made to raise a tree. The lord of Col has lately introduced the culture of turnips, to provide food for his cattle in the winter. This island has many lochs, some of which have trouts and eels. The quadrupeds are horses, cows, sheep, and goats. It has neither deer, hares, nor rabbits. Rats are its only vermin, and they have been brought thither by sea; they have no serpents, frogs, or toads. The number of inhabitants is estimated at somewhat more than 800. It is 11 miles N.W. from the island of Mul. N. lat. 56° 38′. W. long. 6° 3′.

Col of Arez, a passage of the Pyrenees, in the road from Prats de Molo, in France, to Campredo, in Spain.

Col of *Argentiere*, a passage of the Alps, between Nice and Saluzzo.

Col *de Balme*, an eminence of the Alps, in the vicinity of Mont Blanc, lying in the way from Trient to Chamouny. It is very steep, but not dangerous, and the path, which is in no point bare rock, runs through a thick wood cloathing the sides of the mountain.

Col of *Limon*, a passage of the Alps, between Sospella and Coni.

Col of *Paracols*, a passage of the Pyrenées, between Ceret, in France, and Ampurdan, in Spain.

Col of *Pertus*, a passage of the Pyrenées, between Boulou and Junquere.

Col of *Tenda*, a passage of the Alps, between Piedmont and Nice, over the mountains of Tenda.

COLA dell'Amatrice, in *Biography*, a painter and architect, so called from the place of his birth, a small town near Aquila, in the state of Naples. At Ascoli, and in all that province, where he spent the latter part of his life, Cola enjoys the reputation of having been an excellent painter, as well as a great architect. In some of his early pictures, there is a degree of dryness in the style, but, in his latter works, his drawing is in a grand taste, and his pictures in every respect worthy of admiration. His most celebrated picture at Ascoli, represents our Saviour distributing the eucharist to the apostles, in the Oratorio del Corpus Domini. His greatest work of architecture is the façade of the magnificent church of St. Bernardino, at Aquila, which was begun in 1525, and finished in 1542; it bears this inscription on the architrave: Cola. Amatricius. Architector. Instruxit. This artist is likewise spoken of as a sculptor. Lanzi. Storia Pitt. Milizia. Mem. degli Arch.

Cola, Gennaro di, one of the painters who flourished in Naples in the 14th century. He was born about 1320, and was the scholar of Maestro Simone, an artist of some eminence in the city. There are several stories of the life of the Madonna, painted by this master, in company with another Neapolitan painter called Stefanone, in the church of St. Giovanni da Carbonara; they are executed with great diligence. This artist died about the year 1370. Lanzi. Storia Pitt. Domenici.

COLAIR Lake, a lake of Hindoostan, which, during the inundations in the season of the periodical rains, is 40 or 50 miles in extent, and at all times a considerable piece of water, and lies about midway between the Godavery and Kistnah, in the new soil gradually formed by the inundations of these rivers, about 12 British miles to the N. of Masulipatam. The origin of this lake may be referred to the same cause as that which produces the lakes and morasses of the Egyptian and Bengal deltas; which is, that the deposition of mud by the two rivers (or the two branches of one river) at the time when they overflow, is greatest near the banks; and thus the ground acquires the form of an inclined plane from each river bank towards the interior part of the country, where a hollow space will be left. The subsequent inundations finding their way into this hollow place, from the lower part of the river, will gradually fill up with mud that part of the lake which lies towards the source of it; and as the new land continues to encroach upon the sea, the lake will travel downwards in the same proportion. A plan has been

been propofed for opening a communication at all feafons between the Colair lake and its parent rivers, with a view to the improvement of the adjacent lands, which form a part of the circars, and of the inland navigation. But though the propofal was made in 1779, it does not feem to have been adopted. Rennell's Mem. p. 256.

COLAIRCOTTA, a town of Hindooftan, in the circar of Ellore; 10 miles E. of Ellore.

COL. Ital. *with*, in *Mufic*, a contraction of con-la, con-le, con-lo, as *col baffo*, with the bafe; *col cembalo*, with the harpfichord; *colla parte*, with the voice-part; *coll'organo*, with the organ, &c.

[illegible], a town of India, on [illegible] the Ganges. Ptolemy.

COLÆPIANI, a people of Pannonia, who, according to Pliny, inhabited the country near the Savus; fuppofed to have derived their name from the river Col[illegible]

COLAN, in *Geography*, a fmall town fituated near the South Sea, on the bay of Paita, in the kingdom of Peru, and jurifdiction of P[illegible] [illegible] is town runs the river Chera, the fame ftream which waters Amotape. The inhabitants cultivate grain and breed cattle, with which they fupply Paita, at the diftance of about four leagues towards the fouth, and alfo other towns. The Indians of this town are under an obligation of daily fending to Paita one or two balzas loaded with water, which is diftributed among the inhabitants by ftated proportions. The nature of the foil, and the fituation of the place, render it extremely hot. Its inhabitants, compofing about 35 or 40 families, and confifting of Spaniards, Mulattoes, and Meftizos, live chiefly by paffengers going or returning from Panama to Lima. The town thus owes its whole fupport to the harbour, which is the place where the cargoes of goods fent from Panama are landed, together with thofe coming from Callao to the jurifdiction of Piura and Loja. Here they alfo conftruct large rafts of logs, which will carry 60 or 70 tons of goods: with thefe they make long voyages, even to Panama, at the diftance of five or fix hundred leagues. They bear a maft with a fail attached to it, and they always go before the wind, being unable to ply againft it, fo that they are adapted to thefe feas in which the wind is always nearly in the fame direction. Their cargo is ufually wine, oil, fugar, Quito cloth, foap, and dreffed goat-fkins. The float is commonly navigated by two or three men, who fell their float when they difpofe of their cargo, and return as paffengers to the port from which they came. The Indians go out at night by favour of the land-wind, with fifhing floats, more manageable than the others, though thefe have mafts and fails too, and they return again in the day-time with the fea-wind.

COLANA, in *Ancient Geography*, a town of the Greater Armenia, near the Euphrates. Ptolemy.

COLANCORUM, a town of Germany, according to Ptolemy.

COLANIA, or COLONIA, a town of the ifle of Albion, affigned by Ptolemy to the Damnii, and fuppofed by Camden and Baxter to be the prefent Coldingham; but this being at too great a diftance, and belonging to another nation, others have thought it more probable that it was fituated at or near Lanark, the fhire-town of Clydefdale.

COLANTONIO, MARZIO DI, in *Biography*, a painter of confiderable merit, who flourifhed towards the latter part of the 16th century. He was born at Rome, and was inftructed in the art by his father, an indifferent painter of grotefques. Marzio foon made a rapid progrefs, and excelled in frefco, in which way he was employed, upon many confiderable works, in the churches and palaces of Rome: amongft others he painted a chapel dedicated to St. Andrea, in the church of the Madonna della Confolazione, with ftories of that apoftle. He afterwards painted many fmall pictures of battles and landfcapes, in the ftyle of Tempefta, for which he was much admired. The laft years of his life were fpent in Piedmont, in the fervice of the prince of Savoy. He died in the prime of life, in the pontificate of Paul V. Baglione. Lanzi. Storia Pitt.

COLAPIANI. See COLÆPIANI.

COLAPIS, a river of Pannonia, which difcharged itfelf into the Savus, near Sifcia, according to Pliny: Strabo and Dion Caffius mention this river; but the latter calls it Colops.

COLAPTICE, the art of carving, or cutting, the refemblances and figures of natural things in ftone. The term for the artift is *lithoxos*.

COLAR, in *Geography*, a town of Hindooftan, in the Myfore country; 35 miles E.N.E. of Bangalore, and 135 W. of Madras. N. lat. 13° 9'. E. long. 78° 19'.

COLARBASIANS, or COLORBASIANS, in *Ecclefiaftical Hiftory*, a fect of Chriftians in the fecond century; fo called from their leader, Colarbafus, a difciple of Valentinus; who, with Marcus, another difciple of the fame mafter, maintained the whole plenitude and perfection of truth and religion, to be contained in the Greek alphabet; and that it was upon this account that Jefus Chrift was called the *alpha* and *omega*. This fect was a branch of the VALENTINIANS. See alfo MARCOSIANS.

COLARIN. See COLLARINO.

COLARNI, in *Ancient Geography*, a people of Spain, in Lufitania, according to Pliny. Ptolemy calls their town *Colarnum*.

COLARUS, in *Geography*, a town of Hindooftan, in the circar of Gohud; 30 miles S.S.W. of Narwa, and 125 S. of Agra.

COLATTO, a town of Italy, belonging to the ftate of Venice, in the Trevifan; 6 miles S.S.W. of Ceneda.

COLATURE. See FILTRATION.

COLBA, a town of Germany, in the circle of Upper Saxony, and territory of Neuftadt; 3 miles W.S.W. of Neuftadt.

COLBATCH, JOHN, in *Biography*, an apothecary and furgeon, and in his later years member of the college of phyficians, London, a man of much induftry and ingenuity, and author of numerous publications on medical fubjects. He appears to have practifed medicine in London, and to have been in confiderable repute from the beginning to nearly the middle of the laft century. His firft work was entitled "A New Light of Chirurgery," publifhed in London in 8vo. 1695. He fhews the mifchief occafioned by ufing tents, and injecting acrid fubftances into wounds, and inftead of them recommends a powder of his compofing, which he diffolved in water and applied. It reftrains hæmorrhage, he fays, fooths pain, and difpofes ulcers and wounds to heal. As this excited oppofition, in an edition of the fame work publifhed fome years after he vindicated his doctrine, and adds a variety of cafes and experiments, in which his method had been attended with complete fuccefs. In 1696, he publifhed "A Phyfico-Medical Effay concerning Alkali and Acid," 8vo. He attributes moft difeafes to a predominant alkali in the conftitution, and fays they are to be moft efficacioufly relieved by adminiftering acids. Lemon juice, cream of tartar, and the acid of vitriol, were found by him to be fovereign remedies againft moft difeafes. Among other complaints, they cured the gout, on which he wrote a treatife the following year. His laft publication was on the "Mifletoe of the Oak," London,

don, 1719. He found it efficacious against the epilepsy, chorea sancti viti, and other diseases of the nervous system. He gives half a drachm of the powder of the missletoe, every three or four hours. The book contains full directions for collecting and preparing the plant, which is equally efficacious, he says, gathered from any other tree, as from the oak. His opinion of the efficacy of the plant is confirmed by the recital of several cases in which he had given it with success. Notwithstanding the high character he gives of the missletoe, it has long since fallen into disuse. Dr. Fraser has lately endeavoured to recal the attention of physicians to the subject, but he seems rather to have been led to it, by reading the account given by Colbatch, than from his own experience; at the least, the few cases he recites are not in point. Of the time when Colbatch died we have no account. Haller Bib. Chir. &c.

COLBERG, in *Geography*, a well fortified Prussian town in that part of Pomerania anciently called Cassubia, is situated on the river Persante; which, not far from hence, falls into the Baltic sea, and forms a convenient harbour. It has a few linen and woollen manufactures, a good salmon and lamprey fishery, and a tolerable trade. Some salt is made, on account of the crown, out of a salt spring close to the town. In 1758 Colberg was bombarded by the Russians without effect. Under the command of the brave colonel Loucadou, the garrison opposed an equally successful resistance to the French, who invested the place in November, 1806, and raised the siege in April, 1807. Colberg is distant 98 miles N.N.E. from Kustrin, and 124 N.E. from Berlin. N. lat. 54° 8'. E. long. 15° 27'.

COLBERT, John Baptist, marquis Seignelai, in *Biography*, one of the greatest statesmen that ever had the management of the affairs of France, was born at Rheims, in 1619. His father was Nicholas Colbert, whose family was originally from Scotland. The subject of this memoir shewed an early attachment to commercial and financial pursuits, and to gratify his inclinations, in this respect, he made a tour through the provinces of France, which were the most famous for trade and manufactures. At Paris he was introduced to the prime minister, cardinal Mazarin, who admitted him to his confidence, and in a short time entrusted to his management the most important concerns. The cardinal, during his last illness in 1661, recommended Colbert to his sovereign, as a man qualified for the highest office, and appointed him one of the executors to his last will. Louis XVI. attended to his late minister's recommendation and appointed Colbert as intendant of the finances. He immediately set about reforming abuses, and abolishing a number of useless places which, in that, as in other states, had been created for the purpose of serving individuals, rather than of benefiting the public. He quickly re-established order in the receipts and payments, and by a strict regard to the principles of economy, was enabled to augment the public treasury, while at the same time he actually diminished the taxes imposed on the people. He established a court of justice to examine and decide on all matters relating to finance, and thus recovered many alienations of the revenue, and suppressed annuities to a great amount, which had been acquired unjustly, and for which the original price was repaid. In 1664 he was appointed superintendant of the public buildings, and invited architects, sculptors, and other artists of real eminence, from all parts, whom he employed, on the most liberal terms, to decorate the palaces, and to render the capital worthy of the greatness of the kingdom. It was about this time that he turned his attention to commerce, and by his prudence and activity, raised, as a preparatory step, the royal navy to a most respectable state, so as to enable it to protect the designs which he had in view. He conceived the project of reviving the French East India Company, notwithstanding all the misfortunes which had disappointed the skill and diligence of his predecessors; for this purpose he made himself acquainted with such merchants and seamen as were most conversant with the business. From them he learnt that a scheme of this magnitude could not succeed, without a very large fund established for the purpose: a peremptory exclusion of foreigners; and such a degree of liberty and independence being secured to the company as might be satisfactory to every one, whether native or foreigner, of the safety of the property entrusted to them. To attain these objects it was necessary to give a stimulus to the nation; accordingly the pens of the most able academicians were employed to recommend them to public notice. Colbert succeeded, and he established also the West India and African companies, which gave to France many important advantages. Nor was the minister less attentive to the internal manufactures of the country; those of silk, of wool, of glass, and of steel, were either introduced or liberally encouraged, and fostered by his care and solicitude; and it is said that there was scarcely a year of his ministry in which he did not introduce some new and useful manufacture to excite the industry, and augment the wealth of his countrymen.

Colbert was the zealous patron of the arts and literature; he prevailed upon Cassini to quit Italy, and to place himself under the protection of the king of France, by whom he was pensioned. The French academy of painting was likewise founded by Colbert; he was greatly instrumental in the establishment of the Academy of Sciences, and that of inscriptions took its rise from an assembly in his own house for the purpose of furnishing designs for the king's medals. To encourage national industry he projected the grand canal of Languedoc, thereby uniting the two seas by which France is bounded. This undertaking, which was completed in about fourteen years, has afforded prodigious advantages to the enterprizes of the French nation, which would have been raised to a much higher degree of opulence had not the sovereign's inclination for war, and for expences of every kind, brought on embarrassments, which not only thwarted the designs of the minister, but finally destroyed many of his best plans. He himself has been accused of a too great regard to show and parade, and with a desire of encouraging the industry of towns, to the detriment of the agricultural interests. To render provisions cheap to the inhabitants of towns, and thereby encourage manufactures and commerce, he prohibited the exportation of corn, and thus excluded the inhabitants of the country from every foreign market for the produce of their industry. This great man, after having passed through many offices of the first importance in the state, died of the stone in September, 1683, in the sixty-fifth year of his age, leaving behind him six sons and three daughters. He was a man of great probity, extensive knowledge, in whatever concerned his own situation, and of the most indefatigable industry. His well timed, and necessary reforms, created him enemies, but his name has descended to posterity, accompanied with the plaudits of the wise and good of every nation. Nouv. Dict. Hist. Univer. Hist. Histoire de France.

Colbert, John Baptist, marquis de Torci, and son of the above, was born in 1665. In 1686 he was appointed secretary of state for the foreign department, and in 1699 director-general of the posts. He is said to have surpassed his father in the extent of his abilities and in the cultivation of his faculties: but in imitation of him he was a zealous promoter of commerce and the arts, and raised the French navy

navy to a superiority over every other in Europe. He died in 1746, having attained the reputation of an able statesman, and an excellent man. He left behind him memoirs of the negociations from the treaty of Ryswick to the peace of Utrecht, which were published in 1756 in three vols. 12mo.

COLBERTI's MSS. *Codices Colbertini*, in *Biblical History*, were collected by the celebrated Colbert, minister of the marine to Louis XIV. and are at present in the royal library in Paris, for which they were purchased by cardinal Fleury. They are described in general in the "Bibliotheca Colbertina," Parisiis, 1728, p. ii. 8vo. and in Montfaucon's "Bibliothecarum" tom. ii. But several of Colbert's MSS. and especially those of the Greek Testament, appear to have been separated from those of the Colbert library, and placed among the MSS. which were before in the royal library. The Colbert MSS. of the Greek Testament must therefore be sought among the Codices Regii, in the second volume of the "Catalogue MSS. Bibl. Regiæ." Five of these MSS. which contain the four gospels, of which two are referred to the 11th century, were collated by Simon, and their readings noted in the margin of Curcellæus's edition of the Greek Testament. Of seven other MSS. given in Mill's Greek Testament as eight, that learned critic has given a collection of readings, made by Larroque in a very superficial manner, and communicated by Allix. One of these divided by Mill into three separate MSS. contains the whole New Testament, except the book of Revelation, and was in Mill's time supposed to be 600 years old. This important MS. is described by Griesbach in his "Symbolæ," who defends it against the suspicion of its having been altered from the Latin, relates that its readings harmonize with those of Origen, refers it to the 11th or 12th century, and estimates it as a MS. of great value. Twelve other Codices Colbertini are simply Lectionaria of the four gospels, which Wetstein collated in 1715. See Michaelis's Introd. to the N. T. by Marsh, vols. ii. and iii.

COLBUSA, in *Ancient Geography*, a town of Bithynia. Pliny.

COLCHAGUA, or COLLAGUA, in *Geography*, a town of South America, in the kingdom of Chili, and capital of a jurisdiction containing about 1500 families.

COLCHESTER is a large market and borough town of Essex, England, and, as its name imports, was formerly a Roman station. From an examination of the best authorities it appears to have been the Camalodunum of the Romans; and Tacitus, with some other ancient historians, relate that it was the principal military colony of the legions under Claudius. That emperor, having subjugated the Trinobantes, took possession of this strong hold, and garrisoned it with the second, ninth, and fourteenth legions, whom he flattered with the pompous appellation of "conquerors of Britain," and named the place Colonia; probably as a preeminent memorial of its being the first Roman colony established in this island. In the Itinerary of Antoninus, it is distinguished both by that appellation, and by its original one of Camalodunum. It appears also, from the coins of Claudius, mentioned by Camden, to have been called Colonia-Camalodunum. Claudius, after establishing this colony, reduced the adjacent country into a Roman province; and having appointed Plautius, proprætor, returned to Rome, where a magnificent triumph was decreed to him by the senate, an anniversary solemnity instituted to commemorate his victory, and the surname of Britannicus entailed on his family. His success caused equal rejoicing at Camaloduđum, where a temple was erected to his memory, and he was worshipped as the tutelar deity of the place. This prosperity was not destined to last; for though the oppressed Britons were conquered, they were not subdued; and after several unsuccessful efforts to regain this station, they at length effected it under Boadicea. This Amazonian princess, taking advantage of a favourable opportunity, when the chief part of the veteran legions was withdrawn, directed her force against this devoted colony; fire and slaughter marked her progress; and Camalodunum, the seat of Roman tyranny in Britain, was overwhelmed in its own ruins, after a feeble resistance from the remaining soldiers, who defended themselves for two days in the temple. From the authority of Pliny, and the evidence of Roman coins, with other antiquities, it is, with high probability, deduced that Camalodunum was soon rebuilt.

"There are more Roman remains in and about this town than in any other part of South Britain. Immense quantities of Roman bricks and tiles are to be seen incorporated, or rather are the chief materials in all the most ancient and public edifices. The town-walls, the castle, and the churches are half built with them; and in several parts even the Roman workmanship is copied. The bricks are generally about 14 inches by 13, some 18 by 14; exceedingly hard and well baked. The *supellex Romana* of all kinds still abounds here; hardly any place being dug up, without urns, vases, and pottery of all sorts, or at least, fragments of them being discovered. Sepulchral urns, with the ashes therein, are likewise frequently found; as well as lamps, rings, intaglios, chains, &c. A remarkable sepulchral urn, in particular, was taken up here a few years ago. It was a large vessel, made of thick, coarse, light clay, containing twenty gallons; within was an urn of black earth, holding about two gallons, and having in it the ashes of a Roman lady, as may be supposed, because there were also with it two bottles of clay for incense, two clay lamps, one metal vessel for ointment, and a speculum of polished metal, anciently used for a looking glass." Morant's Essex.

The tessellated pavements are generally found at the depth of between three and four feet beneath the surface. There appear to have been several in the church-yard of St. Mary's at the Wall; tesseræ having been frequently dug up in different places. Many Roman pateræ, fragments of sculptured vessels, sacrificing instruments, Roman bracelets, and other antiquities have also been found here; and lately in a field near the west end of the town, part of a Roman hypocaust was discovered. The continued residence of the Romans at Colchester is farther confirmed by the many strong entrenchments, stretching from north to south, westward of the town. These are conjectured to be the remains of the Castra, Castella, and Præsidia, which, we learn from Tacitus, were formed about this station.

Ancient tradition gives to the town the honour of being the birth-place of Constantine, the first Christian emperor, and his mother Helena; the substance of this legend, which has frequently engaged the attention of the learned, is briefly this; that Coël, a British prince, was invested by the Romans with the government of this district; where, taking advantage of the distraction of the Roman empire, he assumed independence, repaired the public works, and gave his capital the name of Caer-Coel; that Constantius, empowered with sovereign authority by Dioclesian and Maximilian, was sent to Britain to reduce the revolters, and that he laid siege to Caer-Coel as the centre of the insurrection; that during the siege, which continued three years, Constantius became acquainted with Helena, the daughter of Coel, was captivated by her personal charms and mental endowments, and made peace with Coel, on condition of receiving his accomplished daughter in marriage; and that Constantine was the issue of this union, and was born at Caer-

Caer-Coel. This tradition, which originated with British writers, is wholly unnoticed by Roman historians, and contradicted by the concurrent evidence of the best informed writers on Roman history. (See Gibbon's "Decline and Fall of the Roman Empire.") The real birth-place of Constantine is generally supposed to have been Naissus in Dacia. Though the tradition which assigns it to Colchester is found to be unworthy of credit, yet it probably owed its rise to some occurrences in the history of this city, particularly connected with his family. Constantius resided in Britain a considerable time, accompanied by his son Constantine, and probably by his wife Helena; and Colonia being then a flourishing station, he may be supposed to have made it, at least, an occasional residence. Constantius was a secret promoter of Christianity; and Constantine and Helena being avowedly so, obtained the veneration of the inhabitants, who ascribe to her, among other pious labours, the foundation of St. Helen's chapel.

Under the Saxon government, Colchester, then called Colon-ceaster, or Colne-ceaster, lost much of its ancient consequence, by the increased importance of the English metropolis, which arose from its more favourable situation for trade and commerce. The Danes afterwards obtained possession of Colchester, and, by a treaty with Alfred, were established here and in the adjacent country; but recommencing their usual system of destruction and plunder, Edward the Elder laid siege to this town, which was taken by assault, and the Danes were all put to the sword. Edward is supposed to have repeopled the desolated city by a colony of West-Saxons, and in 922, according to the Saxon Chronicle, he rebuilt or repaired the walls. Colchester appears to have been a considerable town at the time of the Domesday Survey; the number of burgesses, who then held houses under the king, was 276; the number of houses in their possession 355, besides many others occupied by different proprietors. At the commencement of the civil commotions in the reign of Charles I., the inhabitants of Colchester coalesced with the parliament and petitioned that the town might be better fortified; in consequence of which 1500*l.* was accordingly granted for that purpose. Unwarranted acts of outrage were soon committed by the lower classes against the Lucas family; but the horrors of civil war were not felt in all their severity till the year 1648, when the memorable siege of this town reduced the inhabitants to the greatest distress.

Colchester is situated principally on the summit and northern aspect of a gentle eminence, rising from the river Colne, which flows on the north and east sides, and is navigable to the spot called the New-Hythe, in the east quarter of the town. The space inclosed by the remains of the ancient walls, forms a parallelogram, having its longest sides towards the north and south; the buildings without the walls, chiefly on the south and east, are very irregularly disposed. The principal street, which runs nearly east and west, contains many respectable houses and large shops; but is disfigured by the old market-house and other small buildings, which, occupying the middle of the street, obstruct the passage. Part of the town was first paved in the year 1473: in the reign of James I. an act was obtained for paving the whole, and its provisions were enforced by another act passed in 1750. By these statutes, the land-owners and proprietors of buildings, are compelled to pave and repair all the ways contiguous to their respective possessions. The preservation of the walls was formerly an object of great attention, but they are now nearly destroyed; and what remains is only kept in repair by those who have gardens or grounds adjoining. The walls consist of stone and Roman brick, united by a very strong cement; their circumference is one mile and three quarters, inclosing an area of rather more than 108 acres. Edward the Elder, as already mentioned, rebuilt or repaired them after the defeat of the Danes in 921; and Richard II. is recorded to have exempted the burgesses from the charge of sending members to three parliaments, on account of the great expence they were at "in repairing their wall with lime and stone against all invaders." Similar exemption was granted by the two succeeding sovereigns; but since the siege in 1648 no public attention has been paid to the walls. When in their perfect state, the entrance to the town was by four principal gates and three posterns; most of which are now destroyed. The walls were strengthened by several bastions, and defended on the west by a small ancient fort of Roman workmanship, constructed with the walls originally called Colkynge's castel; the arches that remain are formed of Roman brick; on the north and west sides were deep ditches in the places most open to attack.

On an elevated spot, north of the High street, and commanding a prospect of the winding valley to the north and east, stand the ruins of a very ancient castle. The outer walls of the keep are nearly perfect, and by their vast thickness and solidity, evince the importance that in the early ages was attached to this situation. The whole building is constructed with a mixture of stone, flint, and Roman bricks; but the latter are chiefly in such pieces as convey an idea of being taken from some more ancient building. The erection of this fortress is ascribed by Norden to Edward the Elder; but the Monasticon refers it to Eudo Dapifer, sewer or steward to William the Conqueror; it is evidently Norman in its general structure; yet it seems probable, from the great number of Roman bricks worked up in the walls, that it was raised on the site of some Roman building, and with a large portion of its materials. The tradition recorded in the Colchester Chronicle, precisely points out a more ancient edifice on this spot; "in fundo palatii Coelii quondam regis;" now if, according to Mr. Gough's supposition, Coel or Coelius was a Roman name, the origin of the fortress seems to be ascertained; and unless some spacious structure had previously occupied this site, there would be great difficulty in accounting for so large a space as the castle and its ramparts include, so near the centre of the town, remaining unoccupied till the time of the Normans. For a more particular account of the castle, vide "Architectural Antiquities of Great Britain," vol. i.

The town and suburbs of Colchester comprehend sixteen parishes; some of the churches are destroyed; the remainder, with the ruins of St. John's abbey, St. Botolph's priory, and the Moot-Hall, constitute the chief of the ancient and public buildings. St. John's abbey, so called from its dedication to St. John the Baptist, was a very magnificent structure, founded by Eudo Dapifer, in the year 1097; it occupied a pleasant eminence without the walls on the south side; but only the entrance gateway, and some fragments of other parts, now remain. The gateway is built with hewn stone and flint, and the workmanship is very uniform and stable. The abbey church was of singular construction, having a tower in the centre, with circular angles, terminated by small conical spires; the west front also was furnished with circular turrets. The abbey had the privilege of sanctuary. At a small distance, north-east, are the remains of St. Botolph's priory, generally supposed to have been founded by a monk named Eynulph or Ernulph, early in the twelfth century; though some portions of the ruins imply a far anterior date. Ernulph was the first prior, and placed on his foundation regular canons of the Augustine order. The priory church, which was parochial as well as conventual, continued nearly perfect till the siege in 1648,

when

when it was in a great meafure deftroyed; the contending parties charge each other with having wantonly occafioned its demolition. Its ruins are peculiarly interefting to the architectural antiquary, as prefenting fome curious fpecimens of brick ornaments, and of interlaced arches, from which the idea of the pointed arch is fuppofed to have originated. The length of this edifice within the walls, was, in its priftine ftate, 108 feet; its breadth, including the naves and ailes, nearly 44. The weft-front was highly decorated; on this fide was the principal entrance, which is ftill extant. The door-way is a fine femicircular retiring arch, having various zig-zag mouldings conftructed with fmall thin bricks and hewn ftone in alternate fucceffion. Thefe venerable remains are particularly defcribed in the "Architectural Antiquities of Great Britain," vol. i.

Eaft of St. Botolph's, is St. Mary Magdalen's hofpital, originally founded for perfons afflicted with leprofy, by Eudo Dapifer, temp. Henry I. To Eudo alfo the Moot-Hall owes its origin, where the courts are held, and the public bufinefs tranfacted. Adjoining to it are the town gaol and theatre. A free fchool and feveral charity fchools have been eftablifhed, and various meeting-houfes built for different religious fects. Colchefter was incorporated by charter of Richard I. dated 1189; and the burgeffes were at the fame time invefted with many valuable privileges, particularly the exclufive right of fifhery on the Colne, from the north bridge to Weft-Neffe. Thefe privileges have been confirmed and extended by feveral fubfequent fovereigns, efpecially by Henry V., the initial letter of whofe charter reprefents St. Helena before the crofs, finely illuminated. The laft charter, under which the town is now governed, was granted by George III. in 1763. Its provifions are nearly fimilar to thofe of the former charters granted by Charles II. and William and Mary, which have on different occafions been furrendered. The corporation confifts of a mayor, recorder, town-clerk, twelve aldermen, eighteen affiftants, eighteen common-councilmen, and fome inferior officers. The right of returning reprefentatives to parliament is vefted in the corporation and free burgeffes not receiving alms; the number of voters is about 1400. The earlieft return was made 25 Edward I.

Colchefter has been a market-town time immemorial; but this privilege was confirmed by Richard the Firft's charter. The market is held on Saturday. The number of inhabitants returned under the late act, as refiding within the town and liberties, was 10,089; the number of houfes 1793. A confiderable portion of the trade of the town arifes from the oyfter fifhery: Colchefter oyfters having been long celebrated for their goodnefs and flavour. This town is diftant from London 51 miles N.E.

Mile End, fo named from being nearly that diftance north of Colchefter, is an extenfive parifh, chiefly belonging to the burgeffes of that town, by a grant either from Henry I. or Stephen, which was renewed by Henry VIII. Morant's Hiftory of Effex, 2 vols. fol. Hiftory of Colchefter, 2 vols. 8vo.

The top of the ftaircafe of St. Mary's church fteeple in this town, was, about the year 1798, felected as one of the ftations in the Government Trigonometrical Survey, and its fituation was determined by an obfervation from Great Tay fteeple diftant 33,056 feet, and bearing 84° 22′ 42″ N.W. from the parallel to the meridian of Greenwich, and another from Stoke fteeple diftant 36,796, and bearing 1° 47′ 26″ N.W. from the fame parallel, whence was deduced its latitude 51° 53′ 17″.7 N. and its longitude 0° 53′ 33″.7 E. of Greenwich. The obfervations from this place were ufed with thofe of Great Tay for fettling the fituation of Weft Bergholt; and with thofe of Stoke, for Earl's Colne and Little Bromley churches. The Colne river is navigable for fmall fea-built veffels up to this town. See Canal.

Colchester, a townfhip of America, in Ulfter county, New York, fituated on the Popachton branch of Delaware river, S.W. of Middletown, and about 50 miles S.W. by S. of Cooperftown.—Alfo, a large townfhip in New London county, Connecticut, fettled in 1701; about 15 miles weftward of Norwich, 25 S.E. of Hartford, and 20 N.W. of New London city.—Alfo, the chief town of Chittenden county, Vermont, fituated on the eaft bank of lake Champlain, at the mouth of Onion river, and N. of Burlington, or Colchefter bay, which fpreads N. of the town.—Alfo, a poft-town of Fairfax county in Virginia, fituated on the N.E. bank of Occoquam creek, three or four miles from its confluence with the Potowmack; and here about 100 yards wide, and navigable for boats. It contains about 40 houfes, and lies 16 miles S.W. of Alexandria, 106 N. by E. of Richmond, and 172 from Philadelphia.

COLCHICUM, in *Botany*, (fuppofed to be fo called from Colchis, where it is faid to grow in great abundance,) Linn. Gen. 457. Schreb. 621. Willd. 707. Gært. 81. Juff. 47. Vent. 2. 155. Tourn. Claff. 9. Sect. 1. Gen. 5. Clafs and order, *hexandria trigynia*. Nat. Ord. *Spathaceæ*; Linn. *Junci*, Juff. *Joncacei*, Vent.

Gen. Ch. *Cal.* a fpathe. *Cor.* monopetalous, tubular, very long, fpringing immediately from the root; border campanulate, deeply divided into fix lanceolate-egg-fhaped fegments. *Stam.* Filaments fix, awl-fhaped, fhorter than the corolla, inferted into the tube; anthers oblong, four-valved, incumbent. *Pift.* Germ fuperior, fituated at the bottom of the tube of the corolla, contiguous to the root, below the furface of the ground; ftyles three, a little longer than the ftamens; ftigmas reflexed, channelled. *Peric.* Capfules three, inflated, coherent in their lower part, flightly feparated towards the fummit, opening longitudinally on the inner fide. *Seeds* numerous, almoft round, wrinkled.

Eff. Ch. Calyx a fpathe. Corolla fix-cleft; tube fpringing immediately from the root. Capfules three, connected, inflated, with many feeds.

Sp. 1. C. *autumnale*. Linn. Sp. Pl. 1. Mart. 1. Lam. 1. Willd. 1. Lam. Ill. tab. 267. Eng. Bot. tab. 133. Woodv. Med. Bot. tab. 177. (C. commune; Bauh. Pin. 67. Moris. fect. 4. tab. 3. fig. 1. Rai. Hift. 1172. Syn. 373.) "Leaves flat, lanceolate, erect." *Root* bulbous, nearly as large as that of the tulip, flefhy, abounding in a milky juice, perifhing after the ripening of the feeds, but firft throwing out a lateral bulbous offset, which produces the flowers of the enfuing year. *Flowers* generally purplifh, opening in the latter end of September without ftem or leaves; tube of the corolla very long; fegments of the calyx, lanceolate, large; anthers yellow; germ remaining under ground during the winter. *Leaves* appearing in the enfuing fpring, a foot long, broad, flattifh, obtufe, dark green, upright, three or four together, fheathing. *Capfules* rifing with the leaves, and ripening the feeds in May. There is a variety, or rather a monftrofity of this fpecies, figured in Englifh botany, tab. 1432. It is produced by fome accidental caufe which prevents the plant from flowering at the proper feafon, in confequence of which the flowers accompany the leaves in the fpring; but all their parts are imperfect; there is no pollen in the anthers, the fegments of the corolla are unnaturally long and narrow, of a greenifh fickly hue; and the germ is entirely abortive. Specimens were fent to Dr. Smith by Mr. Salmon, from a meadow near the Devizes, Wilts. We are in poffeffion of fpecimens gathered in the neighbourhood of York by the Rev. Mr. Wellbeloved. A native

A native of many parts of Europe, abundant in the weft and north of England, moft frequently, but by no means exclufively, in a calcareous foil. The whole plant has a ftrong and naufeous fmell. The recent fucculent bulb has an acrid, cauftic, bitter tafte, and is poifonous to man and other animals. A preparation of it is ufed in France, by order of government, to deftroy wolves. Deprived of its juices by age, or dried in an earlier ftate, it lofes its active qualities, and may be eaten with impunity. If taken out of the ground before the plants flower, and completely freed from its juices, it affords, like many other bulbs and tubers, a farinaceous matter which is wholefome and nutritious. Baron Stoerk of Vienna firft introduced it into ufe as a medicine. He fliced an ounce of the frefh root, and digefted it for forty-eight hours in a pound of vinegar, with a gentle heat. He then ftrained the vinegar, and added to it twice its weight of honey. The oxymel, thus produced, taken twice a day in dofes of a dram, and gradually increafed to an ounce or more, proved a very powerful diuretic, and in many cafes cured dropfies, which had been efteemed defperate. Pills are alfo made of the dried root reduced to powder, which have been found beneficial in removing obftructions. It is a favourite medicine in Germany and France; but the Englifh phyficians have found it a lefs efficacious diuretic than the fquill, by which it is ftill more excelled as an expectorant. The London college directs an oxymel colchici; that of Edinburgh, a fyrup; the latter differs from the former only in ufing fugar inftead of honey. The expreffed juice of the leaves, or an infufion of them in boiling water, applied as a lotion, has been ufed in France to deftroy the lice which infeft horned cattle. In an agricultural point of view, it is certainly a noxious weed to the farmer; not, indeed, on account of its poifonous qualities, for neither cows, horfes, nor fheep will touch it; but on account of its broad leaves, which occupy the place of better herbage. The only method of getting rid of it is to dig up the bulbs with a fpade, and to replace the earth when they have been feparated from it. 2. C. *montanum.* Linn. Sp. Pl. 2. Mart. 2. Lam. 2. Willd. 2. Hall. Helv. n. 1256. Allion. Ped. tab. 74. fig. 2. (C. montanum anguftifolium; Bauh. Pin. 68.) "Leaves linear, fpreading widely." *Root* fmaller than that of the preceding fpecies, with a darker coat. *Leaves* about three inches long, and half an inch broad, coming out with the flower in Auguft and September, and continuing green all the winter, at firft broadifh and egg-fhaped, afterwards almoft linear. *Flowers* reddifh purple, marked with lines; border deeply divided into narrow, almoft linear fegments. A native of Spain, Portugal, Italy, Switzerland, and the fouth of France; cultivated in England in 1629. 3. C. *variegatum.* Linn. Sp. 3. Mart. 3. Lam. 3. Willd. 3. Morif. tab. 3. fig. 4. "Leaves undulated, fpreading." *Leaves* appearing after the flowers are over, fmaller than thofe of C. autumnale, moft commonly three in number, of a paler and frefher green colour, lying clofe upon the ground, broad at the bottom, a little pointed at the end. *Flowers* whitifh, beautifully marked with purplifh fpots; border broad, with expanding fegments. A native of the iflands in the Archipelago, flowering in October or November.

Propagation and Culture. All the three fpecies are defirable ornaments to the flower-garden, particularly as they appear at a feafon when moft other plants have loft their beauty. Their bulbs require the fame treatment as thofe of the tulip. They fhould be taken up about the end of May, when the leaves are withered, and may be kept above ground until the beginning of Auguft. The third fpecies is rather tender. Many varieties of the common fort were known in the time of Parkinfon, and are ftill propagated by the florift; thofe moft common are the fingle and double-flowered white, the fingle and double-flowered purple, the variegated purple, the rofe-coloured, and the ftripe-leaved.

COLCHICUM *vernum hifpanicum;* Bauh. Pin. See BULBOCODIUM.

COLCHIS, or COLCHOS, in *Ancient Geography,* now *Mingrelia,* was bounded on the eaft by Iberia and Caucafus, on the weft by the Euxine fea, on the fouth by Armenia and part of Pontus, and on the north by mount Caucafus, dividing it from Sarmatia Afiatica. The moft noted cities in this country were Pityus, Diofcurias, Aea, and Cyta, which fee refpectively. The cities of Saracæ, Zudris, Surium, Madia, and Zaliffa, are alfo mentioned by Pliny, Strabo, and Ptolemy. Colchis was watered by many rivers, as the Corax, the Hippus, the Cyaneus, the Chariftus, the Phafis, the Abfarus, the Ciffa, and the Ophis, all emptying themfelves into the Euxine fea. The Colchians were, according to Herodotus, originally Egyptians; Sefoftris having left part of the army, with which he invaded Scythia, in Colchis, to people that country, and guard the paffes. Apollonius, Diodorus Siculus, Strabo, Euftathius, and Marcellinus, agree with Herodotus, who mentions many particulars in which the Colchians refembled the Egyptians. "They had," he fays, (lib. ii. c. 104, 105.) "the like tendency to woolly hair, and were of the fame dark complexion. There was a great fimilitude in their manufactures, particularly in their linen; for they abounded in flax, which they wrought up to a high perfection after the Egyptian method. In fhort, their whole way of life, and their language, had a great refemblance." Hence we may perceive, fays Bryant, (Anal. Anc. Myth. vol. iii. p. 451.) that though they were not, as the ancient hiftorian fuppofes, of the real Mizraim race, yet they came from a collateral branch, and were a colony from Egypt. Accordingly, this learned writer fuppofes, that the Colchians were one of the moft ancient colonies of the Cuthites, which is faid to have exifted many ages before the era of the Argonautæ; fo that, according to the poet (Apollonius Argon. l. iv. v. 267. v. 276.) many of the conftellations were not found in the heavens at the time when this colony was founded. One of the principal cities was called Cuta and Cutaia; and the country was called Cuteis and Cutais, from the Cuthite inhabitants. They retained, fays Bryant, a great reverence for the memory of their anceftor Chus, and the ridge of mountains, which ran through their country, was from him denominated Caucafus. The Colchians not only derived their origin from Egypt, but they were, as Bryant maintains, a part of that body, who by the Egyptians were ftyled the Hellenic and Phœnician fhepherds. They quitted Egypt, and were fucceeded by the Ifraelites, called afterwards the Jews. To this purpofe Diodorus fays, (lib. ii.), "that the Colchic nation upon the Pontus Euxinus, as well as that of the Jews, who fettled (in Canaan) between Syria and Arabia, were both founded by people, who went forth in early times from Egypt." As they enriched this country with many ufeful arts, it may well be expected that they fhould retain to the laft fome of their original excellence. We accordingly find, that writers extoll their advances in fcience, though it muft have been much impaired, before the Grecians were acquainted with their coaft.

In procefs of time many other nations fettled in Colchis, as the Heniochi, the Amprentæ, the Lazi, the Ligures, the Marfi, the Iftri, the Mofchi, and the Manralæ. The Colchians carried on for a long time an extenfive commerce. Strabo (lib. xi.) has given us a good defcription of their country;

country; and we may presume that the nature of it must have been always much the same. He says, that the whole region abounded with fruit of every kind, and with every material that was requisite for navigation. The only product of the country that was at all exceptionable was the honey, which had a bitter taste. They had plenty of timber, and many rivers for its conveyance downwards. They had also abundance of flax and hemp; together with wax and pitch. The linen manufactured by the natives was in high repute. Some of it was curiously painted with figures of animals and flowers; and afterwards dyed, like the linen of the Indians. And Herodotus tells us (lib. i. c. 203.), that the whole was so deeply tinctured, that no washing could efface the colours. They accordingly exported it to various marts, as it was every where greatly sought after. Strabo says, that many people who thought that they perceived a similitude between the natives of Colchis and those of Egypt, particularly in their customs, made use of this circumstance to prove the resemblance. He adds, that the high reputation and splendour, which they once maintained, may be known by the repeated evidences that writers have transmitted concerning them. The enterprising disposition or extensive commerce of the Colchians led them to establish many settlements; so that the coast of the Euxine, upon which they lived, was in many places peopled from them. One of their chief colonies seems to have been that of the *Amazons*, which see. Colchis, besides its other productions, was enriched with many mines of gold, which gave occasion to the fable of the golden fleece, and the *Argonautic* expedition, so much celebrated by the ancients. See ARGONAUTIC.

The Colchians were governed by their own kings in the earliest ages; for Pliny tells us (l. xxxiii. c. 3.) that Sesostris, king of Egypt, was overcome, and put to flight, by the king of Colchis. Little, however, that is certain, is known concerning their kings.

Upon the death of Œetes, in whose reign the famous expedition of the Argonauts occurred, Colchis, as we learn from Strabo, (l. i. and xvi.) was divided into several petty kingdoms; but the occasion of this division is not known. We find no further mention of the affairs of Colchis, or of the princes who reigned there, till the time of Xenophon, who tells us (Anab. l. v.) that the son of Œetes, the second of that name, reigned in Colchis, while he was making war in Asia. Colchis was afterwards subdued by Mithridates the Great, but revolted from him while his forces were employed against the Romans. As soon as the king of Pontus had concluded a peace with Sylla, he marched against the Colchians, who offered to submit, upon condition that he would appoint his son to reign over them, with the title of king of Colchis. This proposal so provoked Mithridates, that he caused his son to be arrested and loaded with chains of gold, sacrificing him soon after to his jealousy and ambition. Mithridates, finding that the Colchians obstinately refused to submit on any terms, assembled his troops in order to reduce them by force; but as he passed through the country of the Achæans, that people attacked him with such vigour, and defended the passes with such resolution, that, after having lost a great part of his army by the ambuscades of the enemy, and by the excessive cold of the country, he was under a necessity of returning into Pontus. Colchis, during its subjection to Mithridates, was governed by prefects of his appointment, one of whom was Moaphernes, great uncle to Strabo the geographer. The Colchians took part with Mithridates against Pompey; and, during that war, were governed by their own king, called Olthaus, who was vanquished, taken prisoner, and led in triumph by Pompey. Pompey conferred the sovereignty on Aristarchus, for his eminent services during the Mithridatic war. Afterwards Pharnaces II., king of Pontus, seized on the kingdom of Colchis, while Cæsar was entertained by Cleopatra in Egypt; but was soon obliged to abandon his conquests, and retire into the country of the Bosporani, where he was killed by Asander. From this time no mention of the Colchians occurs till the reign of the emperor Trajan, to whom they submitted of their own accord. Perhaps they were governed by their own king; for Strabo makes the river Phasis the northern boundary of the Roman empire. Under the emperors, Colchis was subject to the prætors who governed Bithynia and Pontus; but never made part of any province. Anc. Un. Hist. vol. ix. For the present state of Colchis or Colchos, see MINGRELIA.

COLCOTHAR, in *Natural History*, &c. The Latin writers of the middle ages use *colcothar* as a name of vitriol in general, which was called by the Greeks *chalcanthum*.

Colcothar is originally an Arabic word, which does not signify the common vitriol, but the *chalcitis*. The word has been spelt *calchuthar*, and from this the word *chalcitis* differs not very much. The Greeks of the middle ages followed the Arabians in the use of the word *colcothar*, but added to it a termination proper to their language, and particularly to the custom of those times, which seemed not to express exactly the same thing, but a diminutive of it: they wrote it *colcotharion*, or *chalcitarion*. This they also called the *orchis*, *orchidion*, the *ladi eladion*, and so in a thousand other instances. Avicenna uses the word *zagi* to express this substance, but then he is by no means determinate in it, but makes it include the *misy*, *sory*, and *melanteria*, as well as the *chalcitis*; but distinguishing in another place the several kinds of *zagi*, he tells us, that one was the *chalcand*, which was green; a second the *chalcitis*, which was yellow; a third the *sory*, which was red. *Alzagiat* is a name also used by him to express all these kinds; and this word the interpreters generally render *atramenta*, inks. This is generally supposed to express their being all black substances, which is not the case; but it properly signifies, that they are all vitriolic fossils: *atramentum* being a name of vitriol, as a substance used in the making of ink.

There are two kinds of *colcothar*, *natural* and *factitious*.

COLCOTHAR, *Natural*, otherwise called *chalcitis*, is a red vitriol, brought from Germany; formed from the common green vitriol, calcined naturally by some subterraneous fire.

COLCOTHAR, *Artificial*, is a substance which remains after martial vitriol has been calcined, and distilled for a long time by an intense fire; and by that means reduced to the redness of blood.

Mr. Le Fevre proposes an easy method of making *colcothar of vitriol*: he mixes two parts of filings of iron with one of sulphur, and a little water. After the acid of the sulphur has dissolved the iron, he exposes the paste to the air, and it changes into *colcothar*. See Mem. of the A. D. S. an. 1730, H. 52.

To obtain this article the most inferior kind of copperas is employed; it is first placed in a tolerably regular manner about two inches thick, upon iron plates which cover the first half of the bottom of a stove or oven which is heated, and nearly evaporates the water of crystallization; beyond these plates in the same oven, which is built with the best fire bricks, after having undergone the evaporation upon the iron plates, on which the copperas is thrown, it is then submitted to a red heat; during which, as may be readily supposed, its loss is considerable, eight cwt. of copperas producing scarcely five cwt. of colcothar. In the last named process the evaporation is entirely effected, and the substance completely calcined; from this it is taken to a mill, where it is ground

and

and sifted into an impalpable powder of a strong red colour.

Colcothar, after calcination, retains some of its acid, and imbibes moisture from the air; but if it is washed in water, the remaining acid is discharged; it no longer attracts moisture, and becomes what is called the *sweet earth* of vitriol. Unwashed colcothar is an antiseptic, tonic, astringent, and corrosive, and is therefore applied externally to all putrid, sanious, and fungous ulcers. See VITRIOL.

Colcothar is a dark red brown oxyd of iron, the residue of the distillation of nitrous acid, from nitre and vitriol of iron. This is calcined, washed, and thoroughly levigated, and in that state is much employed by painters, and in polishing glass and steel. It is called by artists crocus, or crocus martis, from its colour.

COLD, in common language, denotes the sensation which is felt, or the effect which is produced, by the abstraction of heat; that is, heat and cold are opposite to each other, and the existence or increment of the one is equal to the want or decrement of the other; so that the same degree of temperature may be called hot or cold, according as it is compared with a colder or a hotter temperature. Thus the climate of Great Britain is a cold climate in comparison with that of the West India islands, and a hot climate in comparison with that of Siberia. If a man warms one of his hands near a fire, whilst he cools his other hand by means of ice; and if, afterwards, he plunges both his hands in a bason of water of the common temperature of the atmosphere; that water will feel cold to the hand that has been heated, and hot to the other hand.

From this it appears that cold is not any thing real, but merely a privation of heat; so that instead of saying that a body has been cooled to a certain degree, it may with equal truth and propriety be said, that the body has been deprived of heat to that certain degree. Notwithstanding the simplicity of this theory, and the conviction which seems to accompany it, philosophers have often entertained doubts concerning it; and they have endeavoured to inquire into the real state of the matter, by devising experiments capable of demonstrating whether the cause of heat was any thing real, and that of cold only a privation or diminution of the former; or, *vice versâ*, whether the cause of cold was any thing real, and that of heat a diminution of it; or, lastly, whether the production of heat and the production of cold were not owing to two distinct principles, or elements. On the supposition that the cause of one of those effects only is real, it is much more natural to suppose, that the cause of heat is the real principle or element; since its effects, *viz.* enlargement of the bulk of bodies, the separation of their parts, &c. are such as must be produced by the introduction of something real; and the abstraction of this principle may naturally produce the effects of cold, such as contraction of the bulk of bodies, agglutination, &c.; whereas it would be unnatural to suppose that a body contracts its bulk, or its parts come into closer contact, because something else has been introduced amongst them. With respect to the last supposition, *viz.* whether the effects of heat and those of cold be not owing to two distinct principles, few arguments, and the equivocal result of few experiments, have, at times, been adduced in support of it. But the general and prevailing opinion amongst philosophers is, that a single element, called *caloric*, produces heat or the effects of expanding bodies, separating their parts, &c. and that cold is only a relative expression; that is, meaning only the decrement of heat; so that real or absolute cold consists only in the total abstraction of caloric; and, that such a point, *viz.* the zero of heat may be determined, has been shewn by the experiments, the discoveries, and the calculations, of some late eminent philosophers, *viz.* Irvine, Black, Crawford, and others. We shall presently give a compendious account of the particulars relating to the determination of this remarkable point; this total privation of heat, below which cold can not increase, since heat can not decrease. But it will be necessary, previously to it, briefly to mention an experiment which at first sight seems to prove that cold is something real, and independent of heat.

Let two concave metallic reflectors, about 10 inches in diameter, or larger, be placed facing each other at about the distance of 15 feet; and suppose the focus of each to be 18 inches distant from the surface of the speculum. Call the focus of one reflector A, and that of the other B. In order to situate the reflectors exactly facing each other, place a lighted candle in the focus of one of them, then move the other, so that the reflected image of the candle in the focus of this other reflector appears, by trial (*viz.* by receiving it upon a piece of paper), to fall in the direction of the focus and centre of the first reflector. Now, if a piece of red hot iron, or a burning charcoal be held in the focus, A, of one of those reflectors; and the bulb of a thermometer be placed in the focus, B, of the other reflector, the mercury in the thermometer will be raised by the radiant heat of the iron which falls upon the first speculum in a diverging manner, is reflected from it in parallel lines to the other speculum; and lastly, is reflected from this in converging lines to its focus, B, where the thermometer is situated. And that this is actually the case may be easily proved; for if the surface of either reflector be covered; every thing else remaining unaltered, the effect will not take place, *viz.* the mercury in the thermometer will not be heated. If, instead of the red hot iron, a piece of ice be placed in the focus, A, the thermometer will be lowered in the focus, B. Cover the surface of either reflector, and the mercury will rise in the thermometer. Uncover the reflector, and the mercury will descend, and so on. The result of this experiment has been supposed to prove that cold is something real or positive; for it proceeds from the ice to the speculum, is reflected from this to the other speculum, and is lastly reflected from this other speculum to its focus, B, where it cools the thermometer. But the true cause of the phenomenon is, that the heat of the thermometer is reflected upon the ice, in the same manner as the heat of the red hot iron was reflected upon the thermometer; for in this last disposition of the apparatus with the ice and the thermometer, the latter is the hottest of the two bodies. If instead of the thermometer, a piece of burning charcoal be placed in the focus, B, no person will hesitate to say, that the heat of the charcoal is reflected upon the ice at A. And there is no reason whatever for asserting that the same thing does not take place, when the thermometer is in the focus B.

We may now proceed to explain the determination of the zero of heat. If a quantity of water, whose temperature is 100°, be mixed with an equal weight of mercury, whose temperature is 50°, the temperature of the mixture will be found to be 88°; consequently the water has lost 12° of heat, and the mercury has gained 38° of heat. But if the original temperature be reversed, *viz.* the water at 50° be mixed with an equal weight of mercury at 100°, the temperature of the mixture will be 62°; consequently, the water has gained 12° of heat and the mercury has lost 38°. Therefore it is evident that the same quantity of caloric which raises the temperature of water 12°, will raise that of an equal weight of mercury 38°; or, by the rule of proportion, the same quantity of caloric which raises the temperature of water 1°, will raise that of the same weight of mercury 3.16 degrees.

Hence

Hence it may be concluded that when water and mercury are of the ſame temperature, the water actually contains rather more than three times as much caloric as an equal weight of mercury. Or, by the rule of proportion, if the caloric of water be called 1, that of mercury, (always meaning of an equal weight and equal temperature) will be 0.31. And theſe are called the ſpecific calorics of water and of mercury. By the like means the ſpecific calorics of various other bodies have been determined, in relation to that of water, which is always called one, or unity. The ſpecific caloric of ice, which is different from that of water, has been found to be 0.9. This may be ſufficent to give an idea of what is meant by ſpecific caloric in this place; but, for a full account and explanation of the ſubject, ſee the articles CALORIC and HEAT.

It has alſo been found, that when equal weights of water and ice are at the temperature of 32°; the water contains 140° of caloric more than the ice, which 140° of caloric are neceſſary to keep it in a fluid ſtate; nor can the ice be converted into fluid water without communicating to it 140° of heat. Further, ſince the ſpecific calorics of water and of ice, are as 1 to 0.9, it is natural to ſuppoſe that when they are both at the temperature of 32°, their abſolute or entire quantities of calorics are in the ſame proportion; *viz.* as 1 to 0.9, and 140° is their difference, 140 being the number of degrees of latent caloric, which water at the temperature of 32° holds more than ice at the ſame temperature of 32°. Now from theſe data, the zero of heat is determined by the following algebraical reaſoning, according to Dr. Irvine's theorem. Put x for the unknown number of degrees of caloric from 32° down to zero, or to the whole privation of heat; then the whole caloric of ice, in the above mentioned circumſtances, is x; and the whole or abſolute caloric of water is $x+140$. But the abſolute caloric of ice is to that of water as 0.9 to 1; or as 9 to 10; therefore we have this analogy $x : x+140 :: 9 : 10$, which gives the equation $10x = 9x + 1260$. And by tranſpoſition we have $10x - 9x = 1260$; or, $x = 1260$. Therefore, the zero or total privation of heat ſtands at 1260 degrees below the freezing point, or rather the melting point of congealed water. The ſame zero of heat may be determined by means of other ſubſtances; and it has thus by various means been calculated by other philoſophers: but as their determinations do not agree, ſome fallacy has been generally ſuſpected either in the theory or in the operations. The following are the reſults of the experiments, and the calculations made by divers perſons for the determination of the zero of heat.

Fahrenheit's Scale: degrees below the 0 of that Scale.

Lavoiſier and Laplace, from experiments on a mixture of 9 parts of water, and 16 of quicklime, placed the zero of heat at - - -	$3458\frac{1}{4}$
Their experiments on a mixture of ſulphuric acid, and water in the proportion of 4 to 3, fix the zero of heat at - - - -	$7292\frac{1}{4}$
Their experiments on a mixture of the ſame fluids in the proportion of 4 to 5, place it at -	$2630\frac{1}{2}$
Their experiments on a mixture of nitrous acid and quicklime, fix the 0 of heat at - -	$23837\frac{3}{5}$
Seguin places the zero of heat at - -	$1894\frac{1}{2}$
Other experiments of the ſame fix it at -	2709
And from other experiments he is led to fix it at	$1662\frac{3}{4}$
Kirwan fixes it at - - -	1350
Crawford places it at - - -	1532
Gadolin's experiments fix it at - -	$1461\frac{3}{5}$

This immenſe diſagreement of reſults ſeems to indicate that ſome one at leaſt of Dr. Irvine's ſuppoſitions muſt be miſtaken. But the preſent Dr. Irvine in his edition of his father's eſſays, obſerves, that his father's method of computing the zero of heat or point of total privation, does not appear to lie under any fallacy; but that the great diſcordance between the determinations of that point, as calculated by different perſons, ariſes from the difficulty of determining with accuracy the proportion of the ſpecific calorics, or capacities of ice and water.

In the preſent ſtate of civil ſociety, the production of cold, as ſubſervient to the advantage, the conveniency, and the luxury of mankind, eſpecially under certain obvious circumſtances, and at certain places, is a matter of conſiderable conſequence. The artificial production of cold is by no means ſo eaſy as the production of heat; ſo that great attention muſt be paid to a variety of circumſtances, in order that the cooling of liquors, of apartments, &c. may be performed in the eaſieſt, and moſt economical manner poſſible. The various known artificial methods of cooling, are ventilation; the uſe of cold caves, wells, grottos, &c. when their temperature is lower than that of the ambient air; evaporation; the uſe of ice where ice is to be had; the ſolution of certain ſalts; and the expanſion of air; but for the particular details and practice of thoſe methods, ſee the articles CONGELATION, VENTILATION, FREEZING, EVAPORATION, and EXPANSION.

COLD, in regard to *its action on the living body*, may be conſidered, according to popular language, and the common feelings of men, from which that language is deduced, as a poſitive agent. In ſtrictneſs, it is merely a privative, or relative term, ſignifying a greater or leſſer abſtraction of heat, or *caloric*: but for practical purpoſes, it is uſeful to refer to the ſenſations, as a ſtandard, and to adopt the vulgar acceptation of the term.

The operation of cold on the animal body may be regarded in *three* points of view: 1ſt, as to its general effects, as well in thoſe degrees in which it is conſiſtent with the health and vigour of the body, as in thoſe in which it becomes deſtructive of the principle of life; 2dly, as to its influence in the production of different diſeaſes; and, 3dly, as to its remedial effects, or its power of alleviating and curing ſome of the moſt fatal diſorders, to which the animal economy is liable. In attending to the detail of facts, under the two firſt heads, we ſhall neceſſarily be led to conſider alſo the means of preventing and removing the pernicious effects of the agency of cold.

I. Of the *general effects* of cold on the living body. A certain quantity of heat is obviouſly indiſpenſible to the exiſtence of life, throughout both the animal and vegetable world. The returns of ſummer and winter alternately multiply and diminiſh to a great extent the number of living beings, eſpecially of thoſe which poſſeſs a comparatively leſs perfect organization; and, in all, a free circulation of the fluids is requiſite for the ſupport of the vital principle. Hence life is incompatible with that degree of cold, which produces a congelation of the fluids. It is a law in the nature of heat, as well in living as in dead matter, that it is communicated from a body poſſeſſing a larger quantity, to any other body which comes in contact with it, poſſeſſing a ſmaller quantity, until an equilibrium is produced, or until the degree of heat is the ſame in both. Were living bodies, therefore, poſſeſſed of no other properties, but thoſe which belong to them in common with inorganic bodies, in an atmoſphere of the temperature of 32° of Fahrenheit's thermometer (the freezing point of water), or a little lower, it is obvious that life muſt ceaſe. The animal body, however, is endowed with a power of generating or evolving heat, to a conſiderable extent, much above the ordinary temperature of of the atmofphere. This power is even increafed by the neceffity occafioned by external cold, and diminifhes with the increafe of the atmofpherical warmth; fo that, during a ftate of health, the temperature of the animal body is pretty uniformly the fame, notwithftanding the extenfive variations of the external temperature (within an indefinite limit). Or, in other words, there is in the body a power of regulating or varying the evolution of heat, according to the demand made from without. In the human body, the degree of heat is regularly about 98° of Fahrenheit's fcale; in birds, it is fomewhat higher; and in fome other animals it is much lower, efpecially in the amphibia, &c. which have hence been called cold-blooded animals, and which fuffer great variations of their heat.

In order to afcertain the truth or falfity of an affertion, that fome animals, efpecially ferpents and fifh, had recovered their vitality after being frozen, Mr. John Hunter inftituted a number of interefting experiments on the power of different animals in refifting the agency of cold. Carp was gradually deftroyed, and froze, when fubmitted to a freezing mixture at 10° Fahrenheit, and did not recover. It was with great difficulty that he fucceeded in freezing a dormoufe, fuch were its powers of evolving heat, and the non-conducting quality of its integuments; and it was not till the hair was wetted that life was deftroyed, and the animal, when dead, became ftiff, and could not be recovered. When a toad was fubmitted to a fimilar cold mixture, the water froze round the animal, but it did not die. In other cafes the heat was readily overcome.

It appeared from thofe experiments, that an animal muft be deprived of life before it can be frozen; and that the power of refifting the cold was in proportion to the perfection of the animal, and the natural heat proper to each fpecies and to each age. It may, perhaps, alfo depend in fome degree on other circumftances, not yet afcertained; as in fome of the experiments on dormice, it was found, that in thefe animals, which are of a conftitution to retain nearly the fame heat in all temperatures of the air, it required the greateft cold that could be produced to overcome this power; while in the toad and fnail, whofe natural heat is not always the fame, but is altered very materially according to the external heat or cold, this power was exhaufted in a degree of cold not exceeding 10° or 15°, and the fnail being the moft imperfect of the two, its powers of generating heat were by much the weakeft. But in all there was a great exertion or an expence of the animal powers in this refiftance, in proportion to the neceffity; and the whole animal life was thus, at length, exhaufted. Hence thofe animals, which cannot fupport life for any confiderable time, at the temperature of the freezing point, always endeavour to procure fuch places of abode in the winter as feldom arrive at that point. Thus we find toads burrowing, frogs living under large ftones, fnails protected under the fhelter of ftones and in holes, fifh having recourfe to deep water, all which places are generally above the freezing point in our hardeft frofts; however, our frofts are fometimes fo fevere as to kill many, whofe habitations are not very fecure. When the froft is more intenfe or of longer ftanding than common, or in countries where the winters are always fevere, there is generally fnow, and the water freezes; the advantages arifing from thefe two circumftances are great; the fnow ferving as a blanket to the earth, and the ice to the water. See Philofoph. Tranfactions, vols. lxv. and lxviii.

The power of refifting the action of cold, or of evolving heat, in greater quantity than the furrounding cold media abftract it, could not of courfe be determined by experiment on the human body; but many ordinary and accidental circumftances have demonftrated its exiftence to an extent, which could not have been anticipated. It is fcarcely neceffary to allude to the common occurrences of the winter feafon, when the heat of the body remains at its natural degree of 98, during an expofure to an atmofphere, of 10, 15, or 20 degrees or more below the freezing point, even in this country. In Ruffia, Mr. Tooke obferves, that the drivers and their horfes, during extreme cold, feel little or no inconvenience in purfuing their employment, along the roads, though the beards of the former, and the muzzles of the latter, are covered with hoar froft, and little icicles, from the congelation of their breath; and they travel all day, in the fevereft cold of that northern climate, without receiving any detriment. "Nay, even from twenty to twenty-four degrees" (below the zero or freezing point, we prefume) "of Reaumur, women will ftand rinfing the linen through holes in the ice, four, five, or fix hours together, often bare-foot, with their hands dipping in the water all the while, and their draggled petticoats ftiff with ice." Tooke's View of the Ruffian Empire, vol. i. Even the extremes of cold in Siberia, in the neighbourhood of Hudfon's bay, &c. are compatible with human life, aided by a cloathing of furs, and other flow conductors of heat. We have learnt from accidents, alfo, that cold is fometimes refifted, during a long expofure, without fuch aid. An interefting account is before the public of the cafe of Elizabeth Woodcock, who was involved in a fnow-drift, on February 2d, 1799, in her way home from market, where it is fuppofed fhe drank too freely of fpirituous liquor. The fnow accumulated over her to the height of about fix feet, a fort of hollow cone being left from her head to the furface, through which breathing was performed. From this fituation fhe was removed on the 10th of February, having lain eight days in the fnow. Her life was preferved; but the greater part of her feet were deftroyed. A hiftory, fomewhat refembling the foregoing, is detailed in the "Journal de Medecine" of Paris, for the year 1767, of a man who refifted the action of cold from fnow, in which he was buried four days, and from which he was removed alive on the fifth day; and of a crew of 14 men, fhipwrecked, and immerged in the fea during 23 hours, eleven refifted the action of the cold, and recovered. We fhall have occafion to mention thefe cafes more particularly in the fequel of this article.

Such, indeed, is the power of refiftance to external cold in the human body, or rather fuch the conftant evolution of heat, that an atmofphere of the temperature of 98° of Fahrenheit, which, of courfe, does not abftract any of the heat of the body, is extremely incommoding to the feelings. In a phyfical fenfe, every temperature of the air, or other furrounding medium, below 98°, might be denominated *cold;* but with regard to the feeling and to the health, a degree much lower, namely, from 60° to 65°, is the moft grateful and invigorating. The external medium at the temperature of about 62° appears to abftract the heat of the body, in the fame proportion in which it is generated, without any extraordinary exertions of the fyftem; and therefore neither contributes to exhauft its powers, nor to excite uneafy fenfations. Thus the conftitution of man is wifely adapted to the general or medium temperature of the habitable globe. Hence alfo the general denominations which are given to different degrees of temperature. In a degree of heat from 60° to 64°, every exertion of the body, which is neceffary to man's fubfiftence or gratification, is performed with eafe and fafety; and this degree is called *temperate.* The higher degrees up to 70° are called *warm,* and all above that *hot.* In the inferior range of the fcale, a few

few degrees below 60°, as down to 50° or 47°, are denominated *cool;* and all below, *cold.* There is, however, considerable difference among men, even in a ftate of health, in affigning names to particular degrees of the thermometric fcale; as their fenfations vary, according to the power, which their refpective conftitutions poffefs, of evolving heat. This depends much upon the original vigour of the fyftem, efpecially of the heart and arterial fyftem; it is alfo much influenced, as is every other function of the body, by habit. Mr. Tooke attributed much of the impunity, with which the Ruffians perform their labours, already mentioned, during extreme cold, to their "being feafoned to it;"—a popular term, which implies the acknowledged effect of habit on thofe who take their refidence in climates of widely different temperature.

To perfons who, from vigour of conftitution, or from habit, readily evolve a confiderable quantity of heat, efpecially during moderate corporeal exercife, a degree of cold, which, to the weak and unhabituated, is a fource of painful fenfations of chillinefs, is agreeable to the feelings, and conducive to health. For the fenfation of cold is merely relative; it is in proportion to the previous fenfation of heat, and to the power of evolving it, to fupply the place of that which the external cold medium abftracts. Hence the fame temperature, at different times, excites even oppofite fenfations, according to the ftate of the circulation from exercife, or from difeafe, or previous expofure, &c. And thofe oppofite fenfations are even excited at the fame time in different parts of the body, as is familiarly illuftrated by the following experiment. If the hands be immerfed in two veffels of water, the right hand into a veffel containing water at the temperature of 80°, for inftance, and the left into a veffel in which the water is of the temperature of 40°, and after remaining a fhort time, both be immerfed into a veffel which contains water at the temperature of 60°; this water, of the intermediate degree of heat, will excite a fenfation of cold to the hand, which had previoufly been expofed to the temperature of 80°, and will feel warm to that which had been immerfed in the water of 40°. During the previous immerfion, for a fhort time, a greater abftraction and evolution of caloric had been made in the left hand, under a temperature of 40°, and a leffer in the right, under the higher temperature of 80°; and hence, when the abftraction is fuddenly diminifhed in the left hand, by a higher temperature of 60°, and fuddenly increafed in the right, by the lower temperature of 60°, the fenfation is the fame as if heat were actually added to the left, and cold applied to the right hand; for the fenfation is, as we before ftated, relative.

At the temperature of 62° of Fahrenheit's fcale, the balance of the evolution and abftraction of heat is fteadily maintained, without exertion or injury to the human body; but very low temperatures, by abftracting the animal heat more fpeedily than it can with eafe be evolved, exhauft the living powers, and ultimately deftroy the principle of life.

The firft effect of cold, applied to the human body, is to weaken and diminifh the action of the blood-veffels, efpecially of the fuperficial branches of the arteries, which become unable to tranfmit the blood in the ufual quantity through the integuments; and more efpecially in the extreme parts, as the hands and feet, which are at the greateft diftance from the heart; and in projecting parts, as in the ears, nofe, fcrotum, &c. which expofe a larger furface to the cold. Hence the fkin becomes pale, and, contracting round the miliary glands and roots of the hairs, exhibits a roughnefs, which is compared to the fkin of an unfeathered goofe, and is technically termed, *cutis anferina.* By the fame contraction of the fmaller veffels, and the diminifhed circulation, the extreme and projecting parts are diminifhed in fize; thus rings, which are tight on the fingers, while the body is warm, drop off in cold weather; and even the fhoes fall from the feet during extreme expofure. The heart, and the whole arterial fyftem, become weak, and the number and ftrength of their pulfations are diminifhed, according to the obfervations of Dr. Currie and Dr. Rufh. Dr. Currie remarks, that the natural pulfe of one of the men, on whom his experiments in the cold bath were made, was about 70 in a minute; but that, in confequence of agitation of mind, it was never flower than 85 before immerfion, and generally more. However this might be, it funk invariably to 65 in the water, became firm, regular, and fmall. After being in the bath fome time, it could hardly be felt at the wrift. Phil. Tranfactions, vol. lxxxii. But, from a feries of experiments, made by Dr. Stock of Briftol, a refult fomewhat different was obtained. The ftrength of the arterial action was, in all cafes, diminifhed by immerfion in cold water, but its frequency was, with fcarcely any exception, increafed: in many cafes, from the combination of extreme weaknefs and rapidity, it was fcarcely poffible to count the number of pulfations. The circumftance of the frequency of the pulfe increafing with its debility, feems to be more analogous to the general obfervation with refpect to arterial action. This fact alfo agrees with the obfervations made by Drs. Spooner and M'Donnell, at Edinburgh. See "Stock Medical Collections on the Effects of Cold," *appendix.* Spooner "Diff. Inaug. de Afcite Abdom." Edin. 1785. From the debility of the arterial fyftem, the blood is partially delayed in its courfe through fome of the cutaneous veffels, and, not undergoing the change of colour, which a circulation through the lungs produces, it gives a blueifh or livid colour to the fingers, ears, and other projecting parts. If the cold is intenfe, or the expofure continued long, the circulation in thefe parts becomes altogether interrupted, and the power of evolving heat being altogether deftroyed, a partial lofs of the vital principle takes place, or, in other words, mortification enfues, and the parts fall off from the body. The portions thus deftroyed, are ufually faid to be *froftnipped,* of which an example has already been mentioned, in the cafe of Elizabeth Woodcock, who loft her feet from this caufe. But inftances of this are fo numerous, that it will be unneceffary to detail them here.

The influence of cold in debilitating the force of the circulation of blood is alfo evinced in the perfons of the inhabitants of the frigid zone. "As we approach nearer to the north pole," Mr. Tooke has remarked, "both the animal and vegetable productions of nature become more and more ftunted. The ordinary ftature of the Samoyedes feldom exceeds four or five feet, and their whole exterior correfponds with their dwarfifh fize. The fame bodily ftructure, and the fame features of face, are applicable to the Eaft Siberian tribes. The Kamtfhadales are equally dwarfifh." View of Ruffia, vol. 2d. It is remarked by Linnæus, that the hares, partridges, and other animals, which inhabit the northern climes, are confiderably fmaller in fize, than the fame fpecies in more fouthern countries. Amœnitates Academicæ, vol. vii.

From the languor and weaknefs of the arterial fyftem, produced by the application of cold, other effects on the conftitution neceffarily accrue. It is a fact, well eftablifhed in phyfiology, that a free circulation of blood, which has undergone the falutary change produced by refpiration, to the brain and nervous fyftem, is requifite for the fupport of the fenfibility. If the circulation is fufpended for a few moments, as in fyncope, the fenfibility of the frame is alfo fufpended; and, on the other hand, where there is a more

more than ordinary fupply of blood to any part, as in inflammation, the fenfibility is highly augmented. Hence another immediate effect of the agency of cold on the human body, is a diminution of the fenfibility of the parts on which it is exerted. This is univerfally felt in the numbnefs of the hands and fingers, which, under the impreffion of cold, are altogether incapable of accurate difcrimination of touch; the whole of the furface of the fkin partakes of the imperfect feeling. The tongue is alfo incapable of diftinguifhing the peculiar flavour of fapid bodies, if they be extremely cold; and the fenfe of fmell is in a confiderable degree enfeebled by cold. If the cold be intenfe, or its application long continued, the powers of the whole nervous fyftem become weakened; a torpor of the animal functions enfues; the action of the mufcles is feeble, and fcarcely obedient to the will; an unconquerable languor and indifpofition to motion fucceeds; a gradual exhauftion of the nervous power fhews itfelf in drowfinefs, which terminates in fleep, from which the perfon, unlefs fpeedily roufed, frequently awakes no more.

A ftriking illuftration of thefe effects of cold is related by captain Cook, in an occurrence which took place during a botanical excurfion of fir Jofeph Banks and Dr. Solander, among the hills of Terra del Fuego. The party, confifting of 11 perfons, were overtaken by darknefs, and obliged to fpend the night on the hills, during extreme cold. Dr. Solander, who had more than once croffed the mountains which divide Sweden from Norway, well knew that extreme cold, efpecially when joined with fatigue, produces a torpor and fleepinefs that are almoft irrefiftible; he, therefore, conjured the company to keep moving, whatever pains it might coft them, and whatever relief they might be promifed by an inclination to reft; "whoever fits down," faid he, "will fleep; and whoever fleeps will wake no more." Thus at once admonifhed and alarmed, they fet forward; but while they were ftill upon the naked rock, and before they had got among the bufhes, the cold became fuddenly fo intenfe, as to produce the effects that had been moft dreaded. Dr. Solander himfelf was the firft who found the inclination, againft which he had warned others, irrefiftible, and infifted upon being fuffered to lie down. Mr. Banks entreated and remonftrated in vain; down he lay upon the ground, though it was covered with fnow; and it was with great difficulty that his friend kept him from fleeping. Richmond alfo, one of the black fervants, began to linger, having fuffered from the cold in the fame manner as the doctor. Mr. Banks, therefore, fent five of the company forward, to get a fire ready at the firft convenient place they could find, and himfelf, with four others, remained with the doctor and Richmond, whom, partly by perfuafion and entreaty, and partly by force, they brought on; but when they had got through the greater part of the birch and fwamp, they both declared they could go no farther. Mr. Banks had recourfe again to entreaty and expoftulation, but they produced no effect. When Richmond was told, that if he did not go on he would in a fhort time be frozen to death, he anfwered, that he defired nothing but to lie down and die. The doctor did not fo explicitly renounce his life; he faid he was willing to go on, but that he muft firft take fome fleep, though he had before told the company that to fleep was to perifh. Mr. Banks and the reft found it impoffible to carry them, and there being no remedy, they were both fuffered to fit down, being partly fupported by the bufhes, and in a few minutes they fell into a profound fleep. Soon after fome of the people who had been fent forward, returned with the welcome news, that a fire was kindled about a quarter of a mile farther on the way. Mr. Banks then endeavoured to wake Dr. Solander, and happily fucceeded; but though he had not flept five minutes, he had almoft loft the ufe of his limbs, and the mufcles were fo fhrunk, that his fhoes fell from his feet; he confented to go forward, with fuch affiftance as could be given him; but no attempts to relieve poor Richmond were fuccefsful. He, together with another black, left with him, died. Several others began to lofe their fenfibility, having been expofed to the cold and the fnow near an hour and a half, but the fire recovered them. See captain Cook's firft Voyage.

In addition to this interefting narrative, many examples of death from extreme cold, occurring in a fimilar way, are recorded. Bomare obferves that travellers among the Glaciers of Switzerland, are fometimes furprized and killed by the cold, efpecially thofe who travel on horfeback; and that the approaching danger manifefts itfelf by a ftrong difpofition to fleep; fo that if the perfon does not immediately refift it, and put himfelf into a brifk movement, death is inevitable. Dictionaire d' Hift. Naturelle, *Art.* Froid. Sauffure alfo has remarked that among thefe mountains, even in the fineft weather of fummer, fudden ftorms of the moft intenfe cold wind, with fnow that obfcures the air, are not uncommon, and are frequently fatal to the traveller; for he perifhes with cold, if he ftops; and if he goes on at hazard, he falls in all probability over a precipice. Voyage dans les Alpes, tom. ii.

The French peafants, who inhabit the feet of the bleak mountains, which feparate France from Spain, annually fuffer fatal accidents, in their journeys acrofs the perpetual fnows, which cover them. In February 1765, five men who were returning from the Spanifh forges, to bring their families the fruits of their labour, were caught in one of thofe ftorms defcribed by Sauffure. One of them, named Boutillât, feized by the cold, immediately felt extreme laffitude, his limbs were unable to fupport him, and he fell down, overcome with fleep, and was foon overwhelmed with the fnow. The cold continued, and he lay four days, infenfible, in the fnow, which, to ufe the words of Mr. Hunter, probably "ferved as a blanket," to fhelter him from the more intenfe cold of the atmofphere. He awoke on the 5th morning, with a fenfation of burning thirft in his throat, and he inftinctively bit of the fnow, in which he was enveloped. A fimilar hollow cone, through which he had breathed, was found in this inftance, as in that of Elizabeth Woodcock before defcribed; and he was, like her, unable to affift himfelf to throw off his cold covering. But fome men, fent in fearch of him by the magiftrates of the village, fortunately difcovered him. The cuticle of a confiderable part of his body was detached, as if by blifters; but he was not fenfible of pain; in feveral places gangrene had occurred. When he was taken home, the limbs were ignorantly wrapped in warm linen, fome of which was dipped in aromatic liquors. The feet were deftroyed by the mortification, and came off; and in twelve or fourteen days after the accident he died. M. Pilkes, who details the hiftory of the cafe, remarks, that, if cold applications had been made, inftead of the warm linen, and aromatic liquors, his life might probably have been preferved. See Journal de Medecine, Paris, 1767, tom. xxvii.

The effect of extreme and continued cold is not only to deftroy animal life, but alfo to preferve animal fubftances from decompofition by the procefs of putrefaction. Hence in regions of unvarying cold, the bodies of thofe who perifh are preferved entire under the fnow. Bomare affirms, that there are ftill found in South America, a confiderable number of the firft conquerors of the new world, who, at the commencement of the fixteenth century, preferred to a long and circuitous route, the ſhort but dangerous paſſage of the mountains of Peru, in order to examine more ſpeedily the rich mines, which had been deſcribed to them. "The warmth of their avarice, and their ardour in ſearch of gold, could not defend them from the influence of cold, from which they periſhed, and by which they are ſtill preſerved, with all that they carried with them, and in the various attitudes, in which they were frozen and ſurpriſed by death, conſtituting a ſort of natural mummies." Dict. d' Hiſt. Nat. And Bartholin obſerves, that the Daniſh ſailors had informed him, that bodies had been preſerved in Spitzbergen during 30 years. Gazette de Salut.

When cold is combined with *moiſture*, even at a much higher temperature, its effects are extremely deleterious, and even fatal, independent of the train of diſeaſes, which it excites, and which we ſhall deſcribe hereafter. For water not only conducts the heat away more rapidly, but, by evaporating, it abſtracts an additional quantity from the body, eſpecially when it is expoſed to wind: in this caſe, a new ſheet of cold water is, as it were, perpetually applied to the ſurface of the body, which induces an extreme chill, both by the number of particles in contact with the ſkin, and their greater facility of receiving heat. It appears, however, that the deleterious effects of cold combined with moiſture, are ſomewhat different from thoſe which are the conſequence of a dry cold; and that cold *ſalt* water is leſs prejudicial to the body, than cold *freſh* water; as the following facts and experiments, related by Dr. Currie, will evince.

On the 13th of December, 1790, an American ſhip was caſt away on a ſand bank, that lies in the opening of the river Merſey, into the Iriſh channel. The crew got on a part of the wreck, where they paſſed the night; and a ſignal which they made being diſcovered next day from Hillberry iſland, a boat went off, though at a great riſk, and took up the ſurvivors. The unfortunate men had remained twenty-three hours on the wreck; and of fourteen, the original number, eleven were ſtill alive, all of whom in the end recovered. Of the three that periſhed, one was the maſter of the veſſel; another was a paſſenger, who had been a maſter, but had loſt or ſold his ſhip in America; the third was the cook, who was a weakly man; he died only a few hours before the boat reached the wreck. The two maſters had been long dead. This fact excited much curioſity, and their death was attributed to intoxication from a free uſe of cherries from a keg, which had contained cherry-brandy. But in fact nothing was preſerved, neither food nor drink, and the whole crew were upon an equality, except that ſome were deeper in the water than others; and the two maſters had the advantage in this reſpect, for they ſat on the only part of the wreck that was out of the ſea; they were, however, frequently overwhelmed by the ſurge, and at other times expoſed to heavy ſhowers of ſleet and ſnow, and to a high and piercing wind. The temperature of the air, as nearly as can be gueſſed, was from 30° to 33° of Fahr. and that of the ſea, from trials in ſimilar circumſtances, from 38° to 40°. The mate was generally up to the middle in the water. The crew were worſe ſituated, being ſome of them up to the ſhoulders. They were not at any time able to change their poſition, but kept their legs in pretty conſtant motion to counteract the cold, their arms being employed in holding the wreck. It is remarkable that a poor negro, who eſcaped almoſt unhurt, was perhaps deepeſt in the ſea of any.

The maſter of the ſhip, Capt. Scott, a native of North Carolina, and about 40 years of age, died firſt. As they were in the dark, Mr. Amyat, the mate, could not ſee his countenance; but he was firſt alarmed by hearing him talk incoherently, like one in the delirium of fever. By degrees his voice dwindled into a mutter, and his hearing ſeemed to fail. At length he raiſed himſelf up in a ſort of convulſive motion, in which he continued a few ſeconds, and then fell back dead on the deck. This happened about eight o'clock in the evening, four hours after the ſhip went aground. Soon after this, Capt. Daviſon, who was about 28, began to talk incoherently, in the ſame manner as the other; he ſtruggled longer, but died in the ſame way about eleven at night. The cook died in the forenoon of the ſucceeding day; he was a low-ſpirited man, and deſponded from the beginning. All the reſt held out, though ſorely pinched with cold and hunger, till they were taken up about three in the afternoon. Mr. Amyat ſaid that his hands and feet were ſwelled and numb, though not abſolutely ſenſeleſs; he felt a tightneſs at the pit of his ſtomach, and his mouth and lips were parched; but what diſtreſſed him moſt were cramps in the muſcles of his ſides and hips, which were drawn into knots. Though immerſed in the ſea, they were all of them very thirſty; and though expoſed to ſuch ſevere cold, not one of them was drowzy, nor did ſleep precede death in thoſe who periſhed.

Reflecting on the curious facts mentioned in this melancholy narrative, Dr. Currie was led to inſtitute a ſeries of comparative experiments on the effects of immerſion in cold freſh water and ſalt water baths on the human body. The reſults tended to elucidate in ſome meaſure the facts in queſtion; as well as to aſcertain ſome important practical deductions, which may be of uſe to perſons ſuffering under ſimilar accidents; and others, which relate to the general uſe of the cold-bath. Dr. Currie imagined that the death of the two maſters was to be imputed to their poſition on the wreck. Being expoſed to heavy ſhowers of ſleet and ſnow, they might ſuffer from being wet with freſh, rather than ſalt water; the chilling effects of evaporation might operate againſt them, promoted as they muſt have been by the high wind; or they might receive injury from their frequent immerſions in the ſea, producing an *alteration* in the media ſurrounding. The experiments of Dr. Currie ſeem very ſtrongly to corroborate theſe ſuppoſitions.

The immediate effect of plunging into a cold *ſalt water* bath, was a reduction of the temperature of the body, from its natural ſtandard 98° to about 87°; but while the perſon remained in the water, the conſtitution was called on for a greater evolution of heat, and his temperature aroſe gradually to 94° or 95° in the courſe of twelve or fifteen minutes. On emerging, and being expoſed to a north eaſt wind, the temperature again rapidly ſunk, even while attendants were rubbing him with towels, to 87° or 88°. But a warm bath ſoon reſtored the natural heat. After immerſion in a *freſh water* bath, the heat of the body ſunk gradually, and not ſo low; but after being 30 minutes in it, even the hot bath with difficulty reſtored the heat. In two minutes after the perſon, who had been in the freſh water bath, was put into a warm bath at 90°, he fell into a violent ſhiver, and his heat fell two degrees. The bath was then heated to 95° and 96°, but ſtill he felt cold. It was heated to 99°: he continued in it five minutes, and his heat was ſtill one degree lower, than when he quitted the cold bath. The heat was gradually raiſed to 106°, when the ſenſe of coldneſs of which he had complained at the pit of the ſtomach, gradually went off. After immerſion in the cold ſalt water bath, the perſon, who was the ſubject of the experiment, had been uſually kept in the warm bath till his natural heat was nearly recovered; but now after being half an hour in the heat of 106°, his own heat was ſtill 93°. He now became ſick and very languid, a cold ſweat covering his face, his pulſe very quick and feeble. He was removed into bed, but paſſed a feveriſh

feverish night, and next day had wandering pains over his body, with great debility, resembling the beginning stage of a fever. By cordials and rest, this went off. See the experiments related in the Philos. Transactions, vol. lxxxii. for 1792, and the Appendix to Dr. Currie's Medical Reports on the effects of water, &c. vol. i.

The facts just stated clearly point out the greater danger of being wet with *fresh* than with *salt* water: the superior safety of the latter, probably, consists in the stimulus of the saline impregnation upon the skin, which may counteract the debilitating effects of the cold. The practical inferences which Dr. Currie deduced from these facts are extremely important. He observes,

"1. It is, I think, already well known among seamen, that where there is only the choice of being wet with salt or fresh water, it is always safest to prefer the first. In the heavy showers of rain, hail, or snow, by which gales of wind are generally accompanied, the men that must be exposed to them, ought, like Lieutenant Bligh and his crew, to wring their clothes out of salt water.

"2. In all cases where men are reduced to such distress by shipwreck, or otherwise, that they have it only in their power to chuse between keeping the limbs constantly immerged in the sea, or exposing them to the air while it rains or snows, or of being exposed to it, where the sea is at times washing over them, it is safest to prefer a constant immersion; because, in the northern regions, where the cold becomes dangerous to life, the sea is almost always warmer than the air, as the experiments of Sir Charles Douglas show; and because there is not only a danger from the increased cold produced by evaporation, but also from the loss of heat by the rapid changes of the surrounding medium, as the foregoing experiments point out.

"3. Whether, in high and cold winds without rain or snow, and where a situation may be chosen beyond the reach of the waves, it is safer to continue in the air, or to seek refuge in the sea, must depend upon several circumstances, and cannot perhaps be certainly determined. The motives for chusing the sea will be stronger in proportion as the wind is high and cold, and in proportion as the shore is cold."

Some deductions also were obtained from the experiments, which relate to the common use of the cold-bath, and which, as they do not exactly accord with the vulgar opinion on this subject, and may contribute to correct some practical errors in the use of the bath, we shall transcribe.

"The air and the water being equally cold, and both 45° or under, I found the loss of heat in passing from the one to the other, to be regulated in the following way.

"1. If, instead of being exposed naked to the wind, previous to immersion in the water, the body was kept warm by a flannel covering, the mercury fell much less on the first plunge.

"2. If, after plunging in the water, the person continued in it only a minute or two, a subsequent fall of the mercury did not always take place on his emerging into the air. On the contrary, there was sometimes a rise on such occasions in the mercury, especially if the atmosphere was at rest.

"3. In one instance, after continuing in the water fifteen minutes, on rising into the air in a perfect calm, though during a frost, there was little or no seeming diminution of the heat; while exposure under similar circumstances, with a north-east wind blowing sharply, though the air was many degrees warmer, produced a rapid diminution. The effects of the wind in diminishing the human heat are indeed striking, and are not, in my opinion, explained by the common supposition."

Hence we see an obvious necessity, that invalids should not allow themselves to become chilled, before going into the cold-bath, that they should leave it speedily, and not suffer any exposure to a cool wind on emerging; since by such means they not only counteract the beneficial effects of bathing, but even incur considerable danger. See BATH and BATHING.

Hitherto we have attended to the effects of extreme cold, with or without the joint operation of moisture, on the human body, in a state of previous natural temperature. The action of cold in more moderate degrees on the body, heated to a preternatural extent, by exercise, or other causes, affords a subject of not less important consideration: The more important indeed, as the popular notions on this topic are mostly founded in error, and lead to daily practical consequences of very pernicious tendency. So many instances of the noxious effects of exposure to cold, or of drinking cold liquids, when the body was hot, are recorded, and are believed frequently to occur, that a conviction of the fact is universal; and this conviction is corroborated by the popular hypothesis, that the suppression of perspiration is the source of innumerable evils, and that sudden vicissitudes are invariably noxious. On the other hand, however, a number of facts, standing on equally authentic record, tend to contradict this general doctrine, by showing us that rapid and great transitions, as from vapour-baths to rolling in the snow, &c. are constantly made, in some countries, with impunity, and even with advantage to the health. It remained for the genius of Dr. Currie, (a name to which the highest honours of medical science are due,) to reconcile these contradictions, upon philosophical principles, and to give us rational views of practical utility on this subject. However inconsistent with the vulgar notion, the general truth appears to be, "that, from whatever cause the heat of the body is increased, in proportion to this increase (provided no local disease has occurred, and the body is not already in a state in which it is rapidly parting with its heat,) is the safety with which cold may be applied." Medical Reports, p. 104 and 123. 2nd. edit. The numerous apparent exceptions, upon which the popular opinion is founded, will be found not to invalidate this principle, if the circumstances are minutely examined. For it will then be ascertained, that the injuries which persons have suffered from the application of cold under the circumstances in question, did not arise from its agency on them *when hot*, but *when cooling, after having been heated*; when a profuse general perspiration was rapidly carrying off the heat, or when fatigue had exhausted the vigour of the system, and the power of evolving heat; and that, on the contrary, where the sensation of heat was great and steady, the heat itself steadily retained, or kept up by exertion, and the living power not debilitated by fatigue, the application of cold was safe and salutary. A brief detail of some facts will evince the justice of this conclusion.

First, then, we shall find that all the fatal effects of cold, either when internally or externally applied, have occurred in those situations, where the system, after having been much heated and enfeebled by severe exertions, was losing its preternatural heat from profuse perspiration, and, in general, also from the cessation of the exertions by which this heat was originally produced.

Dr. Currie relates one instance of death from drinking cold water under these circumstances, which occurred in his own experience. It was the case of a young man, who had been

been engaged a long time in a moſt ſevere match at fives. After it was over he ſat down on the ground, panting for breath, and covered with profuſe perſpiration. In this ſtate he called to a ſervant to bring him a pitcher of cold water juſt drawn from a pump in ſight. He held it in his hand for ſome minutes, but put it to his head as ſoon as he had recovered his breath, and drank a large quantity at once. He laid his hand on his ſtomach, and bent forwards; his countenance became pale, his breath laborious, and in a few minutes he expired.

We are told by Dr. Ruſh, that few ſummers elapſe, in which there are not inſtances of many perſons among the labouring part of the community, being thus affected in Philadelphia; and he has deſcribed the ſeries of ſymptoms more minutely. In a few minutes, he ſays, after the patient has ſwallowed the water, he is affected by a dimneſs of ſight, he ſtaggers in attempting to walk, and, unleſs ſupported, falls to the ground; he breathes with difficulty; a rattling is heard in the throat; his noſtrils and cheeks expand and contract in every act of reſpiration; his face appears ſuffuſed with blood, and of a livid colour; his extremities become cold, and his pulſe imperceptible: unleſs relief is ſpeedily obtained, the diſorder terminates in death in four or five minutes. Medical Inquiries and Obſervations, vol. i. More frequently patients are ſeized with acute ſpaſms in the breaſt and ſtomach, which are ſo painful as to produce ſyncope, and even aſphyxia.

Many caſes are related by authors, and Dr. Currie has given a detail of ſeveral, from the collection of Shenck, in which the leading circumſtances are nearly the ſame with thoſe of the example above quoted; and many facts have been incidentally recorded by hiſtorians, which alſo agree with it in the eſſential points. In Quintus Curtius, (lib. vii. cap. 5.) an account is given of the march of the army of Alexander the Great in purſuit of Beſſus, through the country of the Sogdiani, which is repreſented as deſtitute of water, ſterile, and covered with ſcorching ſands. The intolerable heat, fatigue, and thirſt of the ſoldiers in their march through this burning deſert, are deſcribed with all the florid eloquence of the hiſtorian. At length, fainting under their toils, they reached the banks of the river Oxus, where, by indulging in large draughts of the ſtream, Alexander loſt a greater number of his troops than in any of his battles. "Sed qui intemperantius hauſerant, intercluſo ſpiritu extincti ſunt; multoque major horum numerus fuit, quam ullo amiſerat prælio." A ſimilar ſtory is related by Appian (De Bellis Civil. lib. v.); and a diſaſter of the ſame kind is recorded to have occurred to the Chriſtian army in the holy wars, (Gulielm. Tyrius, lib. iii. cap. 16.). See Currie's Reports, p. 99. et ſeq. The almoſt fatal effects which enſued to Alexander himſelf, when, after a long and haraſſing march, covered with duſt and ſweat, he plunged into the Cydnus, in the ſight of his army, are to be accounted for in the ſame way. (Quint. Curt. lib. iii. cap. 5.) The heat preternaturally accumulated by exerciſe is held with little tenacity; it is diſſipated by the profuſe perſpirations; and is ſpeedily loſt, when, to theſe perſpirations is added a ſtate of reſt after fatigue. The vital power is then unable to effect any re-action, and a ſlight application of cold exhauſts the heat and the vitality of the ſyſtem.

But, *ſecondly*, experience has demonſtrated that, on the contrary, where the heat is ſteadily retained, as in the early ſtages of exerciſe, before perſpiration has diſſipated it, or fatigue has debilitated the living power; or where it is continued by ſubſequent exertion; cold drink, or the cold bath, are highly ſafe and ſalutary. Hence the Roman youth, in the heat of their exerciſe in the Campus Martius, frequently plunged into the Tiber, not only with impunity, but deriving from it a high enjoyment: and hence the ſafety of the practice of the Ruſſians, of remaining ſome time in a hot bath of from $106\frac{1}{2}°$ to $116°$ of Fahr., then rolling naked in the ſnow, and returning to the warm bath as before. In the celebrated experiments of Dr. Fordyce, ſir Charles Blagden, &c. theſe gentlemen paſſed from a room, heated to upwards of 200°, naked, to the cold air, yet no one received the leaſt injury. The heat of the body and the action of the arterial ſyſtem were here increaſed; but had they continued expoſed naked to the cold air, till the heat ſunk as low as its natural ſtandard, and the heart and arteries ſubſided into their uſual ſtate of action, their ſituation would have been very hazardous.

From the preceding ſtatements then, it is evident, that the application of cold to the body, when heated, is always ſafe, while the heat is kept up by exertion, and while there is ſtill a ſufficient power remaining in the conſtitution of generating heat. Perhaps the ſteadineſs of the ſenſation of warmth, or at leaſt the abſence of chillineſs, is the beſt teſt of this ſafety. Hence the danger of a popular practice, of waiting till a degree of coolneſs has taken place, before quitting a hot room, or before going into a cold bath, is ſufficiently obvious; and the frequent bad conſequences of leaving hot rooms are moſt frequently the effect of this imprudent practice. We doubt whether any perſon ever received an injury from cold, after leaving a heated aſſembly, if he left it while he continued warm, and either by exerciſe in the air, or by a warm covering, kept up that warmth in ſome degree till he reached his home. And with reſpect to the cold bath, every judicious phyſician now recommends all who are delicate and infirm, to uſe ſuch a degree of exerciſe before immerſion, as may produce ſome increaſed action of the veſſels, with ſome increaſe of heat, and thus ſecure a degree of re-action under the ſhock. Thoſe who, being heated and beginning to perſpire, wait on the edge of the bath until they are perfectly cooled, and then plunge into the water, often feel a ſudden chillineſs and ſhivering, which are alarming and dangerous. In ſuch caſes the injury is generally imputed to going into the water too warm, whereas in truth it ariſes from going in too cold. See Currie's Reports, p. 109. Buchan on Sea-Bathing.

Some controverſy has been maintained among phyſicians as to the mode of action of cold on the living body, and ſome apparent inconſiſtency is to be found in the language of writers, when treating on this ſubject. Thus Dr. Cullen mentions the *ſtimulant* operation of cold, as well as the *tonic*, and the contrary, or *ſedative* operation of the ſame agent. This has ariſen from not diſtinguiſhing between the direct and indirect effects of cold. The direct effect of the application of cold, or, ſtrictly ſpeaking, of the abſtraction of heat, is ſimply the abſtraction of a great and general ſtimulus, *viz. heat*; and this is of neceſſity a *ſedative* operation. Hence, by its continuance, all the actions of the ſyſtem, and the functions of life, are enfeebled and ultimately deſtroyed. This, the two late ſyſtematic writers, Brown and Darwin, contend, is the only operation of cold. When again Dr. Cullen ſpeaks of the *ſtimulant* power, he means the *indirect* action of cold, or the conſequences which reſult from the ſubſequent operation of the ordinary temperature of the air, after the cold is withdrawn. Theſe conſequences are attributed by Drs. Brown and Darwin, not to the cold, but to the returning ſtimulus of heat. The diſpute, therefore, is obviouſly little more than verbal. The direct

direct action of cold is *fedative;* the indirect operation is *ftimulant*, or *tonic*; whatever theory we adopt on the fubject.

The mode in which the latter effect is produced, was, indeed, not explained until Dr. Brown's fyftem was promulgated. This acute, but prejudiced theorift, demonftrated this general fact in the animal economy; that whenever any accuftomed ftimulus is greatly reduced, or withdrawn, the living fyftem becomes more acutely fufceptible of ftimulation; fo that a leffer portion of ftimulus, fubfequently applied, will excite an equal action; and the ufual proportion will excite an extraordinary degree of action, or, to ufe the language of Brown, the *excitability* is accumulated during the abftraction of ftimuli. In Dr. Darwin's phrafeology the excitability is called *fenforial power*. Thus, Dr. Brown obferves, "If cold fometimes appears to ftimulate, it produces that effect not as actual cold, but either by diminifhing exceffive heat, and reducing it to its proper ftimulating temperature, or by accumulating the excitability diminifhed by exceffive ftimulus." Elements of Medicine, vol. i. fect. 37. And Dr. Darwin remarks, that, "After any part of the vafcular fyftem of the body has been long expofed to cold, the fenforial power is fo much accumulated in it, that on coming into a warm room the pain of hot-ach is produced, and inflammation and confequent mortification, owing to the greater exertion of thofe veffels, when again expofed to a moderate degree of warmth." Zoonomia, vol. ii. cl. iii. 2. 1. 17, &c. Hence, the glow on the fkin, produced by the increafed action of the cutaneous veffels, on emerging from a cold bath; and hence the face becomes of a red colour in a cold day in turning from the wind. This re-action, however, or increafed excitability of the fyftem, is in proportion to the relative vigour of the conftitution and the degree and period of the action of the cold. In a delicate habit, the vital power is fo fpeedily enfeebled by cold, that it becomes almoft incapable of fubfequent excitement; and languor, debility, palenefs, chillinefs, and fhivering enfue after immerfion in the cold bath; this ftate is fucceeded by a dry and burning heat of the fkin, which terminates in a free perfpiration, conftituting, in fact, the fimpleft form of a febrile paroxyfm.

But although it be admitted, that the action of cold, as merely confifting in the abftraction of the ftimulus of heat, is directly *fedative*, and only indirectly *ftimulant;* yet we muft contend that cold alfo exerts a different agency on the living body, which is directly ftimulant; namely, an agency on the faculty of fenfation. This fenforial power was altogether overlooked by Dr. Brown; but it is not eafy to explain why Dr. Darwin, who underftood the laws of fenfation fo well, fhould have difregarded the influence of cold upon it altogether. The ftimulating action of cold, as Dr. Currie has obferved, though fhort in duration, is powerful in degree. In the torpor of convulfion, when weaker ftimuli are unperceived, the affufion of cold water on the naked body will often excite the dormant fenfibility, and introduce a new action throughout the nervous fyftem. In the apoplectic ftate, brought on by the fumes of charcoal, this remedy is of all others the moft efficacious. In a cafe of afphyxia from this caufe, which was lately detailed to a medical fociety, by an eminent phyfician, it was remarked, that the fprinkling of cold water over the cheft and face produced an effect of ftimulation, and excited motions which were only equalled by powerful fhocks paffed from a Galvanic battery. When dogs are fuffocated in the vapour of the *grotto del cani*, it is well known that they are recovered by plunging them in the adjoining lake. The ftimulating influence of cold water in fyncope, or fainting, is a matter of vulgar obfervation. It is impoffible, therefore, to deny this influence of cold, unlefs, indeed, it fhould be faid that it is not the cold that ftimulates, but the fenfation which the cold produces; a point which it would be a wafte of time to difpute.

Befides the difference in the intenfity of the cold, in the period of its application, in its being accompanied with moifture, or with a current of air and evaporation, and other external circumftances already defcribed, as modifying its operation on the living body; there are many internal circumftances which render the body more liable to be injured by cold, or, on the contrary, enable it to refift the deleterious effects of this agent. Whatever induces debility, efpecially of the circulating fyftem, tends to enfeeble the calorific power, and, therefore, to diminifh the means of refiftance to the action of cold. Hence, long fafting, great fatigue, a previous debauch, excefs in venery, long watching, evacuations, fevere ftudy, with its concomitant, a fedentary life, all contributing to debilitate the body, render it particularly liable to fuffer from expofure to cold. Hence alfo, during fleep, (in which the heat is commonly $1\frac{1}{2}°$ lower than the ftandard of health when awake, according to Mr. Hunter), in a ftate of reft after violent exertion, and during convalefcence from difeafe, when the arterial action is languid and feeble, even flight cold is capable of producing injury, unlefs the internal heat is retained by means of warm cloathing. Injury is likewife more frequently fuftained, when one part of the body is expofed, while the reft are kept more warmly covered than ufual; or where there is a peculiar fenfibility of the conftitution, or of any particular organ of the body.

On the contrary, circumftances of an oppofite nature enable the body to refift the morbid effects of cold. Such are vigour of conftitution, efpecially of the heart and arteries; exercife, by which the action of the latter, and confequently the evolution of caloric, is increafed; and the ufe of cordials, by which the fame action is promoted. The operation of active paffions, or of vigorous attention to certain other objects, weaken the fenfation of cold, and its phyfical action on the body. Thus the aftronomer, intent on the object of his fublime fcience, it is faid, neither feels, nor is injured by, the damps or chillnefs of the night. And in certain ftates of excitement of the brain and nerves, as in fome fpecies of madnefs, cold is refifted in an extraordinary degree. Dr. Currie fays, "I have feen a young woman, once of the greateft delicacy of frame, ftruck with madnefs, lie all night on a cold floor, with hardly the covering that decency requires, when the water was frozen on the table by her, and the milk that fhe was to feed on was a mafs of ice." The influence of habit is alfo great, in enabling the body to refift the effects of cold; and the ufe of the cold bath is hence a powerful prefervative from its injuries. Cullen. Dif. Inaug. de Frigore. 1780.

The means to be adopted for the relief of thofe who have fuffered from the action of cold, will be readily underftood from a confideration of the principles, which have already been ftated. Where a ftate of torpor, or a fufpenfion of the animal functions, has been the confequence of expofure to cold, the principal object is to reftore heat to the body, and to excite the refpiration and circulation; in as much as it has already been fhewn, that the torpor of the nervous fyftem depends upon the imperfect performance of thefe functions. The patient then may be brought into a warm but well-ventilated room, and gently rubbed with warm flannels. His feet and legs may be immerfed in tepid or warm water. The action of the diaphragm and the heart, are moft readily excited by warmth and other ftimuli, applied to the pit of the ftomach. Dr. Currie invariably found in his experiments, that a bladder filled with warm water applied

plied to this part, was the most effectual mode of communicating an equable heat to the body, and removing the shiverings, the sense of chillness, and languors, produced by extreme cold in the bath. And Dr. Kellie remarked, that the good effects of friction with ammonia on the epigastric region were very striking, in exciting the action of respiration, and the motion of the heart. (See Edinburgh Med. and Surg. Journal, N° iv. p. 313.) He observed, too, that the progress of the restoration of the temperature of the body, appeared to keep pace with, and to be regulated more by, the excitement of these functions, than determined by the caloric communicated from without. The application of ammonia, or other stimulants, to the nostrils, is also useful; and as soon as the patient has so far recovered as to be able to swallow, some warm and gently stimulating drink should be given, in small quantities, from time to time.

From the accumulation of excitability, during exposure to cold, and the consequent tendency to violent inflammatory action, on the restoration of heat, it has been recommended to begin the attempt to recover persons under those circumstances, by the application of cold of a less severe degree, as by friction with snow. But the writer just quoted has suggested the propriety of discriminating between a general torpor, and the local affection in a frost-bitten limb. In the latter case, where, notwithstanding the injury done to a part, the general powers of the system remain excitable, heat must be very slowly and gradually communicated, or inflammation, gangrene, and loss of the part ensue. But in the former occurrence there does not appear to be the same danger of violent reaction, or of destroying, by premature stimulation, the accumulated sensibility, where the sensorial functions have been altogether suspended.

When disorder has been produced by drinking large quantities of cold water during profuse perspiration, after violent exercise, two remedies have been found useful; namely, a bladder filled with water heated to 110° or 115° of Fahrenheit, and the tincture of opium; the latter of which is recommended by Dr. Rush, and the combination of the two by Dr. Currie. "I know but one certain remedy for this disease," says Dr. Rush, "and that is *liquid laudanum*. The doses of it, as in other cases of spasm, should be proportioned to the violence of the disease. From a tea-spoonful to near a table-spoonful has been given in some instances before relief has been obtained. Where the powers of life appear to be suddenly suspended, the same remedies should be used which have been so successfully employed in recovering persons supposed to be dead from drowning." Med. Inq. & Obs. vol. i. p. 152.

II. *Of the Effects of Cold in producing different Diseases.*— It is well known, that the application of cold, in very moderate degrees, whether the body were previously of its natural temperature, or had been heated above that point, though incapable of producing the fatal consequences before enumerated, is nevertheless productive of numerous diseases. We have already remarked, that, in a person of a delicate constitution, immersion in cold water so far sinks the calorific powers, as to leave a great chillness, shivering, and languor on emersion, which, by a law of the animal economy not satisfactorily understood, is succeeded by a dry burning heat of the skin, quick pulse, and thirst, constituting a febrile paroxysm, of the simplest form. Now, exposure to cold, especially *after* having been heated, produces, in many persons, a similar febrile state. If it subsides in the space of 24 or 48 hours, it is denominated an *ephemera*, or fever of a day. Most commonly it remains longer, and is accompanied with symptoms of catarrh, with a diminution of the discharge from the skin. This disorder is so common a consequence of such exposure, that it is denominated vulgarly *a cold*. See CATARRH. According to the predisposition of the constitution, however, or the particular exposure or susceptibility of parts, a local inflammatory affection of one part or other, generally accompanies the febrile state. Hence we see the different forms of catarrh; inflammations of the eyes, throat, lungs, bowels, &c.; rheumatism, erysipelas, and other inflammatory diseases.

Since the experiments of Sanctorius attracted the public attention to the discharge of perspirable fluids from the skin, a great importance has been attached to the regularity of this discharge, and all the morbid effects of cold are still attributed by the vulgar to the interruption or suppression of it. This notion is apparently countenanced by the dry state of the skin during the febrile state which ensues; and by the termination of the fever, when a free perspiration again breaks forth. But it is more probable that those complaints arise from the irregularity of the circulation, and the congestion of blood in some parts, and diminution of it in others; the diminution of the distension and action of the vessels of any part being generally followed by an increase of both (by the law of excitability), which, in those cases, amounts to inflammation. Hence the parts most frequently disordered by cold, are those which are most exposed to its action, as the limbs, lungs, and throat; and rheumatism, catarrh, and inflammation of the throat, are the most common diseases: and those internal parts, which are most affected by the diminished circulation of the surface, as the bowels, also suffer considerably; whence dysentery and diarrhœa are frequent consequences of exposure to cold.

In all the attempts which have been made to pass the winter in extremely cold climates, the *scurvy* appears to have been the most fatal disease. It becomes therefore a subject of important inquiry, whether this dreadful malady is caused by the *cold*, or by the diet and other circumstances, and what means are the most effectual in preventing its occurrence. Dr. Aikin has collected together several accounts of such attempts in the first volume of the Memoirs of the Lit. and Philos. Society of Manchester, p. 89, et seq. from which some important inferences relative to these inquiries may be deduced. It is remarkable, that those who were compelled by accident, and without a supply of provisions, to pass the cold season in those inclement regions, were nearly all preserved; while those who were left by design, and with plenty of stores, all perished in the scurvy.

Capt. Monck, a Dane, in 1619, wintered in Hudson's bay, lat. 63° 20′, with the crews of two ships, well provided with necessaries; the crews amounted to sixty-four persons, all of whom, except the captain and two men, perished. In 1633, two trials were made by the Dutch of establishing wintering-places at their northern fisheries; the one at Spitzbergen, the other on the coast of Greenland, in latitudes about 77° or 78°. Seven sailors were left at each place, amply furnished with every article of cloathing, provision, and utensils, which were thought necessary or useful in such a situation. The journals of both companies are preserved, but they were all found dead on the return of the vessels in the spring.

On the other hand, Capt. James, an Englishman, wintered on an island in Hudson's bay, with a crew of twenty-two, of whom only two died. They were all affected with the scurvy, but, weak and sick as they were, compelled to labour hard out of doors, during the greatest inclemency of the season, in building a pinnace. Two other instances, one of eight Englishmen, the other of four Russians, left by accident, and destitute of provision, in Spitzbergen, are recorded,

corded; the whole of the former returned home the enfuing fpring; the latter all furvived fix years on the ifland, when one died, and the three others were refcued.

The *three* principal circumftances which diftinguifh the fatal attempts from thofe which fucceeded, are, that, in the former inftances, the men fed on *falt provifions*, drank *fpirituous liquors*, and lived in *indolence;* whereas the men who furvived the winters, and were but flightly affected by, or altogether efcaped, the fcurvy, fed upon *frefh* animal food, or at leaft preferved *without falt*; they drank *water* only, and ufed much *exercife*. On the value of frefh meat and exercife, as preventives of difeafe, it is unneceffary to comment. With refpect to the ufe of fpirituous liquors, the preceding facts are extremely important and fatisfactory. Thefe pernicious liquors, indeed, are now generally underftood to be prejudicial during fevere and continued cold, although they afford fome fupport againft the temporary effects of cold and moifture. The brief elevation which they produce, is a very fallacious token of their good effects, as it is always fucceeded by the greater depreffion, and therefore tends rather to exhauft, than to invigorate, the principle of vitality.

The popular opinion in regard to the influence of cold on the health, is, in this country, founded altogether in error. During a mild winter, complaints of the unwholefomenefs of the feafon are heard perpetually, and the falubrity of froft is generally extolled. Now the fact is entirely the reverfe, as the experience of every phyfician will evince. Dr. Fothergill fays, "it has been frequently obferved, and, as far as the bills of mortality may be depended on, is demonftrable, that an excefs of wet with moderate warmth, is not fo injurious to our conftitutions as a fevere cold feafon." Obfervations on Weather and Difeafes, Nov. 1751. And again, Dec. 1757, he remarks, "that no weather is in common fo little productive of acute and fatal difeafes, as the warm and the moift, nor any fo dangerous, in thefe refpects, as the oppofite:" this fact is alfo confirmed by Dr. Willan. Reports on Difeafes in London, p. 211. Dr. Heberden has fhewn, that, of the two fucceffive winters of 1794-5, and 1795-6, the former was the coldeft, the latter the warmeft, of which any regular account has been kept in this country, and the comparative mortality was not lefs remarkable than the temperature. "For in five weeks, between the 31ft of December, 1794, and the 3d of February, 1795, the whole number of burials amounted to 2823; and in an equal period of five weeks, between the 30th of December, 1795, and the 2d of February, 1796, it was 1471; fo that the excefs of the mortality in January, 1795, (the cold feafon) above that of January, 1796, (the mild feafon) was not lefs than 1352 perfons; a number fufficient furely to awaken the attention of the moft prejudiced admirer of a frofty winter." Philof. Tranfac. for 1796. The moft remarkable effect of a cold winter is apparent in the difeafes of old people; a mild winter, is, indeed, a year's refpite from death to many of the aged. "It is curious to obferve," fays Dr. Heberden, "among thofe who are faid, in the bills, to die above 60 years of age, how regular the tide of mortality follows the influence of this prevailing caufe; fo that a perfon, ufed to fuch inquiries, may form no contemptible judgment of the feverity of any of our winter months, merely by attending to this circumftance. Thus their number in January, 1796, was not much above one fifth of that in 1795." All the chronic difeafes of this country feem to be hurried on to a premature termination by a cold winter. In fhort, if there be any whofe lungs are tender, any whofe conftitution has been impaired by age, intemperance, or difeafe, he will be liable to have all his complaints increafed, and all his infirmities aggravated by fuch a feafon.

III. *Of the Effects of Cold as a Remedy in certain Difeafes.*—Although the action of cold on the living body, whether by directly reducing the powers of the vafcular, and nervous fyftems, by occafioning great irregularities of the circulation, or by accumulating the excitability, is a prolific fource of difeafes; it is fitted, at the fame time, by thefe powerful qualities, to counteract many of the morbid actions of the conftitution, and to arreft fome of its moft fatal diforders. Hence, from the time of Hippocrates downwards, it has been claffed among the moft active remedies which the art of medicine is poffeffed of, more efpecially in the febrile and inflammatory complaints. The writings of that extraordinary man, as well as thofe of Galen, Celfus, and moft of the celebrated phyficians whofe works have come down to us, contain many fuggeftions, both as to the internal and external application of cold; and a hoft of modern writers have commented on its ufe. In our own country it was propofed as an almoft univerfal remedy by Smith; and Dr. Hancock wrote a treatife on the fubject in the early part of the 18th century, under the title of "Febrifugum Magnum," which excited fome controverfy. But in Spain and Italy the ufe of cold water obtained, about the fame period, a greater and more general reputation, than in any of the other countries of Europe. This treatment was celebrated under the title of "Diæta Aquea." See Dr. Cyrillus's Account of it. Philof. Tranfac. vol. xxxvi.

But although the ufe of cold, as a remedy, is fupported by the fanction of antiquity, and by a feries of fucceeding authorities, it has been recommended, efpecially in febrile diforders, in a vague indifcriminate and empirical manner. It was referved for a medical philofopher of the prefent age, to determine the circumftances which render its employment in fevers fafe and falutary, and to point out the nature of its operation on clear and rational principles. We allude to Dr. Currie of Liverpool, whofe name we have already frequently mentioned. From the ftatement of the facts and principles before laid down, the reader will eafily comprehend the practical rules and cautions which muft be obferved in the application of cold to febrile difeafes.

We have already feen, from many facts and experiments, that wherever the heat of the body is increafed above its natural degree, and is retained fteadily, the action of cold is fafe, pleafant, and falutary. Now in *continued* fevers, the heat is retained in general with a tenacity much greater than when it is the confequence of temporary exertion, or of expofure to heat from without. There is, in the febrile ftate, an inflammatory conftriction of the cutaneous veffels, which tends at once to keep up the febrile action, and to prevent the flow of perfpiration, the great refrigerating procefs of the conftitution. Its fafety, therefore, in the hot ftages of *continued* fever, is decided and complete. But it is, moreover, extremely falutary and remedial in various ways. In the firft place, the fenfation of heat is one of the greateft fources of irritation in fever, and therefore tends to augment and to continue the febrile action, and to prevent the refrefhment of fleep. The operation of cold, by relieving that fenfation, contributes materially to leffen the febrile actions, and to footh the patient to repofe, at a time when all opiates are unable to effect that purpofe, but rather aggravate the reftleffnefs. Secondly, it has been proved by the experiments of Dr. Alexander and Dr. Currie, that a confiderable elevation of the heat of the body, above the ftandard of health, is incompatible with the procefs of perfpiration. Thus at the temperature of 104° or 105° of Fahr. the veffels of the fkin remain obftinately conftricted, the fkin continues dry,

dry, and pungently hot to the touch of the byſtander; and it is only when it is reduced to 99° or 100°, that the orifices of the veſſels relax, and a free perſpiration diminiſhes the heat, and moderates the febrile condition. Hence the obvious abſurdity of attempting to force ſweats, by covering the patient with a load of bedclothes, a practice ſtill unfortunately prevalent among the vulgar and the ignorant, but which all intelligent practitioners have long ago abandoned. In fact, the only means of exciting perſpiration, under ſuch high temperatures, is to *cool* the body to that lower degree at which the veſſels can relax and pour out their fluids. In fevers, therefore, as in health, *when there is no ſenſe of chillineſs preſent, when the heat of the ſurface is ſteadily above what is natural, and when there is no general or profuſe perſpiration*, the free uſe of cold drink, and the affuſion of cold water over the ſkin, are the moſt ſalutary remedies which can be adopted, as ample experience has now unequivocally decided. The conſequences of the waſhing of the body with cold water, or of the uſe of the ſhower-bath, in *typhus* fever, under the circumſtances juſt quoted, are almoſt invariably the following, as we have witneſſed in the London Houſe of Recovery. As ſoon as the patient is returned to bed, a gentle, ſometimes a profuſe, perſpiration breaks out, and a calm and quiet ſleep enſues; the actual heat of the ſurface and the diſtreſſing ſenſation of heat, are greatly diminiſhed, the pulſe becomes much leſs frequent, the tongue cleaner and moiſt, the pains of the head and limbs are alleviated, and the whole febrile condition is relieved, and its courſe rendered milder, and conſiderably abridged. This relief is the more effectual and permanent, in proportion as the remedy is more early reſorted to. When it is employed on or before the third day of the fever, in the form of affuſion, by means of a bucket of water, or the ſhower bath, it ſometimes produces a complete ſolution of the diſeaſe; but after that period, its effect is merely to relieve the ſymptoms, and, eſpecially if repeated when the heat returns, to bring the diſeaſe to a ſpeedy happy termination. In the former caſe, the great operation is attributed to *the ſhock* produced by the ſtrong ſenſation of cold; which, like other violent operations, ſuch as an emetic, a briſk purgative, &c. adminiſtered in the beginning, diſſevers the catenation of ſymptoms, which, by delay, become indiſſoluble by medicine.

Experience has now confirmed the great benefit ariſing from the application of cold water to the ſurface of the body, according to the practical precept before quoted, in typhus fever, whether originating from contagion, or other cauſes; in the ſynochus, or ſub-inflammatory fever of ſummer, in this climate; and alſo in the exanthemata, as in the eruptive fever of ſmall-pox, in which the fever and ſubſequent eruption are rendered extremely mild; and, above all, in the ſcarlet fever, in which the heat of the body riſes higher than in any other febrile diſeaſe of this country. Several remarkable inſtances of the rapid alleviation of this ſevere diſeaſe are related, which occurred in the family of Dr. Gregory, at Edinburgh, and among Dr. Currie's own children. Reports, vol. ii. In the plague, ſeveral accidents have occurred, which render it probable that cold water would be of the higheſt benefit in that terrible diſeaſe. M. Deſgenettes, phyſician to the French army in Egypt, relates that a miner, attacked by the plague, during the expedition into Syria, eſcaped naked, during a violent delirium, from the fort of Cathieth, and wandered nearly three weeks in the deſert. Two buboes, which he had upon him at that time, ſuppurated and healed of themſelves. This man perfectly recovered. An artilleryman alſo, who had two buboes and an anthrax, made his eſcape from the lazaretto of Boulak, on the day of his being admitted, and in a violent delirium precipitated himſelf into the Nile. He was taken up about half an hour afterwards, below Embabeth, by the people of that village; and he afterwards perfectly recovered. Hiſtoire Medicale de l'Armee d'Orient, p. 249. Theſe extraordinary cures correſpond perfectly with a number of ſtriking facts of the ſame kind, all pointing out the powerful inſtinct by which, in the delirium of the plague, as in other burning fevers, the patient is impelled to ſeek the moſt eaſy and obvious modes of relief. "How fruitleſs and how perverted," Dr. Currie remarks on theſe facts, "are the efforts by which learning and ſcience have attempted to combat this fatal diſeaſe! The beſt remedies for the plague were probably miſſed by the phyſicians both of France and England: they were not to be traced in the prevailing ſyſtems of medicine, or in the pharmacy of our ſhops; but it is probable they might have been found, in the refreſhment of the breeze, in the dews of the night, and in the waters of the Nile." The application of cold water to the ſkin, in the yellow fever of the Weſt Indies, has been attended with great benefit. For the evidence on this ſubject the reader may conſult Dr. Currie's ſecond volume of Reports. Dr. Jackſon's Treatiſe on the Fevers of Jamaica. Dr. Chiſholm's Eſſay on the malignant peſtilential Fever of the Weſt Indies. Dr. Stock's Medical Collections on the Effects of Cold, &c. &c.

In *intermittent* fever the preternatural heat is retained more feebly than in continued fever; and, therefore, the uſe of cold muſt be reſorted to with more caution. In the cold fit, when there is not only a ſenſation of great cold, but an actual diminution of the heat, as ſhewn by the thermometer, its application would be extremely deleterious; but experience has ſhewn, that *when the hot ſtage is fully formed*, the affuſion of cold water ſpeedily brings on the ſweating ſtage, and ſhortens the paroxyſm. Dr. Currie has related a caſe of tertian intermittent, of three months ſtanding, which had reſiſted every medicine, but of which only one paroxyſm occurred after the cold affuſion had been uſed, the bark being taken in the interval. Indeed he almoſt always found the cold affuſion produce an immediate ſolution of the fit; but, in general, if no remedy were uſed in the intermiſſion, the fever returned at its uſual period. In ſome inſtances, however, the ſucceeding paroxyſm was prevented by uſing the cold affuſion about an hour previous to its expected return; and the diſeaſe ultimately removed by continuing this practice through four or five of the following periods. But the uſe of the cold affuſion in the abſence of this fever, requires a conſtitution in a great meaſure unbroken, to render it ſafe.

In recommending the application of cold water to the ſkin as a remedy in fevers, an expreſs exception is made againſt it, during the feveriſh chill, or after the perſpiration has begun to flow profuſely, and more eſpecially after it has continued to flow profuſely, for ſome time. An exception is alſo made againſt its being employed in the latter end of fever, when the ſtrength is much exhauſted, and the heat is ſometimes as low or lower than the temperature of health. We ſpeak at preſent of fevers unaccompanied by any viſceral inflammation. The only caution, then, which is requiſite is, *that the heat of the body be ſteadily above the natural degree, and that there be no chillineſs on the one hand, nor profuſe perſpiration on the other.* Theſe obſervations apply equally to the uſe of cold drink, as to the external application of cold water.

If the aſperſion of cold water on the ſurface of the body be uſed during the cold ſtage of the paroxyſm of fever, the reſpiration is nearly ſuſpended; the pulſe becomes fluttering, feeble, and of an incalculable frequency; the ſurface and the extremities become doubly cold and ſhrivelled, and the patient ſeems to ſtruggle with the pangs of inſtant diſſolution. Conſequences, not leſs alarming, enſue, if the cold is applied during

during profuse perspiration, when the heat is rapidly sinking; and the application is sometimes equally hazardous, when the heat, measured by the thermometer, is less than, or only equal to, the natural heat, though the patient should feel no degree of chilliness. This is especially the case towards the last stages of fever, when the powers of life are too weak to sustain so powerful a shock. When these alarming symptoms have been produced by accident or inadvertence on the part of the attendants, frictions on the surface, and particularly on the extremities, should be employed; a bladder filled with warm water, of the heat of 110° or 120°, should be applied to the pit of the stomach; and cordials cautiously administered in small quantities.

With respect to the modes in which external cold may be applied to the body, it may be observed, that circumstances will determine the eligibility of each. In the commencement of fever, where the object is to cut-short the disease, by the shock of the sensation of cold, as well as by the sudden abstraction of the stimulus of heat, the *cold affusion* is to be preferred. This is performed by throwing a bucket full of water over the naked body of the patient; the shower-bath is also a convenient mode of affusion. But where the simple cooling of the body is the object of the practice, the skin may be washed with cold water alone, or with a mixture of vinegar, or common salt, by means of a sponge. This mode seems preferable in all cases in which great re-action of the system would be detrimental; as it may be regulated according to the heat, and the state of the sensations of the patient, so as to avoid, in a considerable degree, the flush of heat which ensues, after a momentary cold. The affusion of *tepid* water, *i. e.* of the heat of 87° to 97° of Fahrenheit, may be advantageously used with the same view. "The tepid affusion," Dr. Currie remarks, "is little, if at all, stimulating; and does not, like the cold affusion, rouse the system to those actions by which heat is evolved, and the effects of external cold are resisted. Where the object is to diminish heat, that may be obtained with great certainty by the repeated use of the tepid affusion, suffering the surface of the body to be exposed in the interval to the external air; and if the beams of the sun are excluded, and a stream of wind blows over it, the heat may be thus reduced where cold water cannot be procured; even in the warmest regions of the earth; on the plains of Bengal, or the sands of Arabia. I have accordingly employed the tepid affusion very generally in those feverish affections, where the morbid actions are weakly catenated, depending rather on the stimulus of preternatural heat, than on contagion, miasmata, the morbid contents of the stomach and bowels, or local inflammatory affection. Of this kind are a great part of the feverish affections of children, in which the tepid affusion is a valuable remedy. It very generally produces a considerable diminution of heat, a diminished frequency of the pulse and respiration, and a tendency to repose and sleep. I have used it also in feverish disorders of various kinds where the lungs are oppressed, and the respiration laborious, and where, of course, the oppression might be dangerously augmented by the sudden stimulus of the cold affusion. It is also applicable to every case of fever in which the cold affusion is recommended, and those may receive much benefit from it, whose fears or whose feebleness deter them from that energetic remedy." Vol. i. p. 69.

It remains to be determined by experience, to what extent the application of cold water to the surface of the body may be advantageously employed, where there is active inflammation in any of the more important organs, as in the lungs, liver, &c. Dr. Currie has collected abundant evidence, from his correspondents, of the safety of cold affusion in typhus fever, when accompanied with a cough, and other catarrhal symptoms. We have used the shower-bath, under such circumstances, in several cases; as well as in fever, combined with inflammation of the tonsils, and with dysenteric affection of the bowels, not only with impunity, but with relief, as well to the febrile as to the inflammatory symptoms.

In all cases of active inflammation, to which topical remedies can be applied, the application of cold is, next to the detraction of blood, the most powerful remedy. In these instances, as the object is simply the diminution of heat, the application of cold must not be sudden and temporary, but considerable in degree, and permanent in duration, so as to prevent any local re-action. Hence the success with which ice and snow, and the clay cap, are applied to the head and other parts, for the purpose of preventing or reducing inflammation. The saturnine and other lotions, which are employed in inflammation of the eyes, &c. seem to owe their powers principally to their cold temperature; and many of the popular remedies in such complaints are useful on this principle only.

In rheumatism, and even gout, the application of cold has, in all ages, been freely recommended by many practitioners. Hippocrates and Celsus employed it largely; and in modern times its benefits have not been overlooked. Dr. Heberden informs us, that "the great Dr. Harvey, upon the first approach of gouty pains in his foot, would instantly put them off by plunging his leg into a pail of cold water." This practice is now recommended by Dr. Kinglake, as invariably safe, and speedily curative; and we doubt not, that, in a majority of cases, where the constitution remains unbroken, and the gouty inflammation is active, such will be the event. We have yet to learn, however, under what circumstances the danger of repulsion, which is perhaps not altogether imaginary, occurs. In the more local attacks of acute rheumatism, or what is commonly called rheumatic-gout, we have seen the application of cold water to the inflamed joints very beneficial.

In the commencement of the painful inflammation produced by fire, whether by burning or scalding, the free use of cold is rapidly beneficial, in relieving the pain, and removing the inflammatory symptoms. A slight burn or scald, if the part be plunged into cold water, and detained there, or on the frequent repetition of the immersion, is frequently cured in a short space of time. The following striking fact is related in the New York Medical Repository, vol. i. p. 538. "Two brothers, apprentices to a hatter, were employed in taking hats from a boiler, and rinsing them out in a very large tub of cold water. Some dispute arising, one of them lifted the other in his arms, and seated him directly in the boiler; but being instantly struck with terror at what he had done; without loosing his hold, he again lifted him from the boiler, and seated him in the tub of cold water. The youth, who had been thus hurried through these extremes of temperature, had on a pair of wide trowsers, and received no other injury, than a narrow blister, which was formed directly under the waistband, and encircled his body."

There is another important class of diseases, in which, as well as in febrile and inflammatory complaints, the application of cold is one of the most active remedies that we possess; namely, *spasmodic*, or *convulsive* diseases. In these, however, the object is not, as in the former, the sedative operation of abstracting heat, and thus diminishing vascular action; it is the *stimulant* effect of cold, the strong impression on the sensations, by which the morbid catenations are dissevered, of which we avail ourselves in treating spasmodic diseases. It is, therefore, only the affusion of cold water, or the sudden immersion in the cold bath, which is serviceable in these maladies; and the chief benefit derived from the application

 of

of cold in these cases, "depends on its being used in the *paroxysm of convulsion*; its efficacy consists in resolving or abating the paroxysm; and when this effect is produced, the return of the paroxysm is greatly retarded, if not entirely prevented." Currie, Reports p. 133. In spasmodic diseases, which do not arise to general convulsion, the cold bath is of little efficacy.

The cold bath and cold affusion have been employed for the cure of convulsive disorders from very early times; there was a great difference of opinion, however, among the ancients as to their good effects. Hippocrates recommends the use of them, and Galen supports the same doctrine; while Paul Œgineta and others assert the insufficiency, and even danger, of these expedients. The continental writers of the last two centuries have detailed numerous instances of their good effects. In that terrible disease, the tetanus, the cold affusion appears to be the most effectual remedy, which has hitherto been adopted. Hippocrates recommends that a quantity of cold water should be poured over the patient in the convulsions of tetanus, with a view of exciting a febrile re-action; as he had observed (Aphorism. 57. sect. 4.) that a fever, supervening on a spasm or tetanus, removes the disease. He adds a caution to this advice, that the practice must not be used, except in summer; nor unless the patient be young, and of a full habit of body, and the disease do not originate from a wound. Aph. 21. sect. 5. In the West Indies, where this disease is of frequent occurrence, the affusion of cold water is said by Dr. Moseley, to have been found by far the most efficacious remedy, during the last fifty years. (Treatise on Tropical diseases. p. 491.) Dr. Currie has related several cases in which it was successful, even though the disease was the consequence of a wound; in which case, it appears that the father of physic relinquished the convulsions to nature, as incurable. Dr. Wright, who first employed the cold affusion in fever, used it also with success in tetanus. And the writer of this article has witnessed one case, which, although originating from a wound in the heel, made by an axe, was successfully treated by the cold affusion, combined with free doses of opium.

"In the *hysteric* paroxysm," Dr. Currie affirms, "the cold bath, or indeed the plentiful affusion of cold water, is an infallible remedy. Those who suppose that the terror it occasions ought, in this case, to prevent our having recourse to it, are, in my opinion, mistaken. Though the hysteric paroxysm be the offspring of passion, it is never occasioned, I will venture to assert, by the passion of fear. A sense of danger will always, I believe, prevent it; or indeed a powerful dread of any kind. I have known a tub of cold water kept in readiness, with the certainty of being plunged into it on the recurrence of the paroxysm, cure this disease, without the remedy being ever actually tried. I know the hysteric paroxysm often takes place when *danger is over*, but that is another case."

In the spasmodic affection of the bowels, which constitutes *colic*, the application of cold, especially to the lower extremities, has been frequently efficacious in dissolving the spasms, and procuring evacuations. A case of obstinate constipation, which continued in spite of all the medicines, that were devised for its relief, and in which there was also extreme pain, and considerable fever, was at length completely removed by dashing cold water on the extremities, up as high as the pubes, and plunging the feet in warm water. See Edin. Med. Essays, vol. v. p. 890. Similar cases are also recorded in the Medical Transactions of the London College, vol. iii.

By the same expedient spasmodic strictures of the neck of the bladder, have been frequently removed. It is a very common practice to place children, when afflicted with a temporary suppression of urine, with their naked feet on a cold stone, or marble hearth; and in general this plan at once removes the obstruction, and causes the urine to flow. The case of an adult (a gentleman of Bristol) is related by Dr. Currie; he was instantly relieved of an obstinate stricture of the neck of the bladder, of thirty hours duration, during all which time not a drop of water had passed, by placing his feet on a marble slab, and dashing cold water over the legs and thighs; the effect was instantaneous. The urine burst from him in a full stream, and the stricture was permanently removed. The common remedies, particularly opium and bleeding, and each of them very largely, had previously been tried in vain. Reports, p. 138.

The effect of the stimulus of the sudden sensation of cold, in the state of suspended animation, occasioned by the fumes of charcoal, has been already mentioned. In the experiments made for the gratification of travellers, who visit the *grotto del cani*, the dogs that are rendered apparently lifeless from the carbonic gas, are speedily recovered on being plunged into the adjoining lake. Several experiments on other animals, in which the same phenomena were observed from the application of ice and cold water, after suffocation by carbonic acid gas, are related by Dr. Stock. See his Med. Collections before quoted, p. 120. et seq. The good effects of the same stimulus are universally known, in common cases of fainting, or syncope, from which the patient is speedily roused by sprinkling cold water on the face. The stimulating effects of this application, were, indeed, in one case of asphyxia, to which we before alluded, not less obvious than those occasioned by the Galvanic fluid.

We shall content ourselves with merely mentioning other instances of disease, in which the application of cold is of considerable value as a remedy. Such are the active hæmorrhagies; phrensy or inflammation of the brain; the early stage of the acute hydrocephalus, and of the torpor from drunkenness; and the paroxysms of acute mania. In all these maladies the cold should be applied steadily, near the parts affected, the object being to diminish the action of the vessels in those parts by abstracting the stimulus of heat. There are other diseases also, in which the sudden and temporary application of cold, in the form of the cold-bath, is efficacious, by gradually strengthening the constitution; such are scrofula; the rickets of children; and some cutaneous disorders. The same expedient is also beneficial as a preventive of several diseases, especially those which arise from exposure to cold and moisture, such as catarrh, rheumatism, inflammatory sore throat, &c. by inuring the system to the action of cold, and thus fortifying it against its deleterious effects.

COLD, the popular term for catarrh, which is the most frequent disease occasioned by the action of cold. See CATARRH.

COLD is also a disease to which horses are subject; this is usually occasioned by want of regular exercise, by overheating them in riding, and suffering them to cool too fast, or neglect of rubbing them down when they come in hot after journeys. The signs of a cold are a cough, heaviness, watery eyes, kernels about the ears and under the jaws, gleets of the nose, and rattles, in breathing, &c. Bleedings, hot mashes of bran and water, and moderate exercise will, in most cases, be an effectual remedy. To these may be added balls consisting of warm opening ingredients; Dr. Bracken prescribes the following; take anniseed, carraway seed, and greater cardamoms, finely powdered, of each one ounce, two ounces of flower of brimstone, one ounce and a half of turmeric in fine powder, two drams of saffron, two ounces of Spanish juice dissolved in water, half an ounce of oil of anniseed, one ounce and a half

half of liquorice powder, and a fufficient quantity of wheat flour; let thefe ingredients be well beat in a mortar and made into a ftiff pafte; and given in fmall quantities about the fize of a pullet's egg. See COUGH.

COLD *Fit*, in *Medicine*, the firft ftage of a paroxyfm of fever, in which there is not only a fenfation of cold, but a pale and contracted fkin, and generally a diminution of the actual heat, as meafured by the thermometer. The cold ftage is moft fevere and obvious in intermittent fevers, in which it is accompanied with great fhivering, and even fhaking of the whole body, and clattering of the teeth: it is denominated by the vulgar, the *ague*, in contradiftinction to the fucceeding hot and fweating ftages, which are called the *fever*. See FEVER and AGUE.

COLD-*Bath*. See BATH, and BATHING.

COLD, *Artificial*. See FEEEZING, or THERMOMETER.

COLD *Diamargariton*. See DIAMARGARITON.

COLD *Diatragacanth*. See DIATRAGACANTH.

COLD *Diftillations*. See DISTILLATION.

COLD *Fufion*. See FUSION.

COLD *charge*, in *Farriery*, a medicine confifting of vinegar, bole, and whites of eggs, mixed to the confiftence of a poultice, and fpread over the injured part for the cure of ftrains, &c.

COLD-*finch*, in *Ornithology*, the name of a fmall bird occafionally obferved in England, and better known by the appellation of pied-fly-catcher. It is the *mufcicapa atricapilla* of Linnæus. See ATRICAPILLA.

COLD-*Afton*, in *Geography*, a vicarage in Gloucefterfhire in the hundred of Puckle-Church; the fituation of its church fteeple was determined in the "Government Trigonometrical Survey," in 1797, by obfervations from Lanfdown ftation, diftant 13,563 feet, and from Farley Down ftation, diftant 24,120 feet, and bearing 33° 43′ 21″ S.E. from the parallel to the meridian of Black-Down; whence was deduced its latitude 51° 26′ 54″.8 N. and its longitude 2° 20′ 44″.4, or 9m 24s.9 W. of Greenwich.

COLD, *Cape*, a cape at the north end of Charles ifland, on the coaft of Eaft Greenland. N. lat. 79° 6′. E. long. 10° 57′.

COLD *Spring Cove*, is fituated near Burlington, New Jerfey, America, and is remarkable for its fand and clay, ufed in the manufacture of glafs; from whence the glafsworks at Hamilton, 10 miles weft of Albany, are fupplied with thefe articles.

COLDDITZ, a town of Germany, in the circle of Upper Saxony, and circle of Leipfick; 21 miles S.E. of Leipfick, and 36 W. of Drefden.

COLDENIA, in *Botany*, (fo named by Linnæus, in honour of C. Colden, a North American botanift, who fent feveral new plants to Europe, which are defcribed in the Upfal acts for 1743.) Linn. Gen. 173. Schreb. 233. Willd. 268. Gært. 424. Juff 130. Clafs and order, *tetrandria tetragynia*. Nat. Ord. *Afperifoliæ*, Linn. *Borragineæ*, Juff.

Gen. Ch. *Cal.* Perianth, four-leaved (four-cleft, Gært.); leaves lanceolate, erect, rough with hairs. *Cor.* monopetalous, funnel-fhaped, the length of the calyx; mouth not clofed; border four-cleft, fpreading, obtufe. *Stam.* Filaments four, inferted into the tube; anthers roundifh. *Pift.* Germs four, fuperior, egg-fhaped, connate in pairs, each ending in a filiform permanent ftyle; ftigmas fimple. (Style one; ftigma bifid; Gært.) *Peric.* none. *Fruit* egg-fhaped, compreffed, fcabrous, acuminate, terminated by four beaks; Linn. (Fruit four-capfular, fcabrous, four-beaked; capfules approximating, one-feeded; Juff. *Seeds* two, two-celled, mucronate at their fummit, echinate with fhort hairs, flattened on the fide where they join, two-lobed on the outfide, forming together four regular lobes, ending in a point compofed of four upright ftyles clofe to each other; Lam. Nuts four, fmall, enclofed in a rind, united into a rounded, tetragonal, mucronate fruit; rind fungous, very thick on the back of the nuts, becoming gradually thinner, and almoft membranous on the fides; fhells bony, hard, convex, and rounded on one fide, compreffed into an acute angle on the other, one-celled; Gært.)

Eff. Ch. Calyx four-leaved. Corolla funnel-fhaped. Styles four. Seeds two, two-celled.

Sp. C. *procumbens*. Linn. Sp. Pl. Mart. Lam. Willd. Gært. tab. 68. (Teucrii facie bifnagarica tetracoccos roftrata; Pluk. Alm. tab. 64. fig. 6. Morif. Hift. 3. 423. n. 22.) *Root* annual. *Stems* trailing on the ground, a foot long, cylindrical, branched, rough with white hairs. *Leaves* alternate, egg-fhaped, rounded at their fummit, nearly feffile, deeply crenated, plaited at the ferratures, unequal at the bafe, cloathed with white hairs except in the plaits. *Flowers* pale blue, fmall, axillary, feffile. A native of the Eaft Indies. It is propagated by feeds, fown in a hot-bed in the fpring. When the plants are fit to remove, they fhould be put into feparate pots, plunged into a hot-bed of tanners' bark, and kept in the fhade till they have taken frefh root; after which they fhould have frefh air, according to the warmth of the weather, and be fparingly watered two or three times a week. They muft remain in the hot-bed, where they will flower in June, and ripen their feeds in September.

COLD-HARBOUR, in *Geography*, a houfe on the north bank of the Thames, oppofite to the town of Earith in Kent, the fituation of which was determined in the "Government Trigonometrical Survey," about the year 1798, by obfervations from Rainham fteeple, diftant 11,090 feet, and bearing 3° 1′ 31″ N.E. from the parallel to the meridian of Greenwich; and from the ftation on Purfleet Cliff, diftant 10,971 feet, and bearing 81° 1′ 59″ S.E. from the fame parallel; whence is deduced its latitude 51° 29′ 16″.5 N. and longitude 0° 11′ 19″.3 E. of Greenwich.

COLDING, or KOLDING, a town of Denmark, in the diocefe of Ripen, fituated between mountains, on the river Thueths, which runs into the Little Belt about a league below. It is an ancient town, and was formerly the refidence of many Danifh kings, who adorned it with feveral edifices. The harbour is now filled up, and its commerce almoft annihilated; 24 miles N.E. of Ripen. N. lat. 55° [illegible]′. E. long. 9° 23′.

COLDINGHAM, a town and parifh in the county of Berwick, Scotland. The town is fituated about a mile from the fea, in a reclufe vale, watered by two rivulets, which flow on either fide of it. The monaftery at Coldingham is faid to have been burnt previous to the confecration of St. Cuthbert, or about 685, and was rebuilt, according to lord Hailes, by king Edgar in 1098, who affifted at its dedication, after which it became one of the moft important in this eaftern portion of the kingdom. The diffolution of the monaftery, or fome other caufe, appears to have injured and diminifhed the town confiderably, but it has recently exhibited indications of renovation, and the inhabitants rapidly increafe. The parifh is fertile with the exception of about 600 acres, which are totally incapable of cultivation, and the peats found in the diftrict are not fufficiently folid for fuel; but the hills are not generally fo fteep as to prevent the ufe of the plough, though St. Abb's head is in the vicinity, and the coaft, compofed of crags, is confidered dangerous to the mariner. The banks of the river Eye, which flows through the parifh, are fringed with wood, and Coldingham loch, a mile weft of St. Abb's head, is a beautiful

beautiful ſheet of water of conſiderable depth, and about a mile in circumference. There are ſeveral hamlets within the pariſh, inhabited principally by farmers and weavers, and the ruins of a church are ſtill viſible on St. Abb's head. Faſt-caſtle in this neighbourhood, is entirely ſurrounded by the ſea, and muſt have been almoſt impregnable before the invention of cannon. Population in 1791, 2391.

COLDITZ, a town of Germany, in the circle of Upper Saxony, and margraviate of Meiſſen, ſituated on the Mulda; 10 miles S.E. of Leipſick.

COLDSHIRE *Iron*, ſuch as is brittle when it is cold; ſee IRON.

COLDSTREAM, in *Geography*, a town ſituated on the north ſide of the river Tweed, in the county of Berwick, Scotland, ſeems to have owed its origin to an abbey of Ciſtertain monks which ſtood within the pariſh of the ſame name. General Monk has contributed to immortalize the place, from having raiſed a regiment here, which he named the Coldſtream, previous to his victorious exertions in favour of Charles II. Since that period a portion of the royal guards have borne the title, which has never yet been ſullied, or diſhonoured; probably this is the moſt important epoch in the annals of Coldſtream. There are ſeveral tumuli in the pariſh, that are ſuppoſed to contain the remains of Chieftains ſlain in remote border wars. The roads from London to Berwick, and from the latter to Kelſo, and Dunſe to England, paſs through Coldſtream, which is admirably ſituated for manufactures, as coals are reaſonable in price, wool plentiful and excellent, and the banks of the Tweed produce great crops of corn, and feed numerous herds of cattle; yet, with all theſe advantages, and a neat bridge facilitating communication between the two kingdoms, no conſiderable trade is carried on.

The pariſh borders on the Tweed for ſeven or eight miles in length, and is about four in breadth; the ſoil on the above river is light, but inclines to clay at ſome diſtance from it, and a ſingular ſlip of barren land, termed the *Muir-Land*, divides the pariſh from eaſt to weſt. Shell and rock marle, free-ſtone, and coals, are found in abundance, and yet the latter is much neglected. Several plantations have lately been ſet to ſupply the deficiency of native trees. The principal ſeats in the pariſh are Hirſel, the reſidence of the earl of Home, who has erected two ſuperb obeliſks to the memory of his ſon, lord Dunglaſs, ſlain in the American war, and Kersfield, the manſion of Mr. Moriſon. Population of the diſtrict in 1793, 2193.

COLD-WATER, a lake of North America. N. lat. 54° 56'. W. long. 111°.

COLE, WILLIAM, in *Biography*, the moſt famous botaniſt of his time, was born at Adderbury in Oxfordſhire, in 1626, and after the uſual elementary learning he went to Merton College, Oxford, where he completed his education. He ſettled at Putney, a village near London, and publiſhed a work intitled "The Art of Simpling, or an Introduction to the Knowledge of gathering Plants," &c. and another intitled "Adam in Eden, or Nature's Paradiſe, containing a Hiſtory of Plants," &c. Upon the reſtoration of Charles II., he was appointed ſecretary to Dr. Duppa, biſhop of Wincheſter, but died in the year 1662, at the early age of 36.

COLE, WILLIAM, a learned and ingenious phyſician, who diſtinguiſhed himſelf by various publications on phyſiology, and on the practice of medicine; received his education at Oxford, where he took his degree of doctor in the year 1666. He ſoon after ſettled at Briſtol, and having acquired celebrity there, he removed to London. He had the merit of being an early convert to the opinion of the excellence of the Peruvian bark, which he preſcribed liberally and with ſucceſs in hyſterical affections, as well as in intermittents. His works abound too much with theory. Fever he ſuppoſed to be occaſioned by a depravation of the nervous fluid. His works are, "De Secretione Animali, cogitata," Oxon. 1677, 8vo. The ſecretions receive their qualities from the ſtructure of the glands, by which they are ſeparated from the blood. "An Eſſay concerning the late frequency of Apoplexies," Oxford 1689. His new hypotheſis as to the cauſe of fever, firſt publiſhed in 1694, was ſeveral times reprinted, "Conſilium ætiologicum de caſu quodam Epileptico." He recommends the miſletoe, by which he pretends to have cured the complaint. The patient, who deſcribes his caſe, ſays he was much relieved. He wrote alſo on inſenſible perſpiration, and was author of ſeveral diſſertations which were publiſhed in the "Philoſophical Tranſactions" of that time. Haller Bib. Med. Eloy. Dict. Hiſt.

COLE, in *Agriculture*, the name of a plant of the cabbage kind, which is cultivated both on account of its ſeed, and for feeding cattle and ſheep. The ſeed, by preſſure in mills contrived for the purpoſe, affords a valuable oil, and the refuſe, or cake, is uſed as a manure.

It has ſometimes the name of *rape*. Martyn, in his edition of Miller's Dictionary, ſeems to conſider cole (*braſſica napus*) as the wild plant; and rape (*napus ſativa*) as a garden or cultivated variety; but obſerves, that "the ſpecific diſtinctions are very inſufficient,"

A late writer on huſbandry remarks, that "as to the difference between cole and rape, it is hardly poſſible to diſtinguiſh them in the ſeed, but when in plants you may eaſily tell one from the other. Cole is generally intended to be eaten by ſheep, and rape to ſtand for ſeed to be manufactured into oil, which is uſed in large quantities by clothiers, and other tradeſmen, and likewiſe in phyſic. Cole is alſo often ſown for the purpoſe of ſtanding for ſeed, from which oil is made. Cole grows to a greater height when in leaf than rape, and the ſtalks are ſo ſoft and pulpy, that ſheep can eat them very near the bottom. Rape is of a hardier nature, fitter to ſtand the winter; the ſtalks are rigid, grow buſhy, and branch much; and when ſpring approaches they ſpread and yield more ſeed than cole. Theſe two ſeeds are in general, he thinks he may ſay always, intermixed; it would, therefore, be well worth while for a grower to collect with care, out of a crop, the different ſeeds, and to ſort them properly, for cole is the beſt for feeding ſheep, and rape for the purpoſe of making oil."

It is a plant which has been found to thrive in the beſt and moſt perfect manner in deep, rich, dry, friable, and kindly ſoils; but which, with plenty of manure, and deep ploughing, may be grown in moſt others. And it has been ſtated by Mr. Young, in his calendar of huſbandry, that upon fen, and peat ſoils and bogs, as well as black peaty low grounds, it thrives aſtoniſhingly, but more eſpecially when the land has been pared and burnt, which is the beſt ſort of preparation for it. But the author of the "New Farmer's Calendar," thinks that it is a plant which is not perhaps worth attention on any but rich and deep ſoils; for inſtance, thoſe luxuriant ſlips that are found by the ſea ſide, fens, or newly broken up grounds, where vaſt crops of it may be raiſed; hence it is, he ſuppoſes, we have heard ſuch different accounts of its produce and uſe.

It has been ſuggeſted by the author of "Practical Agriculture," that when grown on lands that have been long in tillage, the friable, loamy kinds are found to anſwer the beſt; but that it may be grown with perfect ſucceſs on the fenny, marſhy, and other coarſe waſte lands, that have been long in the ſtate of graſs, after being broken up and reduced into a proper ſtate of preparation. As a firſt crop, on ſuch defcriptions of lands, it is often the beft that can be employed. When fown on old tillage lands, the method of preparation is pretty much the fame as that which has been given for the common turnips; the land being ploughed over four or five times, according to the condition it may be in, a fine ftate of pulverization or tilth being requifite for the perfect growth of the crop. In this view, the firft ploughing is moftly given in the autumn, in order that the foil may lie expofed to the influence of the atmofphere, till the early part of the fpring, when it fhould again be turned over twice, at proper diftances of time from each other; and towards the beginning and middle of June, one or two additional ploughings fhould be performed upon it, in order that it may be in a fine mellow condition for the reception of the feed. But if the feed be intended to be put in upon lands that are newly broken up from the ftate of fward, they muft, fays he, be rendered perfectly clean, and in a fufficiently fine ftate of mould for the reception of the feed, either by frequent ploughing in the common way, and afterwards harrowing the furface well by light fhort-tined harrows, or by having recourfe to the practice of paring and burning. The laft is by much the moft effectual, cheap, and advantageous method, where the furface contains a large quantity of coarfe graffy matter, as it can fcarcely be reduced by any other means, without much time and trouble. This is the fort of preparation that is generally employed when the crop is intended to ftand for feed. Further, that where it is fown on the firft fort of preparation, it is the beft practice for it to fucceed wheat or barley crops. When the former, barley and oats, with grafs feeds, may be put in after it, but if the latter, it may be fucceeded to the greateft advantage by wheat, as it is found to be not only an excellent preparation for that fort of grain, but to afford it of the fineft quality; and by its being taken off early, there is fufficient time allowed for getting the land in order for the wheat crop. That where the tillage land is not in a good ftate of fertility, manure of the fame kind, and in the fame proportion as for turnips, fhould be applied, and turned in with the laft ploughing for the feed.

It is ftated in the "Effex Report on Agriculture," that cole feed is ufually prepared for by as full and complete a fallow as turnips, and no lefs quantity of manure. This, however, chiefly refpects arable land long cultivated; but newly broken up ground, efpecially, is found generally moft congenial to this feed, and vaftly the moft productive. The writer faw a ftriking inftance of this. "A fine field, as to quality of foil, was fown broad-caft with cole feed. The greater part of it had been arable time immemorial, the remainder recently broken up. The produce of the former was only between three and four quarters an acre, the latter upwards of five."

It is found in the raifing of this fort of crop, fuch feed as has been perfectly ripened, is quite frefh, and has a fine black colour, is to be preferred, as vegetating in the moft perfect and expeditious manner.

The quantity or proportion of feed that is made ufe of is, in general, from a quarter to half a peck, according to the manner of fowing that may be practifed. Where the crop is intended to be confumed as a green food for cattle, a larger proportion of feed may, however, be neceffary than where the obtaining of feed is the chief object of the cultivator. Two quarts an acre have been mentioned by Mr. Young, but fome, he fays, fow three, and he has heard of a gallon being fown.

In the Effex Survey it is fuggefted, that "from three to four pints per acre fhould be fown if intended to ftand for feed; but if defigned merely for autumn, winter, or fpring feed, more may be requifite, and even five or fix pints may not be too much."

The methods of fowing are different in different cafes; but the moft common practice is that of broad-cafting, or difperfing it in as regular a manner as poffible over the furface of the ground by the hand, covering it by means of a bufh, or other light harrow. Inftead of this it is, however, fometimes ploughed in, when cultivated on the more light and open kinds of foils, a large proportion of feed being allowed, and the furrows made narrow, with but little depth. In cafes of this fort, this has been fuggefted by Mr. Kent as preferable to the former mode.

But the drill method has alfo been practifed, the feed being depofited, to the depth of one inch, in rows; on every other land twelve inches afunder. The fuperiority of this mode, over that of the broad-caft, appears, according to Mr. Amos. to be confiderable, as the land is capable of being kept clean with lefs difficulty and expence than in the other modes.

The author of the "Experienced Farmer," fays, that "rape ought to be drilled in the fame manner as peas and turnips, with the manure in the drills; and, like peas and turnips, fhould be cleaned in the fpring by the plough. If this is properly done, it will, he thinks, make the land equal to the beft fallow in the kingdom. The falling of the leaves, and the fmothering of the crop, will keep it in quite a mellow ftate; and if the ftraw and roots are immediately cleaned off, the ground fcarified, and a fufficient quantity of feed fown, there will be a crop of rape, to be eaten by fheep, between the time of reaping the rape and of fowing wheat. This, inftead of impoverifhing, would improve the land in a very high degree, and intermix the manure in the beft manner poffible." Rape has two years rent to pay, and cannot turn out a very profitable crop, without fome management of this fort, but, by the method here recommended, you get a crop and a half in two years."

It has been fuggefted by Mr. Marfhall, as a defirable method, to fow the feed in beds, for the purpofe of being afterwards tranfplanted into the field, and fet out in the manner of cabbage plants. Half a rood of land, in this way, would, he fays, be fufficient to furnifh plants for five or fix acres. In this manner, as well as by pulling the plants from the places where they may ftand too clofe in the fields, the vacancies that frequently occur in this fort of crop, may be filled up, the work being performed by dibbles. And this Mr. Young confiders as the Flemifh culture.

The feed fhould, he thinks, be fown thick, the plants being fet out on an oat ftubble, after one ploughing.

It is, he conceives, fo great and ftriking an improvement of our culture of the fame plant, that it merits the utmoft attention; for faving a whole year is an object of the firft confequence. The tranfplanting is not performed till October, and lafts all November, if no froft; and at fuch a feafon there is no danger of the plants not fucceeding; earlier would, however, furely be better, to enable them to be ftronger rooted to withftand the frofts, which often deftroy them; but the object of the Flemings is not to give their attention to this bufinefs, till every thing that concerns wheat fowing is over. The plants are large, and two feet long; a man makes the holes with a large dibble, like the potatoe one ufed on the Effex fide of London, and men and women fix the plants at 18 inches by 10 inches, fome at a foot fquare, for which they are paid *9 liv. per manco* of land. The culture is fo common all the way to Valenciennes, that there are pieces of two, three, and four acres of feed-bed, he fays, often met with. The crop is reckoned very uncertain; fometimes it pays nothing; but in a good year, up up to 300 *liv.* the arpent (100 perches, of 24 feet), or 8 *l.* 15 *s.* the English acre. They make the crop in July, and by manuring the land, get good wheat.

In Essex "rape-seed," Mr. Vancouver observes, "is transplanted at twelve inches square upon potatoe land, at a guinea per acre; generally stands for a crop, and is always found to answer extremely well. This practice is strongly recommended where wheat straw is in much demand, as the straw of the rape-seed affords an excellent substitute for littering the straw-yards, the sheds, and the stall-fed cattle."

Another mode is likewise suggested by Mr. Marshall, which is "the transplanting the whole crops, by beginning at one side of the field, and proceeding gradually from one land to another, till the whole is finished, which would, it is believed, be highly advantageous; as in this way the land would be provided with the best plants, and such as are of equal size; and by their being placed at regular distances, the crops would ripen in a more equal manner, while at the same time free admission would be given to the hoe, and the intervals be kept clean by narrow horse-hoes for the purpose. The work is commenced about the beginning of September or October, according to circumstances, in which the plough is made use of, the plants being placed by women in a leaning position in every second furrow, about a foot apart, and the roots covered by the next furrow, after which another is added, and more plants placed in as before, proceeding in the same manner till the whole is finished. The plants, of course, stand about the distance of eighteen or twenty inches by twelve. Where land that has been pared or burned, is managed in this way, it is advised that the first, or seed-ploughing, should be in a cross direction; and that for transplanting lengthways, in order to render the land dry in the winter season.

It may be observed, however, that these latter methods of managing these crops appear better adapted for such as are designed for seed, than for those intended as green food for live-stock; as, by the perfect culture, that may be thus given them, and the use of manure, the inconveniencies attending the feeding of rape crops, may, perhaps, in a great measure, be obviated.

And it is suggested, that when cultivated for use as a green food, the seed should probably be sown more early than where the crop is to stand for seed, or be employed in both ways, but sufficiently early to get a strong leaf without running to stem the first autumn. The middle of June and the last week in July may, it is supposed, be the most proper periods. Mr. Young remarks, that, when for sheep-feed, the crop is sown all through these months, but, for seed, the first week in August will do.

Where, however, the plant is cultivated merely for the seed, it is mostly sown on such lands as have been newly broken up, either by paring and burning, or some other similar means, about July or August. But when it is to be made use of as a winter and spring food for animals, the land is prepared as above, and the seed sown about the same time as that of the turnip.

In respect to the after culture of crops of this sort, it should always be well attended to, in order that large stems may be produced. It is advised by some that the crop should be kept perfectly clean by means of hand and horse-hoeing, a practice which is not, however, by any means general among the cultivators of this kind of produce. It is, indeed, supposed by some farmers, who are in the habit of cultivating this plant, that it would answer well, and pay for the labour and trouble of having the young plants transplanted from a seed-bed, as above; a very small bed, or portion of ground, being sufficient to supply the necessary quantity of plants. By adopting this method, and setting them out upon ridges, as practised in some places for turnips, having a proper allowance of manure and suitable hoeing, the general complaint against the cultivation of this plant for seed might, it is thought, be obviated, as it is probably the weedy and slovenly state in which the crop is suffered to remain that renders it more exhausting than many other similar crops. In whatever way the cultivation may be attempted, it is evident that the land cannot be too mellow or too much pulverized, for the growth of the cole-seed plant; as it not only requires a rich soil, but also that it be in excellent tilth.

In the cases of broad-cast sowing, where the culture of the crops is afterwards attended to, it is suggested as the practice of some farmers, after the plants have attained two or three inches in height, put out six leaves, and begun to spread and shew themselves perfectly above ground, to hoe them over by means of a hand-hoe, somewhat smaller than that employed for turnip crops, setting the plants out to the distances of from six to eight or nine inches from each other, according to their vigour or strength, and the fertility of the soil. This is the only hoeing that is in general given; but in many cases, as where the land is poor and disposed to throw up weeds, much advantage may be derived from a repetition of the operation, not only in cleaning the ground, but promoting the growth of the plants, by stirring the mould round them. This should be done about a month or five weeks after the first hoeing. The expence of performing the work once is mostly from about six to seven or eight shillings the acre. But that in the row method of cultivation, whether by drilling the seed, or transplanting the young plants, the business of hoeing may be performed in a more perfect and cheap manner, on account of the great distances of the plants admitting the earth in the intervals to be stirred by the plough or horse-hoe, while hand-labour becomes only necessary between them in the rows. In this way a garden cleanness may be preserved in such field crops at no great expence.

It is stated, in the "Report of Essex," that in the rich district of Rochford hundred, they have immense crops of cole, and they are admirable farmers in the management of it. Some crops of Mr. Wright's, at the Hall, are exceedingly fine ploughed for seven times, manured with twenty loads an acre of dung, and all hoed out (though not for seed) to a foot asunder: this incomparable management, which stretches away so far beyond the common practice of the kingdom, produces, the writer says, *stalk*, which is the great value of cole; and on this fine land that stalk is as brittle as glass, the sure proof of a feeding property. These crops are mown with a strong scythe made on purpose, and carted to the farm-yard to feed bullocks, which it fattens better than any other food produced by the farm; some also scatter them on dry pastures for fattening sheep. In Lincolnshire, he remarks, they know the value of cole, but none is hoed. And Mr. Prentice, of Prittlewell, is largely in this husbandry, and his crops very fine. He is very careful in the hoeing, as he conceives that great virtue is in the stalks; he gets stalks as large as his wrist, and these are more forcing to a bullock than turnips: this is the object that makes hoeing so profitable. They are mown and carried to bullocks in yards. He finds oats are as good after cole as after turnips; but a clear fallow will give more than either. He has fed part of a field on the land and mown part, the oats were a little better after feeding. Mr. Vassall, of Eastwood, is also so well convinced of the great value of the stalk, that he does not mow but speeds up to get more, and every atom is eaten by sheep. And several feveral other cultivators in the fame diftrict find great advantage from hoeing and keeping the crops clean.

By fome it is thought, that where thefe forts of crops are confumed in their green ftate on the foil, they may be equally beneficial to the landlord and his tenant; but it is fuggefted in the "Agricultural Survey of the county of Middlefex, that, fuffering them to perfect their feed, would be putting a confiderable fum of money into the pocket of the tenant at the certain expence of the landlord."

And it is obferved by Mr. Donaldfon, that where this kind of crop is cultivated for feed, great care fhould be taken that it be not allowed to remain too long uncut; as, in that cafe, it is very apt to fhed its feeds. As foon as the pods begin to affume a brownifh colour, it fhould be reaped, and laid carefully in the ground, where it ought to remain, without moving, till it be ready for thrafhing. This is afcertained by the ftraw or ftalks becoming white, and the feed, when rubbed out, appearing black. It fhould always be thrafhed out on the field on which it grows, as it is almoft impoffible to remove it any diftance, without fhaking out a great part of the feed. The operation is ufually performed on large cloths, about twenty yards fquare; and, in order to do it expeditioufly, a great number of hands are commonly employed.

Mr. Young has remarked, that crops of rape or cole-feed are extremely different, uncertain, and liable to numerous accidents. "They muft," fays he, "be conducted with great fpirit, or the lofs will probably not be fmall. The principal point is to make good ufe of fine weather; for, as they muft be thrafhed as faft as reaped, or at leaft without being houfed or ftacked like other crops, they require a greater number of hands in proportion to the land, than any other part of hufbandry. The reaping is very delicate work; for, if the men are not careful, they will fhed much of the feed. Moving it to the thrafhing floor is another work that requires attention; the beft way is to make little waggons, on four wheels, with poles, and cloths ftrained over them: the diameter of the wheels about two feet; the cloth-body five feet wide, fix long, and two deep, and drawn by one horfe; the whole expence not more than 30 or 40*s*." He has, in large farms, feen feveral of thefe at work at a time in one field. The rape is lifted from the ground gently, and dropped at once into thefe machines without any lofs; they carry it to the thrafhers, who keep hard at work, being fupplied from the waggons as faft as they come, by one fet of men, and their ftraw moved off the floor by another fet; and many hands of all forts being employed, a great breadth of land is finifhed in a day. Some ufe fledges prepared in the fame way. All is, he fays, ftopped by rain, and the crop much damaged; it is therefore of very great confequence to throw in as many people as poffible, men, women, and boys, to make the greateft ufe of fine weather.

The author of the "Rural Economy of Yorkfhire" has obferved, that a public rape thrafhing, conducted as it is in the vale diftrict of this county, is one of the moft ftriking fcenes which occur in the field of rural practice. "Contending armies," fays he, "can fcarcely exhibit, to the diftant eye, greater tumult; nor can the parade boaft of better difcipline, than may fometimes be obferved in a well-conducted rape-thrafhing.

"If the quantity to be thrafhed be large, as 20 or 30 acres, the whole country, for many miles round, are collected. The days of thrafhing are confidered as *public days;* the lord of the harveft keeping *open field,* for all who choofe to enter; ample provifion of meat and drink being made for this purpofe. A wake or a fair is not a fcene of greater jollity.

"It is not common, however, for unbidden guefts to go to thefe rural meetings, without affifting, or at leaft offering their fervices to affift, in forwarding the bufinefs of the day. But to make fure of hands for the more laborious departments, men and women are previoufly retained with wages, over and above the fpoils of the feaft.

"Alfo previous to the day of thrafhing, a "rape-cloth," "carrying cloths," and other neceffaries, are to be provided. The cloths are in the hands of a few men who let them out at fo much a day, or fo much an acre. A rape-cloth of the largeft fize meafures twenty yards fquare, weighing more than half a ton weight. Heffen is the ufual material of which it is made. The hire of fuch a cloth is 15*s.* a day.

"Alfo, before the thrafhing, the rape and the ftubble are to be cleared away from the place, or places, (if the piece be large) where the thrafhing-floor is to be made, the clods being taken off, and the hollows filled up where the cloth is intended to be laid.

"The bufinefs of the day is thus conducted: the men are divided into carriers, thrafhers, and floor-men. Women fill the carrying-cloths, and boys hold them while filling. Thefe cloths are made of canvafs, about fix feet fquare, with poles fixed on two oppofite fides, in the manner of a rolling map; openings being left in the middle between the poles and the canvafs, for two men to run their arms through, one on either fide the poles, refting by them on the men's fhoulders; the cloth filled with rape hanging between them. In thefe cloths the whole of the crop is carried to the thrafhing-floor.

"The floor-men are divided into layers-on, turners, takers-off, rake-men, riddlers, &c. &c. &c.

"The rape to be thrafhed is fpread thin upon the cloth, in a circle as large as the cloth will contain.

"The thrafhers move continually in this ring; marching with a flow ftep, in pairs and in two divifions; the individuals of each divifion following one another, as clofely as the nature of their employment will allow them.

"The firft divifion are preceded by the layers-on, and followed by the turners, and clofe upon the rear of the fecond divifion follow the takers-off, who, with wooden tined forks, fhake and throw off the ftraw, which is piled in heaps by others, with longer implements.

"Finally, the rake-men run off the feed with the ends of their rakes thruft before them, forcing the feed into receffes formed within the ring, or upon the corners of the cloth; where groups of fillers, riddlers, &c. &c. are employed in feparating the feed from the principal parts of the pods and fhort ftraws which are beat off in thrafhing; while others are equally bufy in putting the unwinnowed feed into bags, and carrying it to the *pie* or the waggon.

"Toward the clofe of the day, when the ftraw has rifen in mountain piles of almoft filver brightnefs; when the field of employment appears on its largeft fcale; when every department is in full work; and when every individual is animated, and not yet fatiated with the entertainments of the day, the rape-thrafhing affords the contemplative mind a pleafing fight, and would afford the pencil a picturefque fubject.

"The two divifions of thrafhers, moving in clofe phalanx, with flails nimbly brandifhing, fometimes in open view, fometimes partially hid among the piles of ftraw; the cloth-men, bufy and attentive to their various employments; the team drawing off the loaded feed; the carriers, from every hand, preffing to the thrafhing-floor, with their feemingly

ingly cumbrous loads, and the distant groups of fillers, scattered on every side of the foreground; could not, he thinks, fail of affording matter interesting to the painter; especially in a country where a suitable offscape is seldom wanting.

"It were almost a pity, says he, that a scene, at once so picturesque and so truly rustic, should sink into oblivion, as in all probability it will, in a short course of years. A more frugal management is growing into esteem, and it is highly probable that, in a few years, public rape-thrashing will be discontinued, and in a few years more be forgotten."

The seed of this sort of crop is, likewise, sometimes cleaned in the field, and put into sacks for the market. But where large quantities of seed are brought quickly together, as they are liable to heat and become mouldy, it may be a better method to spread them out thinly over a barn, granary, or other floor, and turn them as often as necessary. It is stated, that the method of binding crops of this kind in small sheaves, and stacking them in the field, is now much adopted. The barn ought, however, to be preferred.

In respect to the expences of the different operations, such as reaping, turning, thrashing, dressing, and depositing the seed in bags, they may, in general, be estimated at from 30*s.* to 40 or 50*s.* the acre.

The produce is various, according to the difference of culture which the crop has undergone, and the manner in which it has been managed in procuring the seed.

It is further stated by the author of "Modern Agriculture," that cole, on which sheep have been folded, is in many places allowed to stand afterwards to perfect its seed:—A practice which cannot however be recommended, except in cases where it has been slightly eaten off. This is particularly the case, he says, in Northamptonshire, as is evident from the following passage in the report of the present state of agriculture in that district. "Cole, or rape, is cultivated as a spring food for sheep. The sheep are folded in the same manner, as on rye and turnips, and continue till about the end of February. If the winter be favourable, and not very wet, the cole is sometimes allowed to stand for seed, when thirty bushels, on an average, are produced on the acre. In Essex on a medium of the county, Mr. Vancouver states the produce to be twenty-nine bushels the acre. But in the parish of Bradwell, it is set by Mr. Dudley at thirty-four. And at Spaines-Hall, in the largest crops, and best seasons, it rises to five, and even six quarters the acre. Others under these last circumstances have found the produce forty or fifty bushels or more per acre. And Mr. Marshall considers it on the whole, as one of the most profitable crops in farming. On cold unproductive old pasture lands, there have, says he, been instances in which the produce of the rape crop has been equal to the purchase value of the land. The seed is usually disposed of by the last of ten quarters, for the purpose of having oil expressed from it, by mills constructed for the purpose. But it is an article which varies very much in price, as from 18 to 35 *l.* the last. As there are ten quarters, or eighty bushels, in a last, the price of this seed may be said to vary from 4 *s.* 6 *d.* to 8 *s.* 9 *d.* the bushel, according to the prices above mentioned; and from 6 *l.* 15*s.* to 13 *l.* 2*s.* 6*d.* by the acre; average, 9 *l.* 18*s.* 9*d.* Cole, when it thrives, and the seeds are well preserved, is, Mr. Donaldson thinks, one of the most profitable crops known in this country. It is, however, at the same time extremely precarious; being, like turnips, very liable to be destroyed by swarms of flies and insects. And from what has been observed above, it is obvious, that uncommon care and attention are necessary in harvesting this sort of crop. If it be not cut down at the proper time, or if a long continued fall of rain should happen immediately afterwards, the crop is in great danger of being entirely lost.

The great application of this crop is, however, as a green food in the feeding of cattle and sheep. And it has been observed, that where it is to be consumed in this way, the crop will, in general, be sufficiently advanced for the purpose, if there should be a necessity for it, towards the latter end of November; but, except where the seed is to be afterward taken, it is probably a much better practice to reserve it as feed in the spring months. When cut or fed down in the autumn, the plants mostly advance so in the spring as to form a second crop in April. But in this method of feeding off the crop, care should be taken that the plants are not pulled up and destroyed by the animals being confined too long upon them at a time.

In its use for sheep it is scarcely surpassed by any other vegetable, in so far as respects its nutritious properties, and those of being agreeable to the taste of the animals; but in quantity of produce, it is inferior to both turnips and cabbages. In this use, the crops are fed off occasionally, from the beginning of November to the middle of April; being found of great value in the first period, in fattening dry ewes, and all sorts of old sheep, and in the latter, for supporting ewes and lambs. The sheep are folded upon them in the same manner as practised for turnips, in which way they are found to pay from 50 to 60 *s.* the acre, that quantity being sufficient for the support of ten sheep, for ten or twelve weeks, or longer, according to circumstances. And it has been found by experience to be superior to turnips in fattening, and in some cases, even to be apt to destroy them by its fattening quality. In the survey of Lincolnshire, it is likewise stated, that the crop which is grown on fresh land has the stem as brittle as glass, and is superior to every other kind of food in fattening these animals; while in that produced on old tillage, the stem is tough and wiry, and has but little proof in it.

In Essex this crop is also sometimes sown for feeding off with sheep, and also for ploughing in for manuring the land. And other farmers are largely in the system of sowing cole crops to be fed off the same year, for wheat, feeding them off in September for that purpose, by weaned calves, and fattening sheep and lambs, &c. One intention beyond the mere value of the food is that of treading and consolidating the land, as a preventative to the ravages of the wire worms.

As a winter and spring food for sheep, it is therefore almost indispensible. It is evident, however, Mr. Donaldson thinks, that the cultivators of cole, in order to turn the crop to the greatest possible advantage, should always keep in view the double purpose to which it may be applied. By feeding it off slightly with sheep in the early part of winter, the following crop is not materially injured; so that, while a considerable supply of winter food is procured, the return of cole seed by the acre, may not be greatly, if at all diminished: and this, therefore, of all others, seems the most profitable mode of management.

But though for sheep this is a very fattening sort of food, highly productive of milk, and much relished by them; it must be given to cattle with proper caution, as it is apt to hove and burst them in the same manner as clover. When it succeeds, the produce of green feed in the spring is considerable; but where afterwards shut up for seed, the quantity cannot however be expected so large as where it is reserved entirely for that purpose. As a winter and spring food, it is worth from about forty shillings, to three or four pounds per acre, for two or three months in the spring season; for which time, an acre may carry from seven or eight, to ten large sheep, according to circumstances. The haulm of this plant is frequently burned; and in some places the ashes, which are

are equal to pot-aſh, are ſold; by which practice, if no manure be ſubſtituted, the ſoil muſt be greatly deteriorated. It is ſuggeſted by Mr. Marſhall, that the value of the ſtraw to cattle in winter is very conſiderable. The *flover* (pulls and points broken off in threſhing) is as acceptable as hay, and the tops are eaten with an avidity nearly equal to cut ſtraw, better than wheat ſtraw. When well got the ſmaller butts will be eaten up clean. The offal makes excellent litter for the farm yards, and is uſeful for the bottoms of mows, ſtacks, &c. It is a cuſtom, in Lincolnſhire, ſometimes to lay their lands down with cole, under which the ſeeds are found to grow well. But this ſort of crop, as has been already obſerved, is moſt ſuited to freſh broken up, or burned lands, or as a ſucceſſor to early peaſe, or ſuch other green crops as are mowed for ſoiling cattle. The culture of theſe crops for ſeed, has been much objected to by ſome, on account of the great degree of exhauſtion of the land that it is ſuppoſed to produce, but where it is grown on a ſuitable ſoil, and preparation, with proper attention in the after culture; and the ſtraw and offal inſtead of being burnt, as in the common practice, are converted to the purpoſes of feeding and littering cattle; it may, in many inſtances, be the moſt proper and advantageous crop that can be employed by the farmer. This is a kind of plant which is ſometimes alſo known and cultivated under the name of rape. See Rape.

Cole-*Seed*, in *Agriculture*, a name by which the above ſort of crop is ſometimes cultivated, eſpecially when the ſeed is the principal object. See Rape.

Cole-*Fiſh*, more properly Coal-*Fiſh*, in *Ichthyology*, the name by which the gadus carbonarius is known in England. In Cornwall it paſſes under the name of the *Rawlin Pollack*. See Gadus *Carbonarius*.

Cole-*Mouſe*, in *Ornithology*, a ſpecies of *Parus*. See Ater.

Cole-*Pearch*, in *Ichthyology*, a name given to a ſmall fiſh, much eſteemed about Dantzick and other places, for its delicate flavour. It is very like the common river pearch, but it does not grow ſo large, and has a greater variety of colours, and its head is proportionably larger. Phil. Tranſ. N° 83.

Cole-*Seed*, in *Botany*. See Brassica *Napus*.

COLEBROOK, in *Geography*, a townſhip of America, in the northern part of New Hampſhire and Grafton county, ſeated on the eaſt bank of Connecticut river, oppoſite to the Great Monadnock, in Canaan, and ſtate of Vermont; joining Cockburne on the ſouthward and Stuartſtown on the northward; 126 miles W. by N. from Portſmouth.—Alſo, a rough, hilly townſhip on the north line of Connecticut, in Litchfield county; 30 miles N.W. of Hartford city. It was ſettled in 1756. It has two iron-works, and ſeveral mills, on Still river, and N.W. water of Farmington river.

Colebrooke-*Dale*. See Coalbrook-Dale.

COLEFORD, a ſmall town of Glouceſterſhire, England; though poſſeſſing the privilege of a weekly market on Tueſdays, it is only a chapelry to Newland, a village in its vicinity. The original charter for this market was granted by king James I. In the time of the civil wars between king Charles and his parliament, this market-houſe, with ſome other buildings, ſuffered from a ſkirmiſh that took place in this town, when Sir Richard Lawdy, the major-general of South Wales, and ſeveral officers were killed. A new market-houſe was built in 1679, towards the expence of which Charles II. contributed 40*l*; queen Anne gave towards rebuilding the chapel, which had ſuffered at the ſame time, 300*l*. The houſes of this town are ranged moſtly in one wide ſtreet. Coleford is 124 miles N. W. from London. This town is ſituated at the edge of the Foreſt of Dean, within a few miles of the navigable river Wye, and near to the tract of the once propoſed Dean Foreſt Rail-way. See Canal. Rudder's Hiſtory of Glouceſterſhire, 2 vols. folio. Rudge's ditto, 2 vols. 8vo.

COLENDA, in *Ancient Geography*, a town of Spain, which was taken, according to Appian, by Titus Didius after a ſeven months ſiege. It is the preſent *Cavarruvias*.

COLENET, or Colnett *Cape*, a cape on the N.E. coaſt of New Caledonia. N. lat. 20° 30′, E. long. 162° 56′.

COLENETO, in *Geography*, a river of Naples, which runs into the gulf of Tarento, four miles E. of *Roſſano*.

COLENICUI, in *Ornithology*, the name given by Buffon to the *Louſiane* quail, *tetrao Mexicanus*, called alſo Colenicuiltu. Hern.

COLENTUM, in *Ancient Geography*, a town of the iſland of Scardona, on the coaſt of Liburnia, forming part of Illyria.

COLEOPTERA, in *Entomology*, an order of the Linnæan ſyſtem, comprehending ſuch inſects as have four wings, the upper pair of which are cruſtaceous and divided by a ſtraight ſuture. The word is derived from κολεὸς, a *ſheath*, and πτερὸν, a *wing*. See Entomology.

COLERAIN, in *Geography*, a townſhip of America, in the ſtate of Pennſylvania, and county of Lancaſter.—Alſo, a town on the north bank of St. Mary's river, in Camden county, Georgia. By a treaty concluded at this place in 1796, between the United States and the Creek nation of Indians, the line between the white people and the Indians was eſtabliſhed to run from the Currahee mountain to the head or ſource of the main ſouth branch of the Oconee river, called by the white people, Appalatohee, and by the Indians, Tulapocha, and down the middle of the ſame. Liberty was alſo given by the Indians to the preſident of the United States to eſtabliſh a trading or military poſt on the ſouth ſide of Alatamaha, about a mile from Beard's Bluff, or any where from thence down the river, on the lands of the Indians; and the Indians agreed to annex to the ſaid poſt a tract of land five miles ſquare; and in return for this and other tokens of friendſhip on the part of the Indians, the United States ſtipulated to give them goods to the value of 6000 dollars, and to furniſh them with two blackſmiths, with tools.

Coleraine, a townſhip of America in the ſtate of Maſſachuſetts and county of Hampſhire, containing 229 houſes, and 1417 inhabitants.

Coleraine, a market, poſt, and borough town of the county of Londonderry, Ireland, ſituated on the river Bann, about three miles above its mouth. It was anciently a great place of note, being the chief town of a county erected by ſir John Perrot, during his government of Ireland; and on the ſettlement of the preſent county of Londonderry, it gave name to a barony, and had a conſiderable tract of land attached to it under the government of its corporation, called the *Liberty of Coleraine*. It is one of the Iriſh boroughs deemed of ſufficient importance to ſend a repreſentative to the parliament of the United Kingdom. It is of a tolerable ſize, and contains nearly 4000 inhabitants. The port is indifferent, occaſioned by the extreme rapidity of the river, which repels the tide and makes the coming up to the town difficult; yet it has no inconſiderable trade in imports, and it exports ſome butter and hides, beſides large quantities of ſalted ſalmon. In 1801, the average annual duties of this port exceeded 6000*l*., and they have ſince increaſed. There has lately been a conſiderable importation of old drapery, but this will be prevented in future, having been diſcovered to be of a fraudulent nature. Many plans for the improvement of the port and town, by making a canal to the ſea, by opening the navigation of the Bann, and removing the ridge of rocks above the town, have been ſuggeſted, but none of them have been carried into effect. The fine ſalmon fiſheries

 above

above and below the town have engaged the notice of travellers. Mr. Young gives the following account of it. "The salmon ſpawn in all the rivers that run into the Bann about the beginning of Auguſt, and as ſoon as they have done, ſwim to the ſea, where they ſtay till January, when they begin to return to the freſh water, and continue doing it till Auguſt, in which voyage they are taken; the nets are ſet the middle of January, but by act of parliament no nets or weirs can be kept down after the 12th of Auguſt. All the fiſheries on the river Bann let at 6000*l*. a-year. From the ſea to the rock above Coleraine, where the weirs are built, belongs to the London companies; the greateſt part of the reſt to the marquis of Donegal. The eel fiſheries let at 1000*l*. a-year, and the ſalmon fiſheries at Coleraine at 1000*l*. The eels make periodical voyages as the ſalmon, but inſtead of ſpawning in the freſh water, they go to the ſea to ſpawn, and the young fry return againſt the ſtream; to enable them to do which with greater eaſe at the leap, ſtraw ropes are hung in the water for them; when they return to the ſea they are taken: many of them weigh 9 or 10 lbs. The young ſalmon are called *grawls*, and grow at a rate which, I ſhould ſuppoſe, ſcarcely any fiſh, commonly known, equals; for within the year ſome of them will come to 16 and 18 lbs. but in general 10 or 12 lbs.; ſuch as eſcape the firſt year's fiſhery are *ſalmon*, and at two years old will generally weigh from 20 to 25 lbs. This year's fiſhery (1776), has proved the greateſt that ever was known, and they had the largeſt hawl, taking 1452 ſalmon at one drag of one net. I had the pleaſure of ſeeing 370 drawn in at once. They have this year taken 400 tons of fiſh; 200 ſold freſh at $1\frac{1}{2}d.$ a pound, and 200 ſalted at 18*l*. and 20*l*. per ton, which are ſent to London, Spain, and Italy. The fiſhery employs 80 men, and the expences in general are calculated to equal the rent." Mr. Sampſon obſerves, that the fiſh moſt eſteemed are thoſe which weigh from 16 to 20 lbs.; and that the grawls are reckoned one penny a pound inferior to ſalmon. He alſo mentions that the price of ſalmon has riſen to 4*d*. and 5*d*. per lb. principally in conſequence of a communication with the Liverpool market by means of faſt ſailing ſmacks. The linen manufacture is carried on extenſively; and Coleraine gives name to a particular kind of linen made and ſold in this town and the neighbouring ones, which is $\frac{7}{8}$ths wide. Coleraine is 114 Iriſh miles (145 Eng.) N. from Dublin, W. long. from Greenwich 6° 30′, N. lat. 55° 8′. Beaufort, Young, Sampſon, &c.

COLESHILL, a town in Warwickſhire, England, was a royal demeſne, held by Edward the Confeſſor, and William the Conqueror, in whoſe reign, or that of his ſucceſſor, it paſſed to the Clintons, from whom it went to ſir John de Mountfort, in conſequence of his marriage with Joan, daughter of ſir John Clinton, in the year 1353. The manor remained in the family of Mountfort till the reign of Henry VII., when ſir Simon Mountfort, deceived by the pretenſions of Perkin Warbeck, with a belief that he really was the ſon of Edward IV., unfortunately ſent the impoſtor 30*l*. by his youngeſt ſon, Henry; he was ſoon afterwards apprehended, on a charge of aiding Warbeck, tried at Guildhall, London, in 1494, and ſubſequently hanged and quartered at Tyburn. The manor of Coleſhill was immediately granted to Simon Digby, deputy conſtable of the caſtle, who had brought ſir Simon Mountfort to the bar; from him the manor deſcended to the preſent poſſeſſor, the lord Digby. The town is ſituated on a hill of conſiderable height, in the neighbourhood of rich meadows, watered by the Cole, and is adorned by the vicinity of beautiful hanging woods, to which its handſome church and lofty ſpire form a moſt pictureſque addition; the view from the church-yard is equally attractive; but the town includes nothing worthy of notice, except a place neatly built. The church contains many ancient and intereſting monuments, particularly two arches, under which are the effigies of two knights, cruſaders, one of which is aſcertained by Dugdale to have been John de Clinton, who died in 1291. The tomb of Simon Digby, erected by himſelf, previous to his deceaſe in 1519, ſupports the effigies of him and his wife, Alice. This lady left a ſingular bequeſt, of a ſilver penny to every child under nine years of age (whoſe parents were houſekeepers within the pariſh), who ſhould kneel at the altar, every day, after the ſacring of the high maſs, and there ſay five paternoſters, an ave, and a creed, for the ſouls of herſelf, her huſband, and all Chriſtian ſouls. The inhabitants, aware of the ſalutary conſequences to early youth, ariſing from this bequeſt, purchaſed the lands charged with the payment, after they had devolved to the crown by the diſſolution of chantries, part of the rent of which is now diſtributed to thoſe children who attend at church every morning at 10 o'clock, and there ſay the Lord's prayer, and part maintains a ſchool. There are, beſides, handſome tombs to the memory of ſeveral other of the family of Digby, whoſe deſerted ſeat, named Coleſhill-hall, of antique architecture, ſtands in a fine park near the town. About a mile below Coleſhill, is Blithe-hall, ſo termed from its ſite on the river Blithe, once the reſidence of the great and excellent antiquary, ſir William Dugdale, where there are many valuable portraits, but none more ſo than that of ſir William by Boiſcler, painted in 1665.

COLET, John, in *Biography*, well known as the founder of St. Paul's ſchool, London, and one of the revivers of ancient literature in England, was the eldeſt ſon of ſir Henry Colet, knight, an opulent tradeſman, who was twice lord mayor of London. He was born in the pariſh of St. Antholin's in the city, in the year 1466, and although it does not appear at what ſchool he received his elementary inſtruction, or at what college at Oxford he was entered, yet it is certain he ſpent ſeveral years at that univerſity, where he took his degrees in arts in 1490. Afterwards he travelled for improvement in France and Italy, where he reſided about four years. During this period, he diligently cultivated the acquaintance of thoſe perſons, whether foreigners or his own countrymen, who were moſt eminent for literary attainments, and embraced every opportunity of ſtudying the Greek language, which, at this time, was but imperfectly taught in our univerſities; and in which he had made, at home, but a ſlender proficiency. While abroad Mr. Colet employed his time in reading the beſt ancient fathers, and in the ſtudy of eccleſiaſtical hiſtory. Notwithſtanding his abſence, he was preſented at different times to valuable preferments in the church of England, though he had not even taken orders. On his return to his own country in 1497, he received firſt deacon's and afterwards prieſt's orders; and then retired to Oxford, that he might purſue his theological ſtudies without interruption. There he read lectures gratis on St. Paul's epiſtles, and contracted an acquaintance with the learned Eraſmus, which grew into an intimacy and friendſhip of the cloſeſt kind. In his lectures he exhibited much learning; and in his expoſition of the ſcriptures he not only expoſed the corrupt notions of the ſchoolmen, but ſhewed a fearleſs integrity in avowing his own ſentiments. This open and manly conduct procured him a high degree of celebrity, which was followed by new preferments in the church. He was ſucceſſively preſented to a prebend in the church of Sarum; to another in St. Paul's; and, through the favour of the king, was made dean of that church. He introduced the practice of preaching and expounding the ſcriptures, and eſtabliſhed a lecture in St. Paul's church, which is ſuppoſed to have made

made way for the reformation. The freedom of his difcourfes, the reform which he introduced into the cathedral church; the contemptible light in which he held out the conduct of the monaftic orders, and his open enmity to the fuperftitions and corruptions of the church, afforded his enemies an opportunity of accufing him of herefy. He was, however, protected by the archbifhop Warham, and favoured by Henry VIII.; and by their means enabled to triumph over his opponents, and to perfevere in his various undertakings.

About the year 1508, he formed his plan for the foundation of St. Paul's fchool, which he completed in the fpace of four years, and endowed with eftates to a confiderable amount. Here the Greek language was firft publicly taught; and in this excellent inftitution have been educated many of the moft diftinguifhed characters that have adorned our country. The celebrated William Lilly was the firft high mafter in dean Colet's fchool; and the Mercers' company were appointed truftees for the management of this important national concern. This foundation conftitutes an æra in the hiftory of Englifh literature, and merits the grateful regards of every friend to found learning. A few years after he had completed the eftablifhment of the fchool, the dean built a handfome houfe near the palace of Richmond, Surrey, where he meant to retire in old age, that he might receive and enjoy the fociety of his friends. He died, however, before he could realize his intentions, in September, 1519, in the fifty-third year of his age, and was buried on the fouth fide of the choir of St. Paul's; over his grave is a ftone, with the infcription of "John Colet" only: his meritorious deeds fpeak more to his praife than the proudeft monuments of brafs or of ftone. The perfon of dean Colet was tall, handfome, and manly. His manners were conciliating, but his temper was very irafcible; and to obtain a command over himfelf, he practifed much abftemioufnefs, and frequent faftings, befides making ufe of all the motives that religion and philofophy could fuggeft. His attachment to literature was ardent; and his public fpirit can never be forgotten fo long as learning is valued. Though a papift, he was an enemy to the grofs fuperftitions of the church of Rome. He difapproved of auricular confeffion, the celibacy of priefts, and thofe other tenets that have been generally condemned by men of found judgment in every age and country.

By one of his biographers, it is obferved, that "no higher teftimony need be given of the merit of dean Colet, than his great intimacy with Erafmus. There was a fimilitude of manners, of ftudies, and of fentiments in religion, betwixt thefe illuftrious men, who ventured to take off the veil from ignorance and fuperftition, and expofe them to the eyes of the world; and to prepare men's minds for the reformation of religion, and the reftoration of learning. Erafmus, who did him the honour to call him mafter, has given us a hint of his religious fentiments, in his colloquy entitled "Peregrinatio Religionis ergo," in which Colet is the perfon meant, under the name of Gratianus Pullus."

Colet was not diftinguifhed as an author, but we have his "Rudimenta Grammatices:" "The conftruction of the eight parts of fpeech;" and fome religious tracts. He left alfo a convocation fermon in Latin, of which there is a tranflation in the firft volume of the Phœnix, and Epiftolæ ad Erafmum, and other treatifes which ftill exift in manufcript. Biog. Brit. Granger.

COLETON, in *Geography*, a hamlet of King's Ware, in Devonfhire, near to the Froward point at the entrance of the navigable river Dart, (fee CANAL) where there is a naval flag-ftaff, whofe fituation was determined in the Government Trigonometrical Survey in 1795, by an obfervation from Butterton ftation, diftant 87,314 feet, and bearing 75° 0′ 28″ N.W. from the parallel to the meridian of Butterton; and from Furland ftation diftant 8593 feet; whence is deduced its latitude 50° 21′ 2.″3 N. and its longitude 3° 31′ 11″.2, or $14^m\ 4^s.7$ W. of Greenwich.

COLEWORT, in *Botany*. See BRASSICA *Oleracea*.

COLEWORT, in *Agriculture*, a plant of the cabbage kind, which was formerly much more cultivated in the field than at prefent, cabbage plants being fubftituted in its room. It might, however, be a very ufeful plant for feeding milch cows or other cattle, in the fpring, when there is a fcarcity of green food, as it is fo hardy that the froft does not deftroy, or in the leaft injure its growth.

The moft advantageous method of cultivating this plant in the field, is that of fowing the feeds about the beginning of July, choofing a moift feafon, by which the plants may be brought up in about ten or fourteen days. The quantity of feed which is neceffary for an acre of land is generally about nine pounds. When the plants have got five or fix leaves, they fhould be hoed in the fame manner as turnips, cutting down all the weeds from among them; and alfo thinning out the plants where they are too thick; but they fhould be kept thicker than turnips becaufe they are in more danger of being deftroyed by the fly. This work fhould be performed in dry weather, that the weeds may be killed. About fix weeks after this, the plants fhould have a fecond hoeing; which, if carefully performed in dry weather, will entirely deftroy the weeds, and make the ground clean, fo that they will require no farther culture. In the fpring they may either be drawn up, and carried out to feed the cattle, or the beafts may be turned into the field to feed upon them as they ftand; but the former method fhould be preferred, becaufe there will then be little wafte; whereas, when the cattle are turned in among the plants, they tread down and deftroy more than they eat: efpecially when they are not fenced off by hurdles. By fowing the feeds in rich beds of ground, and afterwards removing the plants into the field, in the way that cabbage plants are managed, the produce of this vegetable might perhaps be rendered more abundant. See BRASSICA and CABBAGE.

In the practice of J. C. Curwen, efq. thefe plants have been found highly beneficial as a green food for milch cows; they have alfo been found to anfwer well for fheep in fome [illegible].

COLGIAT, a gantlet, which the Turks carry in war. The colgiat covers the arm down to the elbow, and in defending the hand it at the fame time enables them to parry off the blows directed againft the head.

COLI, GIOVANNI, in *Biography*, an excellent frefco painter, who was born at Lucca in 1634. He purfued his ftudies in company with Filippo Gherardi under Pietro di Cortona, and a friendfhip of fo powerful and lafting a nature took place between the two young artifts, that it could only be diffolved by the hand of death, which carried off Coli in 1681. Until this period they had ever painted together, each heightening his enjoyments and foftening his labour, by fharing them with the other. They were fome years at Venice, where they acquired much of the ftyle of that fchool and painted the ceiling of the library of St. Giorgio Maggiore. Amongft the greateft of their joint works at Rome, are thofe of the grand gallery in the palace Colonna, and of the church of the Lucchefi. Their principal work at Lucca is the Tribuna of the church of St. Martino in frefco, and three altar-pieces in oil, in the church of St. Matteo. Orlandi. Lanzi. Storia Pitt.

COLI *Sonalis, feu Goyolcozque*, of Ray, is the leffer Mexican quail. See TETRAO *coyolcos*.

COLI *valvula*, in *Anatomy*, is a valve formed in the point of of communication between the large and small intestines. See INTESTINE.

COLIACUM *promontorium*, in *Ancient Geography*, a promontory of India, N. of Taprobana, separating two small gulfs: the same which is called by Ptolemy *Cory*, and by others, *Calligiacum*, *Colis* and *Colias*.

COLIAS, a promontory of Attica, on the coast of the Saronic gulf, S.E. of the port of Phalerus. In this place were a temple and statue of Venus, whence Venus was denominated Colias. Here were also statues of goddesses called "Genetyllides," because they presided over childbirth. Suidas reports, that in this place there was a manufacture of vessels painted with vermillion.

COLIART, in *Ichthyology*, the French name of the *Raja batis* of Linnæus, which see.

COLIBERTS, *Coliberti*, in *Law*, were tenants in soccage, and particularly such villeins as were manumitted, or made freemen. Domesday.

But they had not an absolute freedom; for though they were better than servants, yet they had superior lords, to whom they paid certain duties, and in that respect might be called servants, though they were of middle condition between freemen and servants. Du-Cange.

COLIBRI, in *Ornithology*, the general name under which Buffon describes the family of humming-birds (Trochili of Linnæus) which have the beak curved. See TROCHILUS.

COLICA, *Colic*, in *Medicine*, a pain in the abdomen, particularly about the region of the umbilicus, or navel, attended with constipation.

This term was probably originally intended to designate a pain of the large intestine, or *colon*, only. Celsus observes, "Intra ipsa intestina consistunt duo morbi, quorum unus in tenuiore, alter in pleniore est. A plerisque video nunc illum priorem εἰλεὸν, hunc κωλικὸν nominari." (Lib. iv. cap. 13.) In the writings of Hippocrates, the word *colic* is not to be found; it was probably first employed by Celsus. (See Tronchin de Colica pictonum, cap. i.) At present, it is used as a general term, and is applied to a variety of painful affections of the abdomen, which differ considerably in their seat and causes; but which agree in their general character of a deep-seated pain in the belly, occupying more especially the umbilical region, frequently accompanied with nausea, or even vomiting, and generally with a constipation of the bowels. See Cullen. Nosol. Method. Gen. 59. Under circumstances of great aggravation, when the peristaltic motion of the intestines becomes inverted, so that stercoraceous matter is thrown up by vomiting, the denomination of *ileus*, or *iliac passion*, has been applied to this disease by modern authors.

The pain, in colic, is seldom fixed and pungent in any one part of the belly; but is generally a painful distention spreading in some measure over the whole of the abdomen, and particularly with a sense of twisting or wringing round the navel. At the same time the navel and teguments of the belly are frequently drawn inwards, and often the muscles of the belly are spasmodically contracted, and this in separate portions, giving the appearance of a bag full of round balls. The bowels are costive, and the stomach is squeamish, so as frequently to reject the food and drink, which are swallowed; and in these vomitings, not only the contents of the stomach are thrown up, but also the contents of the duodenum, and therefore frequently a quantity of bile. The colic is unaccompanied by fever in the beginning; but if it be not relieved, an inflammation is liable to ensue in the part of the intestine especially affected, which aggravates all the symptoms of the disease. When this takes place, the pain of the abdomen, which in the beginning was moveable, and relieved by external pressure, is greatly aggravated by the same cause, and becomes fixed; and the patient is unable to stand erect; but leans forward, to diminish the tension of the muscles and integuments of the belly. The pulse, which was little altered at the commencement, becomes frequent, small and wiry. The breathing becomes difficult, and the patient is cut off with the symptoms of intestinal inflammation. See ENTERITIS. To this inflammation the vomiting of fæcal matter, which constitutes the ileus, has generally been attributed. Dr. Cullen, however affirms, that, as there are inflammations of the intestines without stercoraceous vomiting, so he has seen instances of stercoraceous vomiting without inflammation; there is therefore no ground for distinguishing ileus from colic, but as a higher degree of the same affection. First Lines of Pract. §. 1438.

The symptoms of colic, and the dissections of bodies dead of this disease, shew very clearly, that it depends upon a spasmodic constriction of a part of the intestines; and that this therefore is to be considered as the proximate cause of the disease. In some of the dissections of persons dead of colic, an introsusception, or inversion of one portion of the intestine within another, has been observed to have taken place.

The colic has been described by many writers as being of different species. Sauvages enumerates twenty, exclusive of several species of ileus, rachialgia, &c. which are also varieties of the same affection. (Nosol. Method. Class. vii. Ord. iv.) These distinctions, however, in a practical view, are of little utility; since in all the different modifications of the disease, the proximate cause appears to be the same, that is, a spasmodic constriction of a part of the intestines; and consequently, in all the instances, the principal indication of cure is the same; namely, to remove that constriction. Even where the disease depends upon a mechanical obstruction of the intestine, as from accumulated forces, calculous concretions, or a thickening and narrowing of the bowel itself, it is not produced by the existence of these obstructions, unless spasmodic constrictions of the intestines are brought on.

The exciting *causes*, which are as various as the modes of irritation which can act upon the bowels, have been assumed as the sources of distinction of the species of colic. Hence the following varieties have been pointed out by nosologists; namely *colica flatulenta*, arising from wind in the bowels, and known by the great discharge of it with the stools, or glysters, by the rumbling noise or borborygmi, and by the frequent change of the seat of the pain;—C. *pituitosa*, from a supposed collection of mucus in the canal;—C. *stercorea*, from hardened fæces lodged in the bowels, occurring generally after long constipation, and in persons of habitually slow bowels; this commonly constitutes the variety of colic which occurs in women in the latter stages of pregnancy, or C. *gravidarum*. Other species have been noted under the titles of C. *verminosa*, arising from the irritation of worms in the intestine, which stimulates it to partial spasmodic constrictions, especially the round-worm or lumbricus;—C. *biliosa*, excited by an unusual secretion of acrid bile, frequently accompanied with a lax belly, and bilious stools;—C. *calculosa*, in which the spasmodic actions are excited by the stimulus of concretions lodged in the bowels, especially in the colon; and under which head also may be included the colic occasioned by hard substances taken in by the mouth, as the stones of plums, cherries, or other such fruit;—C. *accidentalis*, which is of temporary duration, being produced by indigestible aliment, or by too great a quantity of proper food, or by other matters, which by their mechanical, chemical, or some other peculiar quality, irritate the intestines as they pass

paſs through it, and which terminate when thoſe matters are diſcharged. The colica *à frigore* ariſes from the action of external cold, eſpecially when applied to the feet, between the integuments of which and the bowels there is a great ſympathy. The C. *hyſterica* may perhaps be properly included under the C. flatulenta. The C. *meconialis*, and C. *lactentium*, conſtitute the gripings of infants and children, the former ariſing from the retention of the meconium, within the firſt ſix weeks after birth; the latter, after that period, from the prevalence of acidity in the ſtomach and primæ viæ. (Sauvage's Loc. Cit.) Of the C. *pictonum*, ariſing from the poiſon of lead, we ſhall ſpeak more particularly afterwards.

The chief point, both in directing our prognoſis, and our choice of remedies, in colic, is the preſence or abſence of inflammation. The continuance of that irritation, which in the beginning excites a ſpaſmodic action in the muſcular coat of the inteſtines, produces at length an inflammation in the ſame part. Before we proceed to apply our remedies, then, the principal diagnoſis which we muſt determine, is whether the pain is occaſioned by ſimple ſpaſm, or by a ſupervening inflammation. The favourable ſymptoms, which imply the ſpaſmodic ſtate, are a ſoft pulſe, of natural, or of little increaſed frequency; the pain intermitting occaſionally, or moving from one part to another, and being relieved, or at leaſt not increaſed, by external preſſure; and the occurrence of fæculent evacuations. The unfavourable ſymptoms, on the contrary, as leading to a ſuſpicion of inflammation, are a conſiderable duration and unremitting ſeverity of the pain, obſtinate conſtipation, with tenſion of the abdomen, and an aggravation of the pain by preſſure; a very frequent, ſmall, and hard pulſe: the ſkin being hot and dry, or partially moiſt with clammy ſweats; frequent retching, with a dry, brown tongue, hiccup, and delirium.

The principal indications of cure, in colic, are, 1ſt, to prevent or remove inflammation; 2d, to relieve the ſpaſmodic conſtriction and pain of the bowels; and 3d, to excite their regular action, and procure free and fæculent ſtools. The means by which theſe indications muſt be fulfilled, though obvious in general, will be neceſſarily varied by circumſtances, eſpecially by a conſideration of the nature of the exciting cauſe, and of the progreſs and variety of particular ſymptoms.

1. Where inflammatory action has already taken place, as indicated by the ſymptoms before enumerated, eſpecially by the ſeverity of pain, by its increaſe on preſſure, and by the very frequent, hard pulſe, recourſe ſhould be immediately had to the lancet, and a free bleeding from the arm, from a large orifice, ſhould be effected. In perſons of full and ſtrong habits, this operation may require to be repeated, if the pain ſhould not remit, and the pulſe ſhould remain hard and frequent, and if the blood drawn ſhould exhibit, not only the buffy coat, but a conſiderable contraction of the coagulum. In more delicate habits the ſame purpoſe may be accompliſhed by the application of ſeveral leeches to the abdomen, aided by the warm bath, or warm fomentations, or by the application of a bliſter. In ſtrong habits, indeed, if the pain has been of conſiderable duration, inflammation is always much to be apprehended, and a moderate veneſection may be beneficially employed in anticipating its actual attack. In perſons of a weak and lax conſtitution, however, conſiderable caution is requiſite in the uſe of this powerful expedient, unleſs there is a ſtrong ſuſpicion of the abſolute exiſtence of inflammation.

2. The moſt effectual antiſpaſmodic means that can be reſorted to, are the application of heat, whether in a dry or humid form; and the uſe of opium, either by the mouth or the anus. The application of a dry heat is frequently employed with relief. Thus bladders filled with warm water, or bags of ſubſtances which long retain their heat, or living animals, have been uſed for this purpoſe. But the application of heat in combination with moiſture is perhaps generally more efficacious; and moſt of all, when it is applied to nearly the whole of the ſurface of the body, as by immerſion in the warm bath. The frequent inconvenience, however, or impracticability of this, renders it neceſſary to adopt, as a ſubſtitute, the local fomentation of the belly with cloths wrung out of hot water. The fomentation has one advantage, that it may be longer continued; but to procure all the benefits of immerſion it ſhould be applied at the ſame time to the lower extremities. Upon the ſame principle, a filthy expedient, frequently adopted by the older practitioners, was beneficial; namely the application of the omentum, or the warm ſkin, of a newly killed animal.

Practitioners are not altogether agreed as to the propriety of adminiſtering opiates in colic; many have extolled them as highly uſeful, while others have conſidered them as ambiguous, if not dangerous, medicines. As the tendency of opium is to produce coſtiveneſs, by diminiſhing the irritability, and therefore ſuſpending the periſtaltic motion of the bowels; it is ſuppoſed that while it relieves the pain, it muſt render the cauſe of the diſeaſe more obſtinate, and more eſpecially as upon the ſame grounds, it alſo has a tendency to impede the operation of purgatives. But it muſt be obſerved that the great cauſe of the conſtipation in colic, as well as of the pain, is the ſpaſmodic conſtriction of the bowels; and, therefore, it is obvious, that the moſt effectual way of aiding the operation of a purgative, is to remove this conſtriction, and thus to ſuffer the contents of the bowels to paſs freely along. And ſo far, we believe, from finding the action of purgative medicines impeded by the effects of an opiate, in colic, the practitioner has generally the ſatisfaction of ſeeing, that, after an opiate has been taken, a milder purgative will produce the deſired evacuations, which a more active one had previouſly failed to produce. It is, therefore, to be recommended that an opiate be generally given a ſhort time preceding the adminiſtration of a purgative; or, as the operation of a purgative on the inteſtines is neceſſarily ſlower than that of an opiate, which acts immediately upon the nervous ſyſtem, through the medium of the ſtomach, the opiate and purgative may be advantageouſly combined. Perhaps the only caſes, in which the operation of an opiate can be conſidered as hazardous, are thoſe which have been preceded by long coſtiveneſs, ſo that a ſtagnation and induration of fæces in the colon are to be ſuſpected. In ſuch caſes a ſtool ought to be firſt procured, if poſſible, by laxative medicines, aided by the uſe of emollient glyſters injected repeatedly, in order to ſoften the hardened fæces, and facilitate their expulſion. But even in thoſe circumſtances of coſtiveneſs, Dr. Cullen juſtly remarks, when, without inflammation, the violence of the ſpaſm is to be ſuſpected, when vomiting prevents the exhibition of purgatives, and when with all this the pain is extremely urgent, opium is to be employed, not merely as an anodyne, but alſo as an antiſpaſmodic, neceſſary to favour the operation of purgatives; and it may be ſo employed, when, either at the ſame time with the opiate, or not long after it, a purgative can be exhibited; and in all caſes where the colic comes on without any previous coſtiveneſs, and ariſes from cold, from paſſions of the mind, or other cauſes which operate eſpecially on the nervous ſyſtem, opium proves a ſafe and certain remedy. Firſt Lines, § 1445.

3. As

3. As the ſpaſmodic pains of colic are neceſſarily increaſed by the ſtagnant fæces, it is always important to excite the action of the bowels, and to procure free natural ſtools. Therefore, as we have already ſtated, either ſoon after or in conjunction with an opiate, ſome cathartic medicine ſhould be adminiſtered, either by the mouth or in a glyſter, or both. If the conſtipation has been but of ſhort duration, the neutral ſalts will generally be adequate to the purpoſe of procuring evacuations; ſuch as the magneſia vitriolata, for inſtance, or the cryſtals of tartar, which laſt Dr. Cullen recommends. They both have the advantage of being conveniently repeated at ſhort intervals, in ſmall quantities, until the deſired effect is produced; and they are alſo not liable to diſagree with the ſtomach. The caſtor oil, *oleum ricini*, is alſo a mild and tolerably certain purgative, which may be advantageouſly uſed where there is no ſickneſs preſent. If more active means are required, a few grains of calomel, either alone or combined with a ſmall quantity of jalap or rhubarb, may be employed. But the more draſtic cathartics ſhould be avoided, becauſe they are apt to be rejected by the ſtomach; but particularly becauſe, if they do not ſucceed in removing the obſtruction, their great irritating qualities are liable to excite inflammation, or to increaſe it, if it has already commenced.

The diſeaſe, however, is often confined to the colon, or large inteſtine, and therefore remedies may be applied immediately to the part affected, by means of glyſters. Large quantities of warm water, injected by a proper ſyringe, have frequently had the effect of removing the pain and ſpaſmodic ſtricture of the colon, partly by the ſoothing effects of the warmth, and partly by mechanical dilatation. Opium may alſo be adminiſtered in this way, eſpecially in combination with neutral ſalts, in a large glyſter of warm water, with conſiderable advantage. Theſe emollient glyſters act alſo powerfully in aid of laxative medicines taken by the mouth, particularly where the latter is impeded in their operation by a collection of indurated fæces; for while the periſtaltic motion of the bowels is rouſed by the laxatives in the upper part of the canal, the obſtruction is ſoftened, and looſened in the lower part, by the glyſter. A ſolution of aſafœtida may be frequently adminiſtered with advantage, in the form of a glyſter, as it tends both to relieve the pain by its antiſpaſmodic qualities, and alſo to ſtimulate the lower bowel, to evacuation. But where there is very obſtinate conſtipation, no glyſters are generally more efficacious than thoſe made of turpentine, properly ſuſpended in water, by means of mucilage, or the yolk of an egg. As a laſt reſource, injections of tobacco ſmoke, or of an infuſion of tobacco, are uſually employed, and are powerful ſtimulants to the inteſtines. There are ſeveral caſes, however, on record, in which, after every purgative medicine had failed, and the moſt acrid glyſters had proved ineffectual, the action of the bowels has been fully excited by throwing cold water on the lower extremities. Two caſes of this kind may be found in the Medical Tranſactions of the College of Phyſicians, vol. iii., and another in the Edinburgh Medical Eſſays, vol. v. p. 190. See Cold.

Colica *Pictonum*, or *Colic of Poictou*, is a ſpecies of the diſeaſe peculiar in reſpect to the cauſe, from which it originated, in the progreſs of its ſymptoms, and in the paralytic condition of the body, which it leaves behind. This colic is endemial in ſome countries, and has alſo been at times epidemical in others, where it is not commonly prevalent. It firſt received the name of colica pictonum, by which it is now generally deſignated, from Citois, or Citeſius, as he calls himſelf, phyſician to cardinal Richelieu, it having been epidemic in Poictou to a great extent in 1572. See "Diatriba, de novo et populari apud Pictones dolore Colico Bilioſo," in his "Opuſcula Medica," Paris, 1639. It has been likewiſe denominated *colica damnonienſis*, or *Devonſhire colic*, by Huxham and others, ſince it is endemic in that county; and *painters' colic*, becauſe frequently occurring among painters; and alſo *colica ſaturnina*, becauſe it originates, perhaps invariably, from the operation of the poiſon of lead. In the Weſt Indies, where it is alſo endemic, it is called the *dry belly-ache*. Sauvages has conſtituted it a *genus* diſtinct from colic, under the title of rachialgia.

But although Citois firſt diſtinguiſhed the diſeaſe by a peculiar name, it was well known long before his work appeared. It was equally familiar to the people of Picardy, Britanny, and other provinces of France, as well as in Moravia, Sileſia, and many parts of Germany. (See Langius Epiſt. Med. Droëtus Conſil. Nov. de Peſtilentia, cap. 5.—1572.) A colic, which terminated in paralyſis of the limbs, a termination, we believe, with ſir George Baker, peculiar to colica pictonum, had been deſcribed by Paulus Ægineta, (cap. 18) "de reſolutione ex colico morbo oborta;" by Avicenna and ſome other Arabian phyſicians; and by ſeveral continental writers, Fernelius, Hollerius, Foreſtus, &c. as well as by our countryman, John of Gaddeſden, in his "Roſa Anglica," cap. 20, prior to the time of Citois. The reader who is deſirous of obtaining a minute hiſtorical view of the diſeaſe will be amply gratified by the peruſal of the treatiſe of Tronchin, "De Colica Pictonum, Jena 1771," and of the excellent papers of ſir George Baker, in the three volumes of the Medical Tranſactions of the Col. of Phyſicians of London.

The attack of colica pictonum is generally preceded by a ſenſe of weight and uneaſineſs, about the region of the ſtomach or umbilicus, accompanied with ſome languor and diminution of appetite. At length ſlight pains are felt, which remit at times, and are particularly aggravated after eating; theſe in a ſhort time become continued, and extremely ſevere, ſo that the patient lies chiefly on his belly; or rolling about, with expreſſions of the greateſt agony. The eyes become dull, and the complexion pale, and of a dirty or livid colour. The pulſe is often quickened by the ſevere irritation of pain, and the ſkin, though generally cold and damp, is occaſionally rather hot; but there appears to be no tendency in this diſeaſe to inflammation. The ſtomach is in ſome caſes extremely irritable, and rejects whatever is ſwallowed, and the conſtipation is obſtinate. The pain often ſhoots, or is fixed in the back, and the limbs alſo are painful. When theſe ſymptoms occur in painters, plumbers, white-lead manufacturers, poliſhers of glaſs, or perſons of other occupations, in which they are expoſed to the action of the poiſon of lead, there can be no doubt of this ſpecies of colic being preſent. After ſeveral attacks of colica pictonum, a paralyſis commonly affects the fingers, or the whole hand and fore arm, ſo that the former become contracted, and the hands, when the arms are extended horizontally, hang nevertheleſs at a right angle to the arms; the *extenſor* muſcles being in both caſes more paralyſed than the *flexors*.

The exciting *cauſe* of colica pictonum appears to be, in all inſtances, as we have already ſtated, the poiſon of lead. The deleterious powers of this metal, eſpecially in the form of oxyd, or in combination with an acid, have been long well known; nor are they confined to the human ſpecies. Dr. Percival has recorded many examples of the poiſonous effects of lead, when given to hounds, cats, linnets, geeſe, ducks, and other poultry. (Obſervations and Experiments on the Poiſon of Lead.) And its power of exciting colic and paralyſis has alſo been long underſtood: ſince these effects have been frequently traced to the accidental or designed use of the metal, as medicine, or in the food and drink. During the 16th and 17th centuries, when the saturnine salts, especially the acetite of lead, or, as it is vulgarly called, sugar of lead, were administered in large doses medicinally, the colica pictonum and paralysis, in their severest forms, appear to have frequently occurred. Nevertheless, it was not until the investigations of sir George Baker were published, that the poison of lead was suspected even to be the common, much less the exclusive cause of colica pictonum. Such is the difficulty of attaining truth and sound experience in medicine! In those countries where the disease was endemic, it was attributed to a free use of the sub-acid wines, or other such liquors, peculiar to the respective districts, with which, in fact, it was very obviously connected. In the various provinces of France and Germany, where it has been observed to be epidemic in different seasons, it has been clearly observed to prevail among persons who drank freely of those sub-acid fermented liquors, by Sennertus, Spigelius, Cardanus, Citois, and many other writers. The colic of Devonshire is always attributed to the use of the cyder of that county, according to Huxham and Musgrave. The latter briefly remarks, "hanc (scil. colicam) acre facit pomaceum, siquidem eos huic assuetos solum afficit, annis hoc potu divitibus grassatur, pomona negante vix datur." Musgrave de Arthritide Symptomatice. Tronchin De Col. Pict. p. 32. In the West Indies, the endemic colic, called the dry belly-ache, is observed to be the consequence of drinking freely of the newly distilled rum; and this liquor is therefore universally considered as the cause of the disease. But besides these peculiar fermented liquors, and other metallic poisons, as well as lead, authors have assigned several causes to colica pictonum; such are, the remains of imperfectly cured fevers, gout and rheumatism, interrupted perspiration, scurvy, melancholia, and emotions of the mind. See Tronchin. Loc. Cit. To these latter circumstances, however, no one now attributes the origin of colica pictonum. The only doubt which can exist at present, is, whether those sub-acid and spirituous liquors possess any property capable of producing the disease, independently of an impregnation with lead.

It has been remarked, that the cyder of Devonshire produced the colic much more frequently and extensively, than that of other countries, as of Herefordshire; and the wines of some districts on the Continent excited the disease, when similar wines of other districts did not. Sir George Baker ascertained, that a small quantity of lead was employed in several of the mills, in which the apples were bruised for the manufacture of cyder, to fasten the iron cranks, which connected the stone-work. It is well known, too, that in several countries on the continent, the practice of sweetening the wines with litharge, and other preparations of lead, was very common, and that in these districts the colic was particularly prevalent. Dr. Moseley observes, that he was cautioned by Dr. Menghin, of Inspruck, to avoid all sweet wines whatever, but particularly the common tavern wines upon the road, in the Tyrol and in Italy. He adds, that he never deviated from this advice but once, and paid dearly for it at Viterbo. (Treatise on Tropical Diseases, p. 527.) On the other hand, colica pictonum is very prevalent in this metropolis, and other large towns; yet we have never seen an instance, which was not decidedly traced to the operation of lead. A great proportion of house-painters and plumbers, suffer the disease at some period of their life; and a very minute quantity of lead will produce it in some constitutions. Dr. Fothergill has recorded several cases, in which the complaint was occasioned in persons employed in painting with water-colours, who were in the habit of pointing the pencil in the mouth. One of the severest cases which we have witnessed, occurred in a woman, who was occasionally occupied in cleansing polished glass of the remains of the putty, which had been used for the purpose of polishing. It is farther to be added, that in many specimens of cyder, which were analyzed by sir George Baker, a small portion of lead was detected. And in the new rum of the West Indies, which excited the colic throughout some regiments of soldiers, while others were totally free from it, Dr. Hunter discovered, by analysis, the presence of lead. This lead appears to be deposited after a certain time, probably within a year, and the rum loses its noxious quality. See Med. Transact. vol. iii. Sir George Baker. Ibid. Dr. Fothergill Med. Obs. and Inquiries, vol. v. On the whole, therefore, we are satisfied of the correctness of the conclusion of sir George Baker, that colica pictonum is occasioned exclusively by the poison of lead.

The *cure* of colica pictonum must be attempted on the same principles, which we have already laid down for the cure of colic in general; in as much as it consists, like the other species, in a spasmodic constriction of some portion of the intestinal canal. But in this form of colic there appears to be little disposition to inflammatory action; and the doubts and apprehensions, which some practitioners have expressed, of the propriety of administering opiates, until some evacuation from the bowels has been procured, are altogether unsupported by experience. We are satisfied, that, wherever colic can be decidedly traced to the operation of lead, the most effectual, and the only ready cure, is to be found in the administration of a large dose of opium, to be repeated at short intervals, until the pain (and of course the spasmodic stricture) is relieved. When this effect has been produced, there is seldom any difficulty in exciting the action of the bowels, and procuring proper evacuations of fæces; after which, the cure is soon completed by tonics and cordials. This practice of first relieving the pain and constriction by opiates, before the bowels are attempted to be forced by purgative medicines, was strongly recommended by Dr. Warren (Med. Transact. vol. ii.); and was also employed by Dr. Darwin, (Zoonomia, vol. ii.). The practice, therefore, is supported by reason, experience, and authority; and the apprehensions, that opium is liable to excite inflammation in colica pictonum, are altogether hypothetical and gratuitous. As assisting the anti-spasmodic operation of opiates, the warm bath, fomentations, &c. as mentioned under the head of COLIC, may be resorted to with benefit.

For the cure of the palsy, which succeeds to colica pictonum, little can be done by the administration of drugs. The use of the waters of Bath is generally found to be productive of advantage. There seems to be a tendency in the constitution, especially in recent cases, to recover itself, if the exciting cause is avoided, and this may be aided by the local stimulus of warm water, friction, &c. and, above all, perhaps, by mechanical support to the paralyzed hands. Dr. Pemberton has recommended, that, for this purpose, the patient should have his hand and fingers extended upon a sort of battledore, tied to the fore-arm, which should be worn daily. He affirms that, in several instances, a perfect cure of the paralysis from lead has been effected in the course of a few weeks. (Treatise on Dis. of the abdominal Viscera.) It is obvious that the return of colica pictonum, and of the palsy which succeeds it, can only be effectually prevented by relinquishing those avocations, which necessarily expose the patient to the influence of the poisonous metal which excites the disease; or by refraining from those liquors with which any of its preparations are intermixed.

Colica, in *Ancient Geography*, a country of Asia, near mount Caucasus, in the country of the Coraxes. Pliny says that it was a country of Pontus, in which the summits of mount Caucasus directed their course towards the Riphæan mountains.

COLICARIA, a place of Italy, in Cisalpine Gaul, according to the Itinerary of Antonine; 25 miles from Hostilia. M. d'Anville places it W. of Vicus Serninus, and N.E. of Mutina.

COLICÆ Arteriæ, in *Anatomy*, are the arteries which supply the colon. There are generally three of these: the *colica dextra*, which supplies the ascending colon, and the *colica media*, which is distributed to the transverse arch of the intestine, come from the superior mesenteric artery; the *colica sinistra*, which supplies the descending colon, arises from the inferior mesenteric trunk. See Arteries.

COLIC Shell, in *Natural History*, a name given by some to the *porcellana*, or *concha venerea*, from its supposed virtue in curing that disease.

Colic-Stone, the name given by some modern authors to a stone found in New Spain, and some other parts of America, and esteemed of great virtues there in the cure of the colic, and in the diseases of the womb. It is a species of jasper very nearly approaching to the lapis nephriticus, and called by the natives *tlayotic*, and by the Spaniards, *piedra de hyada*. It is of a considerable weight and hardness, and is of a dusky green colour, without any variegations. The Indians cut it into various forms, sometimes of men, sometimes of their idols; sometimes also they figure it into long and even columns, and sometimes into round and flat pieces. All these are nicely polished, and those of the last shape are what are principally used in the cure of the colic. They wet these with their spittle, and then rubbing them, till hot, with their hands, they apply them to the navel in a fit of the colic; and they say, that they immediately carry it off, by determining the humours to pass off, either upwards or downwards, or both ways. They sometimes cut this stone into flat plates also, with two holes cut at each end, by means of which it may be worn, tied to the wrist by a ribband, and it is supposed thus to be a preservative from all diseases of this kind, and from many others.

COLIGNON, François, in *Biography*, an engraver, native of Nancy, who, after he had studied under Callot, and spent some time at Rome, established himself in Paris in 1640, as an engraver and print merchant. His works, which are numerous, consist principally of views of buildings, gardens, and plans of cities, executed in a spirited manner, not unlike that of Israel Silvestre, or Stefano della Bella. Amongst these is a plan of the city of Malta, with the ancient fortifications, and a set of prints representing the buildings erected at Rome under pope Sixtus V. He likewise engraved some prints from Raffaele, the Carracci, Domenichino, and several other masters of the Italian school. Strutt. Heinecken.

COLIGNY, Gaspard de, a character of considerable distinction in the civil wars of France, was born in 1517, and trained to the knowledge of arms at a very early period. Of his youthful exploits nothing is mentioned worthy of historical record. In 1550, he was a colonel-general in the infantry, and employed in forming a pacification between England and France. He was shortly after raised to the post of admiral, and was engaged in many important services for his king and country, in one of which he was taken prisoner by the Spaniards. Upon the death of his royal master, Henry II. he united himself with the Huguenots, and avowed his adherence to the Protestant religion. Excepting the prince of Condé, he was at the head of the party, both in matters of diplomacy and as a soldier. He took up arms against the Guises who had planned the extirpation of the Huguenots, and although in several battles he had the mortification of being obliged to retire from the field, yet his courage and intrepidity never failed him; when wounded, and his friends lamenting over his situation, he observed, that in his profession a man should regard death and life on equal terms. By his talents and bravery the Huguenots, though defeated, were sufficiently formidable to conclude a peace. They had increased so much in numbers, and the progress which their doctrines were still making, was such, that it was imagined they would shortly have become the predominant religion in France. Coligny was invited to the court, and the king, with those about him, used every means of flattery and delusion to throw the admiral off his guard. He suspended his usual prudence, and became reconciled to the chiefs of the party who not long before had offered a large reward to any one who would assassinate him. He who had defied equally the power and menaces of royal authority could not wholly withstand the solicitations of his enemies, who, to answer their own sinister views, had put on the mask of friendship. Inattentive to the presages of his firmest adherents, he refused to leave Paris, and was himself the first victim of the infamous massacre which took place, not only in the capital, but in almost all the provinces on St. Bartholemew's day, 1572. He had, only two days before, been wounded by a hired assassin, named Maurevel, as he was returning from the Louvre, and was on that account confined to his room, when a party, headed by his implacable enemy, the duke of Guise, broke open the door where the admiral was sitting. Besme, one of the duke's domestics, approached him with a drawn sword, "Young man," said the gallant but disabled Coligny, "you ought to respect my age, but act as you please, you can only shorten my life a very few days." The savage pierced his body in many places, and then threw his body into the street, where it was exposed for three days, to the insults of the populace, and then hung by the feet on a gibbet. He was afterwards privately buried in the chapel of Chantilly. Such was the end of admiral Coligny, who, before the commencement of hostilities, was desirous of securing to his party that liberty of conscience in the New World which was denied to them in the Old. Permission was granted him to conduct the Huguenots to the Floridas, and they actually sailed in 1562, but through the mismanagement of those to whom the business was principally entrusted, the project failed, and he was reserved to exhibit in Europe invincible courage as a soldier, great skill and prudence as a politician, and a degree of constancy in his religious principles worthy the cause in which he had embarked, and from the defence of which he never once deviated.

Coligny had two brothers who distinguished themselves in the same cause, and took part in all the principal actions. One of them, Odet, had attained the rank of cardinal in the church, and set the honourable example of quitting his preferment, and uniting himself at the call of conscience to the Protestant interest. He joined his brothers in arms, was married, solemnly deposed, and retired to England, where he was poisoned by a domestic in 1571. Nouv. Dict. Hist. Universal Hist.

Coligny, in *Geography*, a town of France, in the department of the Ain, and chief place of a canton, in the district of Bourg; 12 miles N. of Bourg. The place contains 1658, and the canton 9764 inhabitants: the territory comprehends $177\frac{1}{2}$ kiliometres, and 9 communes.

COLIHAUT, a town on the western side of the island of Dominica.

COLIMA,

COLIMA, a large and rich town of America, in the country of Mexico, and province of Mechoacan, situated in one of the most pleasant and fertile vallies of the country, producing cocoa, cassia, and other valuable commodities, besides some gold; of the breadth of eight leagues, and extending to the sea. Near it is a mountain of the same name, with a volcano, described by Dampier as having two sharp peaks, from which smoke and flame continually issue. A famous plant, called *oleacazan*, is said to grow in the neighbourhood, which is reckoned by the natives a catholicon for restoring decayed strength, and a specific against all sorts of poison. Colima lies 110 miles W. of Mechoacan. N. lat. 19° 50′. W. long. 104° 46′.

COLIMER, a town of France, in the department of the Orne, and district of Mortagne; 4 miles W. of it.

COLIN, a town of Bohemia, in the circle of Caarzim, with a strong castle; 28 miles E. of Prague.

Colin, *grand colin*, in *Ornithology*, the name given by Buffon to the Mexican quail, *tetrao novæ hispaniæ*; which see.

COLINDA, in *Geography*, a town of Hindoostan, in the province of Bengal; 28 miles S. of Comillah.

COLINE'E, a town of France, in the department of the Northern Coasts, and chief place of a canton, in the district of Loudéac. The place contains 465, and the canton 5530 inhabitants: the territory includes 127½ kiliometres, and 6 communes.

COLINIA, in *Ancient Geography*, a name given to the isle of Cyprus.

COLIPHIUM, a name given by Athenæus, and some other authors, to coarse bread made of meal with the bran among it, and such as is eaten by the poorer people in most countries.

The word is derived from κωλον, *a limb*, and ιφι, *strength*, and is a very expressive word, as this sort of bread makes people robust and strong, and is greatly preferable to any other kind for people of strong constitutions, who use hard labour or much exercise. It signifies also a kind of food composed of bread, new cheese, and roasted flesh, which Pythagoras taught the athletæ to use, who before had been used to live on figs.

COLIR, an officer in China, who inspects what passes in every court or tribunal in the empire; and though himself not in the number, yet is assisting at all assemblies, the proceedings whereof are communicated to him.

He is properly what we may call an *inspector*; he gives secret intelligence to the court; and even, on occasion, accuses the mandarins of their faults openly; and that not only of faults in their public offices, but even in private life. To keep him impartial, he is kept independent; by having the post for life. These colirs make even the princes of the blood tremble.

COLIS, in *Ancient Geography*, a country of India, near the sea. The rivers Hypanis and Megarses run towards the confines of this country.

COLISEUM, the name given to the amphitheatre of Vespasian at Rome, either from its magnitude, or from Nero's colossal statue. Under the article Amphitheatre, an account has been already given of its dimensions and contrivance. We have here only to say a few words on its history. It stands upon the spot formerly occupied by a pond enclosed within the walls of Nero's gilded house. The pond being dried up, Flavius Vespasian, A.D. 73, began this celebrated edifice, for public exhibitions, on a plan formed by Augustus, in the then centre of the city. The time which it took in building is not exactly agreed upon by historians; but the greater part appears to have owed its origin to Titus, who employed such of the Jews upon it as were brought in slavery to Rome. When the Goths plundered the city, whatever about the Coliseum was precious, portable, or profane, the statues of the gods and heroes, and the costly ornaments of sculpture, which were cast in brass or overspread with leaves of silver and gold, became the first prey of conquest and avarice. The vacant space, in the centre, was converted into a fair or market; the artisans of the Coliseum are mentioned in an ancient survey; and the chasms, which are still discerned among the massy stones, were either perforated or enlarged to receive the poles that supported the shops or tents of the mechanic trades. (Donatus, Roma Vetus et Nova, p. 285.)

Reduced to its native majesty, says Mr. Gibbon, the Flavian amphitheatre was contemplated with awe and admiration by the pilgrims of the north; and their rude enthusiasm broke forth in a sublime proverbial expression, which is recorded in the eighth century, in the fragments of the venerable Bede. "As long as the Coliseum stands, Rome shall stand; when the Coliseum falls, Rome will fall; and when Rome falls, the world will fall." (Beda in Excerptis seu Collectaneis apud Du-Cange Glossar, med. et infimæ Latinitatis, tom. ii. p. 407. Edit. Basil.) The same learned writer makes mention of a passage in Muratori, from which he gathered, that toward the end of the eleventh or beginning of the twelfth century, during a time of faction, a numerous garrison was lodged in its enclosure.

In 1332, we find a bull-feast celebrated here, after the manner of the Moors and Spaniards. It is described, says Mr. Gibbon, from tradition rather than memory, by Ludovico Buonconte Monaldesco, in the most ancient fragments of Roman Annals, (Muratori Script. Rerum Italicarum, tom. xii. p. 535,536.) and however fanciful they may seem, they are deeply marked with the colours of truth and nature. A convenient order of benches was restored, and a general proclamation, as far as Rimini and Ravenna, invited the nobles to exercise their skill and courage in this perilous adventure. The Roman ladies were marshalled in three squadrons, and seated in three balconies, which, on this day, the third of September, were lined with scarlet cloth. The fair Jaceva di Rovere led the matrons from beyond the Tyber, a pure and native race, who still represent the features and character of antiquity. The remainder of the city was divided as usual between the Colonna and the Ursini; the two factions were proud of the number and beauty of their female bands; the charms of Savella Ursini are mentioned with praise; and the Colonna regretted the absence of the youngest of their house, who had sprained her ancle in the garden of Nero's tower. The lots of the champions were drawn by an old and respectable citizen; and they descended into the *arena*, or pit, to encounter the wild bulls, on foot as it should seem, with a single spear. Amidst the crowd, our annalist has selected the names, colours, and devices of twenty of the most conspicuous knights. Several of the names are the most illustrious of Rome, and the ecclesiastical state; Malatesta, Polenta, Della Valle, Cafarello, Savelli, Capoccio, Conti, Annibaldi, Altieri, Corsi; the colours were adapted to their taste and situation; the devices were expressive of hope or despair, and breathed the spirit of gallantry and arms. The pride or prudence of the Ursini restrained them from the field, which was occupied by three of their hereditary rivals, whose inscriptions denoted the lofty greatness of the Colonna name. The combats were dangerous and bloody. Every champion successively encountered a wild bull; and the victory may be ascribed to the quadrupeds, since no less than eleven were left on the field, with the loss of nine wounded, and eighteen killed on

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the ſide of their adverſaries. Some of the nobleſt families might mourn, but the pomp of the funerals, in the churches of St. John Lateran, and St. Maria Maggiore, afforded a ſecond holiday to the people.

This uſe of the amphitheatre, he adds, was a rare, perhaps a ſingular feſtival; the demand for the materials was a daily and continual want, which the citizens could gratify without reſtraint or remorſe. In the fourteenth century, a ſcandalous act of concord ſecured to both factions the privilege of extracting ſtones from it, as a free and common quarry; and Poggius laments that the greater part of theſe ſtones had been burnt to lime by the folly of the Romans. To check this abuſe, and to prevent the nocturnal crimes that might be perpetrated in the vaſt and gloomy receſs, Eugenius IV. ſurrounded it with a wall; and by a charter, long extant, granted both the ground and edifice to the Olivetan Monks. After his death, the wall was overthrown in a tumult of the people; and had they themſelves reſpected the nobleſt monument of their fathers, they might have juſtified the reſolve that it ſhould never be degraded to private property. The inſide was damaged; but in the middle of the ſixteenth century, an æra of taſte and learning, the exterior circumference of one thouſand ſix hundred and twelve feet was ſtill inviolate; a triple elevation of fourſcore arches, which roſe to the height of one hundred and eight feet. Of the preſent ruin, the nephews of Paul III. are the guilty agents; and every traveller who views the Farneſe palace, may curſe the ſacrilege and luxury of theſe upſtart princes. A ſimilar reproach is applied to the Barbarini; and the repetition of injury might be dreaded from every reign, till the Coliſeum was placed under the ſafeguard of religion, by the moſt liberal of the pontiffs, Benedict XIV. who conſecrated a ſpot, which perſecution had ſtained with the blood of ſo many Chriſtian martyrs. (Gibbon's Decline and Fall, vol. vi. p. 635—640.)

Gammucci, Scamozzi, Serlio, Maffei, and ſeveral others occur among the more valuable writers on the Flavian amphitheatre, excluſive of thoſe who have written on the general antiquities of Rome. Some curious particulars alſo may be gathered from "L'Anfiteatro Flavio," "del Cavalier Carlo Fontana," fol. Haia. 1725; and ſome more elaborate details in "Joh. Maranzoni delle Memorie ſacre et profane dell Anfiteatro Flavio di Roma, volgarmente letto il Coloſſe, Diſſertazione," 4to. Rom. 1746. See alſo "Wilkins's deſcription of Ancient and Modern Rome," vol. i. p. 115. and "Tappen's Profeſſional Obſervations on the Architecture of the Ancient and Modern Buildings in France and Italy," p. 151.

The term *Coliſeum* is alſo given to two other amphitheatres; that of the emperor Severus, and the amphitheatre of Capua.

COLISTA, in *Biography*, an eminent performer on the organ at Rome, 1770. He was at this time organiſt of St. John Lateran, the moſt ancient church in Chriſtendom. The organ of this church, which is the largeſt in Rome, was built in 1549, and has undergone two repairs ſince; the one in 1600, by Luca Blaſi Perugino, and a ſecond, a few years ſince, under the direction of the preſent organiſt. It has thirty-ſix ſtops, two ſets of keys, long eighths, an octave below double F. and goes up to E. in altiſſimo. It has likewiſe pedals; in the uſe of which Signor Coliſta is very dextrous. His manner of playing this inſtrument ſeems to be the true organ ſtyle, though his taſte is rather ancient; indeed the organ ſtyle ſeems to be better preſerved throughout Italy than it is with us; as the harpſichord is not ſufficiently cultivated to encroach upon that inſtrument. Signor Coliſta played ſeveral fugues, in which the ſubjects were frequently introduced on the pedals, in a very maſterly manner. But it ſeems as if every virtue in muſic was to border upon ſome vice; for this ſtyle of playing precludes all grace, taſte, and melody; while the light, airy harpſichord kind of playing, deſtroys the *ſoſtenuto* and richneſs of harmony and contrivance of which this divine inſtrument is ſo peculiarly capable.

COLITES, in *Natural Hiſtory*, a name given by ſome writers to a ſtone ſuppoſed to imitate the human *penis*, or *teſtes*, ſeparately, or both together.

COLIUS, in *Ornithology*, the name of the red creeper, β in Moehring's genera of birds, *certhia mexicana* of Gmelin, Trochilus coccineus, Linn. Syſt. nat 6.

Colius, a genus of the paſſerine order, diſtinguiſhed by having the bill ſhort, thick, convex above, and flat beneath; upper mandible bent down at the tip; noſtrils ſmall, ſituated at the baſe of the bill, and nearly covered with feathers; tongue jagged at the tip; tail long and cuneated.

The birds of the colius tribe are moſtly inhabitants of Africa and India. The number of ſpecies at preſent known amount to ſeven, two only of which are deſcribed by Linnæus, the *colius capenſis*, conſidered by that naturaliſt as appertaining to the loxia or croſs-bill tribe, and named by him loxia colius; the other, *colius ſenegalenſis*, which Linnæus claſſes with the butcher birds, under the name of lanius macrourus.

Briſſon firſt propoſed to form a diſtinct genus of thoſe birds under the title of *colius*, which was afterwards adopted by Buffon, under that of *coliou*. The genus *colius*, is inſerted in the Gmelinian edition of the Syſtema Naturæ, and by Dr. Latham in his Index Ornithologicus. Coly is the Engliſh name aſſigned to this genus of birds in the ſynopſis of the laſt-mentioned writer.

Species.

Capensis. Exterior tail feathers white on the outſide; body cinereous, beneath whitiſh. Gmel. Colius capitis bonæ ſpei. Briſſ. Le coliou du cap de B. Eſp. Buff. Vielle, &c. Cape coly. Lath.

This bird inhabits the Cape of Good Hope, and is alſo found in the woods in the ſouthern parts of Africa. Its length is rather more than ten inches; the bill is grey with the tip black; the head and neck purpliſh aſh; breaſt vinaceous; upper tail coverts purpliſh bay; lower coverts, with the belly whitiſh; lower wing-coverts black; legs grey, and armed with black claws.

Senegalensis. Vinaceous-greyiſh; tail blueiſh; head creſted. Gmel. Colius ſenegalenſis criſtatus. Briſſ. Coliou huppé du Senegal. Buff. Senegal Coly. Lath.

According to Latham, this ſpecies is the ſame ſize as the preceding; Gmelin and Vielle deſcribe it as being about the ſame bulk, but meaſuring two inches more in length. As in capenſis the bill is grey with the tip black; the head is decorated with a creſt of long feathers of a ſea green colour, the reſt of the head, neck, breaſt, belly, and lower part of the back grey; wings and tail grey brown; the middle feathers of the tail eight in number, the outer ones ſcarcely an inch in length.

Erythropus. Blueiſh aſh, beneath whitiſh; head creſted; rump purple, with a white ſtreak in the middle; leſs red; all the toes turned forward. Gmel. Le coliou a croupion blanc. Vielle. White-backed coly. Lath.

This bird is a native of the Cape of Good Hope. Its length is twelve inches. The head is ornamented with a creſt ſimilar to that of the Senegal coly; its back is of a cheſnut purple, with a large white band on the lower parr, the reſt of the plumage above is aſh-colour, beneath whitiſh; its legs are yellow with a reddiſh tinge, and the claws are black

black. The fpecies is called by Dr. Latham, colius leuconotos. Ind. Orn.

STRIATUS. Grey; abdomen rufous with tranfverfe black ftreaks; tail green. Colius ftriatus. Gmel. Le coliou rayé. Buff. Radiated coly. Lath.

Rather larger than either of the former fpecies, meafuring in length about thirteen inches; the two middle tail feathers eight inches long. This is an elegant bird, and inhabits the Cape of Good Hope.

PANAYENSIS. Cinereous tinged with yellowifh; beneath rufous; breaft ftriated with black; head crefted. Gmel. Coliou de l'ifle de Panay. Buff. Panayan coly. Lath.

A native of the Ifle of Panay. Size that of the common grofbeak. The feathers on the head are ftraight and very long, and form a creft which the bird can elevate at pleafure. The bill is black; legs pale flefh colour.

VIRIDIS. Shining green; hind head, and eyelids filky black; wings and legs blackifh. Green Coly. Lath. Le Coliou vert. Vielle.

A native of New Holland. The length is twelve inches. The front and bill are black, wings and tail blackifh, the general colour of the plumage fine green.

INDICUS. Cinereous, beneath rufous; hind head, chin, lores, and naked orbits of the eyes yellow. Indian coly. Lath. Le Coliou des Indes. Vielle.

Length fourteen inches. General colour of the plumage cinereous afh above, and reddifh beneath; black, except the bafe, which is red; the legs are red with black claws

COLL, in *Geography*. See COL.

COLLABANG, a town of Hindooftan, in the Malwa country; 44 miles W. of Chandaree.

COLLADO, DIEGO, in *Biography*, a Spanifh Dominican, was born at Eftramadura, at the clofe of the fixteenth century, and ftudied at Salamanca. He went as a miffionary to Japan in 1621, a time when Chriftians were expofed by the natives to every fpecies of perfecution. Meeting with little or no fuccefs, he returned to Rome in 1625, and after fome years he obtained regular permiffion to preach the gofpel in China, Japan, and other eaftern countries. In 1635, he failed with twenty-four of his brethren, and having arrived at the Philippines, he attempted to eftablifh feveral convents, from which miffionaries were to be fent out. This project did not fucceed, and Collado was recalled by the king to Spain; in his voyage home he was fhipwrecked, and loft his life at Manilla. He died in 1638, leaving behind him many works; of thefe the principal are, a "Japonefe Grammar and Dictionary in Latin." "A continuation of Hyacinth Orfanels Hift. Ecclefiaftica Japon." "Dictionarium Linguæ Sinenfis, cum explicatione Latina et Hifpanica, charactere Sinenfi et Latino." Gen. Biog.

COLLAERT, ADRIAN, an engraver and print-feller of Antwerp. He is faid to have received the firft inftructions in his art, in the place of his nativity; after which he repaired to Italy to complete his ftudies. He contributed not a little, by his affiduity, and the facility of his graver, to the numberlefs fets of prints of facred ftories, huntings, landfcapes, flowers, fifh, &c. with which the ftates of Germany and Flanders were at that time inundated. Many of thefe are apparently from his own defigns, and others from Martin de Vos, Theodore Bernard, P. Breughel, John Stradanus, Hans Bol, and other mafters. His ftyle of engraving is at the fame time mafterly and neat, and his knowledge of drawing appears to have been confiderable; but his prints partake of the defects of his contemporaries, with refpect to effect of Chiaro-fcuro; his maffes of light and fhade being too much fcattered, and too equally powerful. The following are amongft his numerous performances. The "life of Chrift in 36 fmall prints." "The twelve months, fmall circles from H. Bol." "The women of Ifrael chanting the pfalm of praife, after the deftruction of the Egyptians in the Red Sea." This artift flourifhed according to Strutt and Heinecken about 1530—1550.

COLLAERT, HANS or JOHN, an excellent draughtfman and engraver, fon to the foregoing artift. He ftudied fome time in Rome, and afterwards fettled in his native place, Antwerp, where he affifted his father in moft of his great works; and afterwards publifhed a prodigious number of prints of his own, nowife inferior to thofe of Adrian. The works attributed by fome to one Herman Coblent, are by Heinecken, fuppofed to be by this mafter. His prints, according to Strutt, are dated from 1555, to 1622, fo that he muft have lived to a great age.

We fhall only notice the following amongft his numerous performances: "the life of St. Francis in 16 prints lengthways, furrounded by grotefque borders." "Time and truth," a fmall upright print beautifully engraved, from J. Stradanus; "the laft Judgment," a large print, encompaffed with fmall ftories of the life of Chrift. M. Heinecken mentions a print by an artift, who figns himfelf William Collaert, and fuppofes him the fon of John Collaert. Strutt. Heinecken.

COLLAR *for Horfes*, from *collier*, Fr. and *collum*, Lat. the *neck*, it being the part to which it is applied. It is not improbable that the ufe of the horfe in draft fervice was prior to that of his being rode, and hence it is reafonable to infer, that the ufe of the collar, or fome fuch apparatus, was nearly coeval with his firft domeftication, or only fecond, perhaps, to the ufe of the pack or pannier, which, as being the moft fimple way of employing the horfe, would firft fuggeft itfelf to his poffeffor.

To any one employing horfes in draft, the conftruction of the collar, and the proper adjuftment of it, cannot be a matter of indifference, as the quantity of force he can exert, and of work which he may be made to perform, will depend in fome degree upon the due application of it, as well as it may ferve, work being made eafy to him, to prolong the period of his fervices.

The collar at prefent in ufe for the lighter kind of draft horfes, may be thus defcribed: it confifts of a frame formed of ftraw, of the exterior figure of the bafe or lower part of the neck; this ftraw is brought together, and firmly bound round by ftrong leather, which is fewed over it; behind this a fofter cufhion or pad is formed, and attached to the former by its leather being reflected over it, and to which it is firmly fewed; as the draft could not be attached to fuch materials, two rods, or ftays of iron, pafs between the collar and pad, having ftaples, loops, or eyes, to which the traces, cords, or chains for draft, are affixed; thefe rods are eafily opened or clofed, and adapted to the fize of the neck by ftraps and buckles at the upper or lower end, or both, the elaftic materials of the collar and pad readily yielding to the figure thefe defcribe; fome of thefe are clofed only by an hinge at the end, and it muft be obvious that they will admit of much variety of ftructure in this refpect; thefe irons are termed the *hames*, probably from carrying the hamus or hook to which the traces are affixed, and on heavy draft horfes they are formed of two ftout pieces of wood, plated with iron, to which the ftaples are affixed, and thefe, as the former, are drawn together or relaxed at either extremity by ftraps or chains, and as they are made to rife confiderably above the withers, it is ufual to place the bearing rein over them, which, in horfes of lighter draft, are carried to the hook of the faddle. All the collars we recollect to have feen, may be reduced to the above general principles of conftruction. This collar fhould not be large enough to get

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upon the shoulders, and good room should be left at its lower part for the freedom of breathing.

For cattle employed in husbandry, another description of collar is used, termed the *yoke*, and which is still very much in use in the western parts of England. It appears to be constructed nearly as follows: Two heavy pieces of wood as large as a man's arm, or larger, form an oblong arch, whose sides are nearly upright, and almost parallel to each other; this is placed over the withers of the beast; and through a hole made in the two extremities of this yoke, passes a long stick or rod, which is transversely perforated to receive two pegs, which prevent the yoke from sliding along upon this rod. The two beasts being brought abreast, the same rod is made to pass through both the yokes, and being fastened by the pegs, the cattle are prevented from going from, or coming nearer to, each other; a ring, situated in the middle between the two, and through which the same stick also passes, serves to attach the draft by a chain passing between the two oxen.

This construction has a truly rustic appearance, and, one should suppose, would be but little liable to be out of order. The heavy, and often unnecessary, weight of the yoke has been objected to, as has also the effect of the solid wood resting on the neck or shoulders; and it is becoming more usual to employ collars instead of this; as, however, the head of the ox, from its size, will not admit a collar over it that would fit the neck, it is made, on this account, to open at the top or bottom, and to close after it is on, by a chain or a strap. It is obvious, however, that the complication of traces is prevented by the yoke, and the regularity and evenness of the work are easily seen by the situation of the cross-piece or stick passing straight through the two yokes.

The war-chariot of the ancients appears to have been used with the latter kind of tackling, of which a lucid, useful account has been given us by governor Pownall. (See Berenger's Horsemanship, vol. ii. p. 271.) A pole in this instance passed between the two horses, resting, by its extremity, upon the cross-piece, from the yokes about breast-high; a spike rising from this passed through a perforation in the extremity of the pole, which was then lashed to it firmly by a strong thong of leather; the axletree of the carriage extended the whole width of the two horses, or if four were used, as in the *quadriga*, a pole passed from the *jugum* between each pair of horses, though on some occasions one pole served for the whole four, passing in the middle between them, so that the two outside horses were lashed to the vehicle somewhat in the manner of what, in modern days, are termed outriggers.

The collar in use with them, termed *lepadna*, was a sort of thick, broad, leathern belt, consisting, according to the representations of it on ancient sculptured buildings, to all appearance "of several folds of leather stuck together and bound at the edges, and so cut and shaped as to fit the neck and breast without pressing or pinching in one part more than another when buttoned on;" and upon this sort of collar, if we mistake not, appears to have rested the yoke.

To this apparatus also belonged the *maschalisteris*, or body girth, being a broad leathern belt passing round the chest, and fixed to the *jugum* and the *lepadna* by the *jugalia lora*. This body-girth appears to have been useful principally in stopping and keeping the carriage steady, the yoke in drawing.

The reins passed through the two rings placed on the top of the jugum above the withers.

"The axletrees of these machines were made of extraordinary length, which enabled them to pass in full career over all kinds of ground, over heaps of arms or slaughtered bodies, without the danger of an over-turn."

The body itself of this carriage was simply fixed to the axletree, without being, as in modern times, suspended from it by chains or springs, and then again was fixed to the pole, or *temo*, so that the whole formed one fixed, and, in respect to its parts, immoveable machine.

Of this nature it is evident, from the descriptions of Homer, were those used in the siege of Troy; and of the same kind it is also clear were those in use with the ancient Britons when subdued by Julius Cæsar, and to whom this art appears to have been disclosed, by colonies arriving in Britain, and trading with her from the eastern parts of the Mediterranean. The astonishing monuments of the Druids, who were the priests of these colonies, are also corroborating proofs of this being the actual source of their communication.

To return, however, to the subject of the collar, we may, in concluding this imperfect account, remark, that it is not every servant, having the care of horses, that knows better than that the collar should rest for its principal support against the shoulders, which, however, it ought in no wise to do, or but in a very secondary way, as in such case it would tend to oppress the movements of the shoulder, and the prominent points of bone upon the shoulder-blade, would get rubbed and sore, as there is nothing but skin, covering them; their solid resistance would soon occasion the skin to be worn through, or be much injured and sore, for the place where the collar should rest is not there, but the base of the neck, which in this part is particularly well covered with stout fleshy muscles to a great depth, affording a kind of elastic cushion, that effectually saves the skin from irritation by the pressure or friction of the collar, and which circumstance cannot be too much attended to.

Some horses, it is true, have necks but ill calculated for this kind of harness, being very lean and devoid of muscle, and with such we may often observe the head is unusually large, so much so, that a collar that would fit the neck could not pass over it; in this case the breast-harness must be had recourse to, or a collar opening at the top, as we have already described for the oxen.

In respect to the use of the horses in draft, it might admit of some inquiry to what point of the collar, or rather hames, the draft should be most properly fixed; one should, however, on a first view, be led to imagine, that about the middle of the depth of the collar, or rather below that, would be the most advantageous point for inserting the hook for the draft; in the yoke it would appear that the point of draft was too low, but we do not venture to form an opinion upon a subject we have so little considered, but merely present it as worthy the consideration of those who may be interested in its discussion. Where the horse is much used with the collar in hot weather, or indeed at all seasons, washing the parts pressed upon frequently with cold water hardens them, and prevents the sweat from collecting and injuring the skin.

Collar is an ornament worn by the kings and heralds at arms, judges, chief magistrates, and others; as also by the knights of several orders, hanging over their shoulders on their mantle. Collars usually consist of a chain of gold enamelled, frequently set with cyphers, or other devices, appropriate to the several orders, with the badge suspended at the bottom. The collar of the most noble order of the Garter, weighs 30 ounces troy, is of gold, and contains 26 roses, all within garters, enamelled, and as many knots (in allusion to the sovereign and his companions), from which is pendant the badge, being the figure of St. George on horseback, in armour, encountering a dragon with a tilting spear; and we often find on old monuments and seals, the collar surrounding the arms of of the knight. For the collars of the other orders, fee an account of them under their refpective heads.

COLLAR, in *Roman Antiquity*, a chain fixed round the necks of flaves who had run away, after they were taken, with an infcription, denoting that they were deferters, and requiring them to be reftored to their proper owners.

COLLARS, in *Antiquity*, were not only worn by way of ornament, but alfo as amulets, againft incantations, &c.

COLLAR, *knights of the*, a military order in the republic of Venice, called alfo the order of *St. Mark*, which fee.

COLLAR, *Lord Mayor's*. See CHAIN.

COLLAR *of Brawn*. See BRAWN.

COLLAR, in *Building*. See CINCTURE.

COLLAR *of the plough*, a term ufed in agriculture to exprefs a ring of iron, which is fixed to the middle of the beam, and ferves to receive the ends of two chains, the lower one called the *tow chain*, and the upper one called the *bridle-chain*. The lower chain is fixed at its other end to the box, and the upper, or bridle-chain, to the ftake which runs parallel with the left hand crow-ftaff. Thefe chains, by means of this collar, and their other infertions, ferve to join the head and tail of the plough together. In fome places the bridle-chain is not fixed to the collar, but to the beam itfelf, by means of a pin; and this is the better way on many accounts. See PLOUGH.

COLLAR-*beam*, in *Carpentry*, a piece of timber placed horizontally between the heads of two queen-pofts in a trufs. See ROOF.

COLLAR, in *Ship Building*, the upper part of a ftay; alfo a rope formed into a wreath, by fplicing the ends together with a heart or dead-eye, feized in the bight, to which the ftay is confined at the lower end. There is alfo a collar, or garland, about the main-maft head, which is a rope wound about there, to fave the fhrouds from galling.

COLLARED, or GORGED, in *Heraldry*, fignifies the wearing a collar round the neck of any beaft.

COLLAREDO, in *Geography*, a town of Italy, in the duchy of Tufcany, 4 miles W. of Parana.

COLLARES, or COLARES, a town of Portugal, in the province of Eftramadura, 10 miles N. of Cafcaes.

COLLARINO, GORGERIN, or NECKING, in *Architecture*, that part of a column which is included between the lower fillet of the capital, and the upper aftragal of the fhaft. Thus the collarino is only found in the modern Tufcan order, the Roman, and modern Doric; (See *Plate* XVI. of *Architecture*;) and fometimes, though rarely, in the Ionic order.

COLLATERAL, any thing, place, country, &c. fituate by the fide of another. The word is compounded of *con*, with, and *latus*, fide.

COLLATERAL *arteries of the arm*, in *Anatomy*. Under this general name are included thofe branches, which, arifing from the humeral artery in its courfe along the arm, communicate with the recurrent branches of the arteries in the fore-arm. The profunda humeri major, is called *collateralis magna*; the profunda minor, and one or two other fmall branches, are named *collaterales minores*. See ARTERIES.

COLLATERAL *Points*, in *Cofmography*, the intermediate points, or thofe between the cardinal points. The collateral points are either primary, which are thofe removed by an equal angle on each fide from two cardinal points, or fecondary; which, again, are either thofe of the firft or fecond order. The firft are thofe equally diftant from a cardinal and firft primary; the latter equally diftant from fome cardinal primary, and the firft fecondary.

COLLATERAL *Winds*, are thofe blowing from collateral points. See WIND.

Such are the north-eaft, fouth-eaft, north-weft, fouth-weft, &c. with their fubdivifions.

COLLATERAL, in *Genealogy*, is underftood of thofe relations, which proceed from the fame ftock or anceftor, and in this refpect they agree with thofe that are lineal; but they differ in this refpect, that they do not defcend one from the other. Accordingly, collateral kinfmen are fuch as lineally fpring from one and the fame anceftor, who is the *ftirps*, or root, the *ftipes*, trunk, or common ftock, from whence thefe relations are branched out. Thus, if John Stiles hath two fons, who have each a numerous iffue, both thefe iffues are lineally defcended from John Stiles, as their common anceftor; and they are collateral kinfmen to each other, becaufe they are all defcended from this common anceftor, and all have a portion of his blood in their veins, which denominates them "confanguineous." See CONSANGUINITY.

COLLATERAL *Defcent*. See DESCENT.

COLLATERAL *Affurance*, in *Law*, is a bond, or other fecurity, made over, and beyond the deed itfelf, for the performance of covenants between man and man; thus called, as being external, and without the nature and effence of the covenant. Crompton fays, that to be fubject to the feeding of the king's deer, is collateral to the foil within the foreft. It may be added, that liberty to pitch booths in a fair, or another man's ground, is collateral to the ground.

COLLATERAL *Condition*. See CONDITION.

COLLATERAL *Warranty*. See WARRANTY.

COLLATERAL *Cut*, in *Artificial Navigation*, fignifies the fame with arm or branch of a canal. See CANAL.

COLLATERAL *Bee boxes*, in *Rural Economy*. See HIVE.

COLLATIA, in *Ancient Geography*, a city that ftood on the borders of Latium, and the country of the Sabines, between the Prænestine way and the left bank of the Anio, about fix miles from Rome.

This town was taken by Tarquinius Prifcus, who left in it a garrifon to awe the inhabitants. Tarquinius Collatinus, the hufband of Lucretia, ravifhed by Sextus Tarquinius, was of this town. In Strabo's time it was only a village. M. l'Abbe Chaupy has found its ruins in a place called *Corcollo*.—Alfo, a town of Italy, in Apulia, near mount Garganus, according to Pliny. The inhabitants were denominated Collatini; and the territory Collatinus Ager.

COLLATIO *Bonorum*, in *Law*. See DISTRIBUTION and HOTCHPOT.

COLLATION, in *Canon Law*, the conferring, or beftowing a benefice by a bifhop, who has it in his own gift, or patronage, and this he does, *jure pleno*.

Collation differs from inftitution in this, that the latter is performed by the bifhop, at the motion or prefentation of another; and the former on his own motion.

Befides, by collation, the church is not full; for the higheft patron may at any time remove the collatee, except he hath a right to collate, which plenary by collation may be pleaded; the bifhop's collation, in this refpect, is no more than a temporary provifion for celebration of divine fervice, till the patron prefents.

Collation alfo differs from prefentation, as the latter is properly the act of a patron, offering his clerk to the bifhop to be inftituted into a benefice; whereas the former is the act of the bifhop himfelf. The collator can never confer a benefice on himfelf.

Collation differs from a common prefentation, as it is the giving of the church to the parfon; and prefentation is the giving, or offering of the parfon to the church. But collation fupplies the place of prefentation and inftitution; and

and amounts to the fame as inftitution, where the bifhop is both patron and ordinary. 1 Lil. Abr. 273.

In the Romifh church the pope is the collator of all the benefices, even elective ones, by prevention; fetting afide confiftorial benefices, and thofe in the nomination of lay-patrons. Prelates and bifhops are called ordinaries, or ordinary collectors.

If the ordinary collator neglect to exercife his right for fix months, the fuperior collator may collate by devolution. Thus, if the bifhop neglect, the metropolitan may confer; then the primate; and fo on from degree to degree. In France, the king, according to the old conftitution, was the collator of all the benefices whereof he is patron, excepting confiftorial ones, to which he had only the nomination, and the pope, by virtue of the concordat, was obliged to confer on whomfoever the king nominates. For the reft, he was direct and abfolute collator; and might confer them, by virtue of a kind of priefthood annexed to the royalty.

Other lay-patrons have feldom more than a mere prefentation; the collation properly belonging to the bifhop: yet there are fome abbots who have the full right of collation. The canonifts reckon two kinds of collation; the one free and voluntary, the other neceffary. The firft depending on the mere will of the collator, who may chufe whom he pleafes to fill the vacancy. In the latter, the collator is not at his liberty; which is the cafe where a benefice has been refigned, or changed, and that refignation or permutation allowed of by the fuperior; for here the collator is obliged to grant the provifion to the refignatory, or compermutant.

It is a maxim in the new canon law, *collationes funt in fructibus*; "Thofe who have the fruits of a benefice, have the collation." But in that cafe, the word collation is ufed for prefentation. See LAPSE and PRESENTATION.

COLLATION, in *Common Law*, is the comparifon, or prefentation of a copy to its original, to fee whether or not it be conformable: or the report, or act of the officer who made the comparifon. A collated act is equivalent to an original, provided all the parties concerned were prefent at the collation.

COLLATION is alfo ufed among the Romanifts for the meal or repaft made on a faft-day, in lieu of a fupper.

Only fruits are allowed in a collation: F. Lobineau obferves, that anciently there was not allowed even bread in the collations in lent: nor anything befide a few comfits, and dried herbs, and fruits; which cuftom, he adds, obtained till the year 1513. Cardinal Humbert obferves further, that in the middle of the eleventh century, there were no collations at all allowed in the Latin church in the time of Lent; and that the cuftom of collations was borrowed from the Greeks; who themfelves did not take it up till about the eleventh century.

COLLATION, in *Scots Law*, denotes the right which an heir has of throwing the whole heritable and moveable eftates of the deceafed into one mafs, and fharing it equally with others in the fame degree of kindred, when he thinks fuch fhare will be more than the value of the heritage to which he had an exclufive title.

COLLATION, *collatio*, συμϐολη, in *Rhetoric*, is ufed for COMPARISON.

But Scaliger diftinguifhes, alleging, that in collation, one thing is compared to another that has preceded it; and that the contrary happens in comparifon. That to which any thing is compared is called protafis, and that which is compared is called antapodofis.

COLLATION is alfo popularly ufed for a repaft between dinner and fupper.

The word collation, in this fenfe, Du-Cange derives from *collocutio, conference*; and maintains, that originally collation was only a conference, or converfation on fubjects of piety, held on faft-days in monafteries; but that, by degrees, the cuftom was introduced, of bringing in a few refrefhments; and that by the exceffes to which thofe fober repafts were at length carried, the name of the abufe was retained, but that of the thing loft.

COLLATION *of feals*, denotes one feal fet on the fame label, on the reverfe of ano[illegible].

COLLATIONE *facta uni poft mortem alterius*, in *Law*, a writ directed to the juftices of the Common Pleas, commanding them to iffue their writ to the bifhop, for the admiffion of a clerk, in the place of another prefented by the king, who died during the fuit between the king and the bifhop's clerk: for, judgment once paffed for the king's clerk, and he dying before admittance, the king may beftow his prefentation on another. Reg. Orig. 31.

COLLATIONE *heremitagii*, a writ whereby the king conferred the keeping of an hermitage upon a clerk.

COLLATIONE-*Cut*, denotes a fide arm or branch of a CANAL.

COLLATIONIS *forma*. See CONTRA.

COLLATIVE *Advowfons*. See ADVOWSON.

COLLE, JOHN, in *Biography*, a voluminous writer on medicine, was born at Belluno, in 1558; he ftudied medicines at Padua, under Capivaccius, and was made doctor in that faculty in 1584. At Venice he practifed medicine about fifteen years, when he was promoted to be firft phyfician to the duke of Urbino. In 1591, he was called to fill the chair of profeffor of medicine at Padua, which poft he held with diftinguifhed credit to the time of his death, which happened in 1631.

Among his works are "Medicina Practica, five Methodus cognofcendorum et curandorum omnium affectuum peftilentialium;" containing a hiftory of epidemic difeafes, fol. 1617. In 1610, a fpecies of pleurify prevailed, he fays, which did not bear bleeding in the arm. It was moft fuccefsfully combated by cupping, glyfters, and mild cathartics. "Cofmitor mediceus triplex in quo exercitatio totius artis medicæ decifa, ac confultationes medicinales, et queftiones practicæ enucleatæ proponuntur," Venet. 1621, folio. The book is dedicated to Cofmo the Second, and contains a rational fyftem of medicine, with numerous ufeful practical obfervations. "De morbo gallico, et ejus fymptomatibus," 4to. 1628, contains a brief hiftory of this difeafe. He gave the decoction of the woods, and when they failed he had recourfe to ointments and fumigations, with mercury. For the titles of the remainder of his works, fee Haller's Biblioth. Med. Pract. &c. Eloy Dict. Hift.

COLLE, RAFFAELLO DEL, fo called from the place of his nativity, a fmall town near the city of St. Sepolcro; was a painter of very extraordinary merit, though the circumftance of his chief performances exifting in the environs of the retired fpot where he was born, has occafioned his being but little known. He is faid to have been, in his youth, the difciple of Raffaelle d'Urbino, and to have painted from that great mafter's defigns, the ftories of the Deluge, and the Adoration of the Golden Calf, in the Loggia of the Vatican. After the death of Raff. d'Urbino, he affifted Giulio Romano in many of his great works at Rome, as well as in thofe of the palace of Te at Mantua.

At St. Sepolcro are two altar-pictures by Raffaello del Colle which poffefs great fpirit and beauty, and are worthy of that fchool in which his talents were matured: the firft in the church of S. Rocco, reprefents the refurrection of our Saviour, where the majefty and triumph in the figure of

Christ are finely contrasted by the astonishment and terror of the guards employed to keep watch; the other, in the church of St. Francesco outside the city, describes the assumption of the virgin, and is replete with all the graces of design and colouring. The periods of the birth and death of this master are unknown; we find, however, that he assisted Vasari in the decorations made for the reception of Charles V. at Florence in the year 1536. Langi. Storia Pitt. Orlandi.

COLLE, CHARLES, secretary and reader to the duke of Orleans, was born at Paris in the year 1709. He exhibited an early taste for poetry, and was author of various dramatic pieces. He was also a song writer, and obtained the name of the French Anacreon. For his song written on the capture of Port Mahon, he was rewarded with a pension of 600 livres. He died in 1783, and his works have been collected in 3 vols. 12mo; under the title of "Theatre de Societè:" his verses are neat, and in general well turned, but they are not unfrequently chargeable with indecency. Nouv. Dict. Hist.

COLLE, in *Geography*, a town of Italy, in the duchy of Tuscany, the see of a bishop, suffragan of Florence; 25 miles south of Florence.

COLLE *Dunenzo*, a town of Naples, in the province of Abruzzo Citra; seven miles north of Civita Borella.

COLLE *Duo*, a town of Naples, in the province of Abruzzo Ultra; 23 miles S.W. of Aquila.

COLLE *Salvieta*, a town of the duchy of Tuscany; 10 miles from Pisa.

COLLEAGUE, a companion, partner, or associate in the same office, or magistrature. See ADJUNCT and ASSOCIATE.

The word is particularly used in speaking of the Roman consuls, and emperors.

COLLECHIO, in *Geography*, a town of Italy in the Parmesan; four miles west of Parma.

COLLECT, COLLECTION, a voluntary gathering of money, for some pious or charitable purpose.

Some say, the name *collect*, or *collection*, was used, because those gatherings were anciently made on the days of *collects*, and in *collects*, *i. e.* in assemblies of Christians; but it was more probably, *quia colligebatur pecunia*.

COLLECT is sometimes also used for a tax, or imposition, raised by a prince for any pious design.—Thus histories say, that in 1166, the king of England, coming into Normandy, appointed a collect for the relief of the Holy Land, at the desire, and after the example, of the king of France. See CROISADE.

COLLECT, in the liturgy of the church of England, and the mass of the Romanists, denotes a prayer accommodated to any particular day, occasion, or the like.

In the general, all the prayers in each office are called *collects*; either because the priest speaks in the name of the whole assembly, whose sentiments and desires he sums up by the word *oremus*, *let us pray*, as is observed by pope Innocent III., or because those prayers are offered when the people are assembled together; which is the opinion of Pamelius on Tertullian.

The congregation often is in some ancient authors called *collect* The popes Gelasius and Gregory are said to have been the first who established collects. Despense, a doctor of the faculty of Paris, has an express treatise on collects, their origin, antiquity, authors, &c

COLLECTION, COLLECTIO, in *Logic*, a term used by some for what is commonly called SYLLOGISM, and RATIOCINATION.

COLLECTIVE *Idea*, is a complex idea, which unites many ideas of the same kind under one name, or under one view: as army, dictionary, flock, &c. See COMPLEX and COMPOUNDED *Idea*.

COLLECTIVE, in *Grammar*, a term applied to a word that expresses a multitude; though itself be singular. Thus, troop, company, and army, are nouns *collective*.

COLLECTOR, a person nominated by the commissioners of any duty, the inhabitants of a parish, or the like, to raise or gather any tax, &c. See RECEIVERS.

COLLECTOR, in *Electricity*, is a small appendage to the prime conductor of the electrical machine, generally consisting of pointed wires, affixed to that end of the prime conductor which stands contiguous to the glass globe, or cylinder, or other electric of the machine. Its office is to receive the electricity, whether positive or negative, from the excited electric, much more readily than the blunt end of the prime conductor would be able to receive it without that appendage.

In the simple, or rather defective, construction of electrical machines towards the beginning of the last century, an iron or brass chain, supported in an horizontal position by means of silk strings, formed the prime conductor; and one extremity of that chain hanging perpendicularly down before the globe of glass or sulphur, or other electric, performed the office of collector. Sometimes instead of the chain, a gun barrel, supported horizontally upon silk strings, was used for a prime conductor, and from one end of the barrel a piece of chain came down before the electric, by way of collector. Several years ago, the late sir William Watson, M.D. constructed an electrical machine, in which four glass globes, set one above the other, were excited at the same time. This machine, it seems, is still in existence at the British Museum. A gun barrel formed the prime conductor, and from one end of this barrel a sort of metallic fringe came down and collected the electricity from the four globes, which it touched in the anterior part of their surface. In other machines a sort of tassel of gilt paper formed the collector. But, though this tassel, or chain, or fringe, might answer the purpose sufficiently, at a time when the excitation of the electric was weak, in consequence of the imperfect construction of the machines, small size of the electric, and especially for want of the amalgam, which, since it was introduced by Mr. Canton, has greatly increased the power of the machines; they were in process of time found less useful, and as the science was improved, other methods were adopted; for when the electricity is copiously supplied, those collectors dissipate a great portion of it into the surrounding air, or the adjacent solids; since the dispersion of electricity from the surface of a certain body, seems to be greater than in the simple proportion of the quantity of electricity in that body.

In Dr. Priestley's electrical machine, which he described in his History of Electricity, (part v. sec. ii.) the prime conductor is an hollow copper vessel of a pear-like form, the upper part of which is furnished with a long bent wire in the form of an arch. The farther end of this wire comes near the glass globe, and is formed into a ring, in which are hung some sharp pointed wires, that play lightly upon the surface of the globe when it is in motion. This form of the prime conductor, bent wire, &c. is, however, very improper on various accounts. But with respect to the collector, there is no occasion to place the pointed wires so near as to touch the glass globe or cylinder. In Nairne's patent electrical machine, in which the conductors are placed parallel to the axis of the glass cylinder, a number of pointed wires, little more than an inch in length, are fixed on the side of the conductor, and are situated so as to come with their points within the diftance of about a quarter of an inch from the furface of the glafs cylinder. Indeed pointed wires, fixed immediately on the blunt end of the prime conductor, from about one quarter of an inch to three inches in length, according to the fize and fhape of the machine, and directed towards the glafs globe, or cylinder, or plate, of the electrical machine, fo that their pointed extremities may ftand at the diftance of about half an inch from the glafs furface, form the beft fort of collector; and fuch have been ufed in the beft and moft powerful machines, conftructed by Nairne, Dollond, Adams, Cuthbertfon, Jones, and other eminent philofophical inftrument makers.

In order to afcertain what number of pointed wires would be fufficient to form the collector for any particular electrical machine, feveral experiments were made fome years ago, by a few fcientific gentlemen. They fucceffively placed at the end of the prime conductor, one, two, three, and many more, pointed wires; and with each number examined the length and power of the fpark drawn from the end of the prime conductor; the revolution and excitation of the cylinder being continued as equally as it was poffible. They alfo repeated the fame experiments with machines of various fizes. Upon the whole they found, that a fingle fharp pointed wire between two and three inches in length, imbibed nearly as much electricity from the largeft cylinder, as any number of wires; and two or three wires fet parallel to, and at about one inch diftance from each other, (which in an electrical machine with a very large cylinder acted very little better than a fingle wire) was the utmoft number of wires, that need be ufed for a collector. A greater number, by reaching too far beyond the protection of the blunt end of the conductor, and by coming nearer to the pillars of the machine, ferve only to diffipate the electricity.

The particular fhapes of the collectors for the various forms of electrical machines are exhibited in feveral of the plates belonging to electricity in this Cyclopædia.

Collectors, in *Botany*, fuch ftudents as have attempted the knowledge of plants, without reducing it to any certain fcience, being barely employed about obferving, or getting together the various fpecies. Linnæi Fund. Bot. p. 1.

COLLEDA, in *Geography*, a town of Germany, in the circle of Upper Saxony, and country of Thuringia, 12 miles N. of Weimar, and 16 N.N.E. of Erfurt.

COLLEGATARY, in the *Civil Law*, a perfon to whom is left a legacy in common with one or more other perfons. If the thing be bequeathed *in folido*, the portion of a deceafed collegatary accrues to the reft.

COLLEGE, an affemblage of feveral bodies, or focieties; or even of feveral perfons into one fociety.

College, *collegium*, among the Romans, was ufed for an affemblage of feveral perfons employed in the fame functions, and, as it were, bound together to act, or ferve in concert. The pontifices, augures, feptemviri epulones, and quindecemviri, were called the four colleges of priefts. When divine honours were decreed to Auguftus, after his death, a fifth college was added, compofed of his priefts, hence called "Collegium fodalium Auguftalium." (Tac. Annal. iii. 64. Dio. lvi. 46. lviii. 12.). So "Flavialum collegium" denoted the priefts of Titus and Vefpafian. (Suet. Dom. 4.). To each of the colleges of pontifices, augures, and quindecemviri, Julius Cæfar added one, and to the feptemviri three. (Dio. xlii.). After the battle of Actium, a power was granted to Auguftus, of adding to thefe colleges as many extraordinary members as he thought proper; which power was exercifed by the fucceeding emperors; fo that the number of thefe colleges was from that time very uncertain. (Dio. li. 20. liii. 17.). They feem, however, to have retained their ancient names. But the name of *collegium* was applied not only to fome other fraternities of priefts, befides thofe above enumerated, but to any number of perfons joined in the fame office, as the confuls, prætors, quæftors, and tribunes. Moreover, it ferved indifferently for thofe employed in the offices of religion, of government, the liberal arts, and even mechanical arts, or trades; fo that the word properly fignified what we call a *corporation*, or *company*. In the Roman empire, there were not only the *college of augurs*, and the *college of capitolini*, *i. e.* of thofe who had the fuperintendence of the capitoline games; but alfo colleges of artificers, *collegia artificum*; college of carpenters, *fabricorum*, or *fabrorum tignariorum*; of potters, *figulorum*; of founders, *ærariorum*; the college of lockfmiths, *fabrorum ferrariorum*; of engineers of the army, *tignariorum*; of butchers, *laniorum*; of dendrophori, *dendrophororum*; of centonaries, *centonariorum*; of makers of military cafques, *fagariorum*; of tent-makers, *tabernaculariorum*; of bakers, *piftorum*; of muficians, *tibicinum*, &c.

Plutarch obferves, that it was Numa who firft divided the people into colleges. Finding, upon his acceffion, the city torn to pieces by the two rival factions of Sabines and Romans, he thought it a prudent and politic meafure to fubdivide thefe two into many fmaller ones, by inftituting feparate focieties of every manual trade and profeffion. This he did to the end, that each confulting the interefts of their college, whereby they were divided from the citizens of the other colleges, they might not enter into any general confpiracy againft the public repofe.

Thefe political conftitutions, originally invented by the Romans, were afterwards much confidered by the civil law, in which they were called "univerfitates," as forming one whole out of many individuals; or "collegia," from being gathered together. They were adopted alfo by the canon law, for the maintenance of ecclefiaftical difcipline; and from them our fpiritual corporations are derived. See Corporation.

Colleges were diftinguifhed from other focieties, not formed into colleges by public authority, in this, that thofe who compofed a college, were qualified to treat of the common interefts of their college, which was, as it were, a member of the ftate, and had a common purfe; an agent to negotiate their affairs; fent deputies to the magiftrates when they wanted to treat with them; might make ftatutes and by-laws, for the adminiftration of their college, &c.

There are various colleges on foot among the moderns, built on the model of thofe of the ancients; as the three colleges of the empire, *viz.* the *college of electors*, *college of princes*, and *college of cities*. This diftinction is faid to have been eftablifhed, at the diet of Frankfort, in the year 1580.

College *of Electors*, is the body of electors, or their deputies, affembled in the diet at Ratifbon. The election of emperor is required to be made at Frankfort by the golden bull; though fome emperors have been elected at Ratifbon. See Elector.

College *of Princes*, is the body of princes, or their deputies, at the diet of Ratifbon.

This college of the princes of the empire is more extenfive, as to number, but lefs powerful than the electoral college, which, with the emperor, is at the head of the Germanic body. Thefe princes, as well as the electors, are divided into two claffes, fecular, as dukes, margraves, landgraves, burgraves, counts, &c.; and ecclefiaftic, fuch as archbifhops, bifhops, abbots, &c. that immediately hold of the empire. Thofe who compofe this college, have the

right

right of sitting in the diets, or general assemblies, with a deliberative and decisive voice, and contribute to the necessities of the empire, according to the tax established by the matricular book, or register of the states. The princes of both orders, in the former state of the German empire, held immediately of the emperor and the empire; they had power to appoint judges for the administration of justice, which some of them exercised as sovereigns, while others were limited to certain sums, above which all causes depending must be decided by appeal to the chamber of Spire. They were allowed to establish new laws, create magistrates, grant letters of grace, respite, safe conduct, majority, and legitimation. They had the right to succeed to bastards, to raise and quarter soldiers, erect universities, coin money, make arms, and cast artillery, to increase the number of their fortresses, and secure them with garrisons; make alliances among themselves, as well as with strangers, for their common defence; and, in a word, to reign in their territories as the emperor reigned in the empire. For the change in the German empire that has recently occurred, see CONFEDERATION and GERMANY.

COLLEGE *of Cities*, is, in like manner, the body of deputies which the several imperial and free cities send to the diet. These cities, which were formerly numerous and important, are now reduced to the following six, *viz.* Hamburgh, Augsburg, Lubeck, Nuremburg, Frankfort, and Bremen. The cities of Ratisbon and Wetzlar are no longer considered as imperial, but enjoy an absolute neutrality, even during the wars of the empire, the first as the seat of the diet, and the second as that of the imperial chamber. See CONFEDERATION and GERMANY.

COLLEGE, *Electoral*, in the late organization of the French constitution, denotes a certain class of persons, nominated by the assembly of canton (see CANTON) for each district and department. The electoral colleges of district have a member for every 500 inhabitants domiciliated within the district; but the number of members cannot exceed 200, nor be less than 120. The electoral colleges of departments have a member for every 1000 inhabitants domiciliated within the department; and these members cannot exceed 300, nor be under 200. The members of the electoral colleges are for life. If any member of the electoral college be denounced to government for any act contrary to honour or the interest of the country, the government invites the college to declare its will; but no number under three fourths of the votes shall deprive the denounced member of his place in the college. A place is lost in the electoral colleges for the same causes that deprive a person of the right of citizen. It is also forfeited without any legitimate obstruction, by non-attendance at their successive meetings. The first consul appoints the presidents of electoral colleges for each session; and the president alone has the police of the electoral college, after it is assembled. The electoral colleges appoint for each session two scrutineers and a secretary.

For the purpose of the formation of electoral colleges of departments, there shall be prepared in every department, under the direction of the minister of finance, a list of 600 of the citizens, who stand highest in the rolls of contributions, landed chattel, and sumptuary, and upon the roll of patents. The assembly of canton shall take from this list the members which it is to appoint to the electoral college of the department. The first consul may add to the electoral colleges of districts 10 members, chosen from the citizens belonging to the legion of honour, or who have rendered services. It may also add to every electoral college of department 20 citizens, of whom 10 shall be taken from the 30 of the first consideration in the department; and the 10 others either from the members of the legion of honour, or citizens who have rendered services. He is not confined for these nominations to any fixed period in point of time. The electoral colleges of district present to the first consul two citizens domiciliated within the district for every vacant place in the council of district. One at least of these citizens ought to be necessarily chosen from without the electoral college that presents him. The councils of district are to be renewed, a third at a time, every three years. The electoral colleges of districts present to every meeting two citizens, to form part of the list from which the members of the tribunate are to be chosen: and one at least of these citizens must be chosen from without the electoral college that presents him. Both may be taken from without the department. The electoral colleges of department present to the first consul two domiciliated within the department for every vacant place in the council general of department. One of these, at least, must be taken from without the electoral college that presents him. The councils-general of department are to be renewed by a third every five years. The electoral colleges of department present to every meeting two citizens to form the list from which are to be appointed the members of the senate, one of whom must be taken from without the college that presents him; and both may be taken from without the department. The electoral colleges of department and district present, each of them, two citizens domiciliated within the department, to form the list from which are to be chosen the members of the deputation to the legislative body; one of these must be taken from without the college that presents him. There must be three times as many different candidates upon the list formed by the union of the presentations of the electoral college of department and district, as there are here vacant places. The same person may be a member of a council of commune, and of an electoral college of district or department. A person cannot be at the same time a member of a college of district, and of a college of department. The members of the legislative body and tribunate cannot assist at the sittings of the electoral college, of which they will make part. All the other public functionaries have a right to assist and vote at them. No assembly of canton shall proceed to the nomination of the places belonging to it in an electoral college until these places are reduced to two-thirds. The electoral colleges cannot assemble but by virtue of an act of convocation issued by government, and in the place appointed for them. They cannot occupy themselves with any operations except those for which they are convened, nor continue their sittings beyond the time fixed by the act of convocation. If they exceed these limits, the government has a right to dissolve them. The electoral colleges can neither directly nor indirectly, under any pretext whatever, correspond between themselves. The dissolution of an electoral body operates the renewal of all its members.

COLLEGE *of Cardinals*, or the *sacred college*, is a body composed of the three orders of cardinals, *viz.* cardinal-bishops, cardinal-priests, and cardinal-deacons.

Each order has its dean, or chief. The dean of the cardinal-bishops is always the bishop of Ostia. See CARDINAL.

COLLEGE is also used for a public place, endowed with certain revenues, where the several parts of learning, both divine and human, are taught, in schools, halls, or classes, appointed for that purpose.

An assemblage of several of these colleges constitutes an university.

Among the Greeks, the lyceum and academy were celebrated colleges: the latter of which has given its name to our universities, which in Latin are called *academiæ*. With

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them, the houfe or apartment of each philofopher, or rhetor, might be efteemed a kind of college of itfelf. See ACADEMY, and LYCEUM.

The Romans came late into the inftitution of fuch colleges; they had, however, feveral founded by their emperors; efpecially in Gaul; the chief whereof were thofe of Marfeilles, Lyons, Befançon, and Bourdeaux.

The Jews, and Egyptians too, have had their colleges; the chief of the firft were thofe of Jerufalem. Tiberius, Nardea, Pompodita, Sura, and Babylon; the laft is faid to have been inftituted by Ezekiel, and to have fubfifted in the time of Mahomet.

Colleges of this kind have been generally in the hands of thofe confecrated to the offices of religion; the Magi in Perfia, the Gymnofophifts in the Indies, and the Druids in Gaul and Britain, had the care of educating youth in the fciences.

After Chriftianity became eftablifhed, there were almoft as many colleges as monafteries; Charlemagne, in his Capitulars, injoining the monks to inftruct youth in mufic, grammar, and arithmetic; but this calling the monks from their folitude, and taking up too much of their time, the care of the colleges was at length put into the hands of thofe who had nothing elfe to do.

In the canon law, it is faid, three perfons make a college, *tres collegium faciunt.*

The eftablifhment of colleges or univerfities is a remarkable æra in literary hiftory. The fchools in cathedrals and monafteries confined themfelves chiefly to the teaching of grammar. But in colleges, profeffors were appointed to teach all the different parts of fcience. The time that ought to be allotted to the ftudy of each was afcertained. A regular form of trying the proficiency of ftudents was prefcribed; and academical titles and honours were conferred on fuch as acquitted themfelves with approbation. A good account of the nature and origin of thefe is given by Seb. Bacmeifterus "Antiquitates Roftochienfes, five, Hiftoria Urbis et Academiæ Roftoch, ap. Monumenta inedita Rer. Germ, per E. S. de Weftphalen," vol. iii. p. 781. Leipf. 1743. The firft obfcure mention of thefe academical degrees in the univerfity of Paris (from which the other univerfities in Europe have borrowed moft of their cuftoms and inftitutions) occurs A.D. 1215. (Crevier, "Hift. de l'Univ. de Paris," tom. i. p. 296, &c.). They were completely eftablifhed A.D. 1231. It is unneceffary to enumerate the feveral privileges to which bachelors, mafters, and doctors were entitled. One circumftance is fufficient to demonftrate the high degree of eftimation in which they were held. Doctors in the different faculties contended with knights for precedence, and the difpute was terminated in many inftances by advancing the former to the dignity of knighthood, which was accompanied with high prerogatives. It was even afferted, that a doctor had a right to that title without creation. Bartolus taught —"doctorum actualiter regentem in jure civili per decennium effici militem ipfo facto." (Honoré de St. Marie, Differt. p. 165.) This was called "Chevalerie de Lectures," and the perfons advanced to that dignity, "milites clerici." Thefe new eftablifhments for education, together with the extraordinary honours conferred on learned men, greatly increafed the number of fcholars. In the year 1262, there were 10,000 ftudents in the univerfity of Bologna; and it appears from the hiftory of that univerfity, that law was the only fcience taught in it at that time. In the year 1340, there were 30,000 in the univerfity of Oxford. (Speed's Chron. ap. Anderfon's "Chron. Deduction of Commerce." vol. i. p. 172.) In the fame century 10,000 perfons voted on a queftion agitated in the univerfity of Paris, and as graduates alone were admitted to that privilege, the number of ftudents muft have been vaftly great. (Velly's "Hift. de France." tom. xi. p. 147.) There were, indeed, few univerfities in Europe at that time; but fuch a number of ftudents may neverthelefs be produced as a proof of the extraordinary ardour with which men turned to the ftudy of fcience in thofe ages. It fhews likewife that they began to confider other profeffions befides that of a foldier as honourable and ufeful. See Robertfon's Hift. Ch. V. vol. i. p. 389, &c.

For an account of the colleges of Cambridge and Oxford; fee thefe articles. For thofe of Scotland, fee ABERDEEN, ST. ANDREW'S, EDINBURGH, and GLASGOW. For thofe of Ireland, fee DUBLIN and IRELAND.

In America they have alfo many colleges. The moft ancient, as well as the principal, literary eftablifhment in this country is Harvard college, or univerfity, which was founded at Newtown, fince called Cambridge, in the province of Maffachufetts, in the year 1638. It derives its name from the Rev. John Harvard of Charleftown, who left a legacy of 779*l.* 17*s.* 2*d.* fterling, being one half of his eftate, to the further endowment of it. In 1650, this college received its firft charter from the court, appointing a corporation confifting of feven perfons, *viz.* a prefident, five fellows, and a treafurer, to have perpetual fucceffion by election to their offices, under the title of "The Prefident and Fellows of Harvard College." After the declaration of the independence of the United States, the fore-mentioned charter was eftablifhed by the conftitution of Maffachufetts; and the governor and lieutenant governor for the time being, together with the council and fenate of the commonwealth, the prefident for the time being, and the congregational minifters of the following fix towns, *viz.* Cambridge, Watertown, Charleftown, Bofton, Roxbury, and Dorchefter, were declared fucceffors of the old board of overfeers, who had been appointed for its fuperintendence in the year 1642. The executive government confifts of the prefident, three profeffors, four tutors, and the librarian, who fuperintend the morals of the ftudents and the obfervance of the ftanding laws, and make difcretionary regulations in cafes not provided for by the laws. The profeffors and tutors give inftruction in the univerfity. It has a profeffor of divinity, a profeffor of mathematics and natural philofophy, and a profeffor of Hebrew and other Oriental languages, who is alfo profeffor of the Englifh language. The two firft of thefe profefforfhips were founded by Mr. Thomas Hollis of London, merchant, who, together with others of his family, furnifhed the college with the philofophical apparatus, and a number of valuable books; the divinity profefforfhip in 1722; the mathematical profefforfhip in 1726; the profefforfhip of Hebrew, &c. by the Hon. Thomas Hancock, efq. in 1765. Thefe feveral profefforfhips bear the names of their founders. Foundations are laid for two other profefforfhips, *viz.* one of rhetoric and oratory, and another of natural religion, moral philofophy, and civil polity, by the legacies of Nicolas Boylfton, efq. of Bofton; and the Hon. John Alford, efq. of Charleftown. In 1782 a medical inftitution was formed in the univerfity. It confifts of three profefforfhips, *viz.* one of anatomy and furgery, one of the theory and practice of phyfic, and another of chemiftry and the materia medica. Among the prefidents and profeffors of this univerfity, we find feveral perfons eminently diftinguifhed both by natural abilities and acquired accomplifhments. The ftudents are annually examined in the feveral branches of education as far as their courfe has been completed, before a com-

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mittee of the corporation and overſeers. The courſe of education is completed in the univerſity in four years, at the end of which term, thoſe ſtudents, who have complied with other requiſites, are candidates for the degree of bachelor of arts, which is conferred after the public performance of appointed literary exerciſes; and at the end of three years from the time of their receiving this degree, they may be admitted to that of maſter of arts, if there be no legal impediment. All academical degrees are publicly conferred by the preſident, on the commencement day, which is the third Wedneſday in July, annually. This, it is ſaid, is one of the moſt ſplendid anniverſaries in the United States. From the eſtabliſhment of this college to the year 1794, 3399 young perſons received its honours, of whom 1079 became miniſters of the goſpel. This moſt ancient of all the American literary inſtitutions has furniſhed, both for the church and ſtate, its full proportion of eminently learned and uſeful men. The college poſſeſſes ſome funds, ariſing from the eſtate of Edward Hopkins, eſq. of Great Britain, for the ſupport of graduates, and alſo from a legacy of 400*l.*, bequeathed by governor Bowdoin, for the encouragement of reſident graduates and under-graduates. The public buildings belonging to the univerſity are Harvard hall, appropriated to public rooms, ſuch as a chapel, a dining-room, library, philoſophy chamber, an apartment for the philoſophical apparatus, which is reſpectable, though deficient in aſtronomical inſtruments, Hollis hall and Maſſachuſetts hall, which contain private rooms, and are occupied by the tutors and ſtudents, and Holden chapel, now occupied by ſome of the medical profeſſors. The ſum of 8000*l.* was raiſed by a lottery in 1794, towards erecting another hall, for the accommodation of ſtudents. The library conſiſts, as we are informed, of about 13,000 well-ſelected and valuable books, the number of which is increaſing by donations, and by the income of a legacy, bequeathed by the late Thomas Hollis, eſq. of London. The muſeum of the univerſity, which has been indebted to the munificence of Dr. Lettſom of London in 1794, and to that of the French Republic in the following year, is furniſhed with a handſome collection of natural and artificial curioſities. The colleges are ſituated in a pleaſant and healthful part of Cambridge. Their diſtance from the centre of Boſton is eight miles by the way of Roxbury, 4½ miles over Charles river bridge, and 3½ miles over Weſt Boſton bridge. The latitude of Harvard hall, determined by obſervations, is 42° 23′ 28″, and W. longitude from Greenwich 4^h 44^m 30ˢ in time, or 71° 7′ 30″.

An academy in Williamſtown, in Berkſhire county, founded and endowed ſeveral years ſince by Col. Ephraim Williams, and in 1790 provided with a brick edifice, containing 24 rooms for ſtudents, a large ſchool-room, a dining-hall, and a room for public ſpeaking, was erected in 1793 into a college by an act of the legiſlature, under the name of "Williams' College," in honour of its liberal founder.

The general aſſembly of the ſtate granted a charter in 1764, for founding a college under the name of "The Truſtees and Fellows of the College or Univerſity, in the Engliſh colony of Rhode iſland and Providence plantations." The number of truſtees is 36, of whom 22 are of the Baptiſt denomination, 5 of the denomination of Friends, 5 Epiſcopalians, and 4 Congregationaliſts. The preſident muſt be a Baptiſt; the profeſſors and other officers for inſtruction are not reſtricted to any particular denomination. This inſtitution was firſt founded at Warren, in the county of Briſtol; but removed in 1770 to Providence, where an elegant building was erected for its accommodation. It has 48 rooms for ſtudents, and 8 of a larger ſize for public uſe. This inſtitution is under the inſtruction of a preſident, a profeſſor of divinity, a profeſſor of natural and experimental philoſophy, a profeſſor of mathematics and aſtronomy, a profeſſor of natural hiſtory, and three tutors. It has a library of between two and three thouſand volumes, and a valuable philoſophical apparatus. The funds of the college, at intereſt in the treaſury of the ſtate, amount to about 2000*l.*

Yale college, in the ſtate of Connecticut, was founded in 1700; and remained at Killingworth until the year 1707; then at Saybrook until 1716, when it was removed to New-Haven, where it was fixed. Governor Yale was one of its principal benefactors, and in honour of him it was named, in 1718, "Yale College." Its building furniſhes chambers for lodging 120 ſtudents, a chapel, a dining-hall, a houſe for the preſident, and another for the profeſſor of divinity. Its library conſiſts of about 3000 volumes, and it is provided with a competent philoſophical apparatus. The college muſeum is a repoſitory of many natural curioſities. The firſt charter of incorporation was granted by the general aſſembly of Connecticut in 1701; renewed in 1723; and in 1745, the truſtees were incorporated by the name of "The Preſident and Fellows of Yale college, New-Haven." And by an act of the general aſſembly, paſſed in 1792, the governor, lieutenant-governor, and the ſix ſenior aſſiſtants in the council of ſtate, are appointed to be for ever, by virtue of their offices, truſtees and fellows of the college, in addition to the former corporation. The corporation is empowered to make laws, to hold eſtates, to continue their ſucceſſion, to elect and conſtitute all officers for inſtruction and government, and to confer all the learned degrees. The immediate executive government is in the hands of the preſident, profeſſors, and tutors. The preſent officers and inſtructors of the college are, a preſident, a profeſſor of divinity, and a profeſſor of natural philoſophy and aſtronomy, and three tutors. The number of ſtudents, at an average, is about 150, divided into four claſſes. The funds of the college, before the liberal addition made by a grant of the general aſſembly in 1792, conſiſted of rents of lands to the amount of 800*l.* a year, about 800*l.* raiſed by fees of the ſtudents for tuition, beſides funds for the ſupport of two profeſſorſhips. The ſeveral claſſes are examined twice in the year; and a public commencement is held annually on the 2d Wedneſday in September. From the year 1700 to 1793, there had been educated and graduated at this univerſity about 2303 perſons; about 800 of whom had been ordained to the work of the miniſtry.

King's college, in the city of New York, was principally founded by the voluntary contributions of the inhabitants of the province, aſſiſted by the general aſſembly and the corporation of Trinity church; and in 1754, a royal charter and grant of money being obtained, a number of gentlemen were incorporated by the name of "The governors of the college of the province of New York, in the city of New York, in America;" which charter granted various privileges, and among others, that of conferring all ſuch degrees as are uſually conferred by the Engliſh univerſities. The charter provides, that the preſident ſhall be always a member of the church of England; but at the ſame time, no teſt of their religious perſuaſion was required from any of the fellows, profeſſors, or tutors; and the advantages of education were equally extended to ſtudents of all denominations. The building is an elegant ſtone edifice, with four ſtair-caſes, having in each 12 apartments, and containing alſo a chapel, hall, library, muſeum, anatomical theatre, and a ſchool for experimental philoſophy. Since the revolution,

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the legislature has passed an act, constituting 12 gentlemen, the governor and lieutenant-governor always included "ex officiis," a body corporate and politic, by the name of "The Regents of the University of the State of New York." This body has powers to grant charters of incorporation for erecting colleges and academies through the state, to visit them whenever they think proper, and to make a report of their state to the legislature once a year. King's college is now called "Columbia College;" and by an act passed in 1787, it was put under the care of 24 gentlemen, who are a body corporate by the name of "The Trustees of Columbia college, in the city of New York." They possess all the powers vested in the governors of King's college before the revolution, or in the regents of the university, since the revolution. The regents of the university have power to confer the higher degrees, and them only. The annual revenue arising from the estate belonging to the college amounts to 1,535 *l.* currency. Columbia college consists of two faculties; one of arts and another of physic. The first has a president and seven professors; and the second a dean and seven professors. The students attending both the faculties in 1795, amounted to 140. The officers for instruction and government in the faculty of each, are a president, a professor of mathematics and natural philosophy, a professor of logic and geography, and a professor of languages. To these have been lately added a professor of chemistry and agriculture, a professor of oriental languages, a professor of law, and a professor of the French language. In the faculty of physic, the dean is lecturer on clinical medicine in the New York hospital, and there are the professorships of botany, of anatomy, of the obstetric art, of materia medica, of the institutes of medicine, of surgery, and the practice of physic. The library and museum were destroyed during the war. Upwards of 800 *l.* granted by the legislature, has been expended in books for augmenting the library. The philosophical apparatus is new and complete.

Another college by the name of "Union college, in the town of Shenectady in the state of New York," was incorporated by the regents of the university in 1794.

In New Jersey there are two colleges, one at Princetown, called Nassau hall; the other at Brunswick, called Queen's college. The former was first founded by charter about the year 1738, and enlarged in 1747. The charter delegates a power of granting "to students of the said college, or to any others thought worthy of them, all such degrees as are granted in either of our universities, or any other college in Great Britain." It has 23 trustees, the governor of the state, and the president of the college, are, "ex officiis," two of them. The establishment in 1796, consisted of a president, who is also professor of moral philosophy, theology, natural and revealed, history, and eloquence; two professors, one of mathematics and natural philosophy, including astronomy, and another of chemistry, considered not only in its relation to medicine, but to agriculture and manufactures; and a grammar master. In the winter session there are generally from 70 to 80 students in the four classes of the college; and in summer from 80 to 90. The present annual income of the college is by fees of the students, and otherwise, about 1000 *l.*; and it has also funds in possession. The library of the college was almost wholly destroyed by the late war; but it has collected, by means of donations, and out of the wreck of the former library, about 2,300 volumes. Its philosophical apparatus, worth about 500 *l.* was destroyed in the war. The college edifice is a handsome stone building, containing 42 chambers, for the accommodation of students, a dining-hall, chapel, and room for the library. Its situation is singularly pleasant and healthful. This college has furnished a number of civilians, divines, and physicians, of the first rank in America. The charter for Queen's college, at Brunswick, was granted just before the war, in consequence of an application from a body of the Dutch church. Its funds, raised wholly by free donations, amounted, soon after its establishment, to 4000 *l.*; but they were considerably diminished by the war. This college at present exists only in name.

The university of Pennsylvania, founded and endowed by the legislature during the war, was lately united with the college of Philadelphia. This college was founded by charter about 50 years ago. In the western part of this state, at Carlisle, is Dickinson college, founded in 1783, and named after his excellency John Dickinson, author of the "Pennsylvania Farmer's Letters," and formerly president of the supreme executive council of this state. It has a principal, three professors, a philosophical apparatus, a library, consisting of nearly 3000 volumes; 4000 *l.* in funded certificates, and 10,000 acres of land, the last, the donation of the state. In 1787, the number of students in this college amounted to 80; and it has since increased every year. In 1787, a college was founded at Lancaster, and honoured with the name of Franklin college, after Dr. Franklin. This college is designed for the Germans, in which they may educate their youth in their own language, and in conformity to their own habits; the English language, however, is taught in it. Its endowments are nearly the same with those of Dickinson college. Its trustees consist of Lutherans, Presbyterians, and Calvinists, German and English, of each an equal number. The principal is a Lutheran, and the vice-principal a Calvinist.

In 1782, a college was instituted at Chestertown, in that county, in the state of Maryland, and honoured with the name of Washington college, after president Washington. It is under the management of 24 visitors, or governors, with power to supply vacancies, and hold estates, whose yearly value shall not exceed 6000 *l.* current money. By a law, enacted in 1787, a permanent fund was granted to this institution, of 1250 *l.* a year, currency, out of the monies arising from marriage licenses, fines, and forfeitures on the eastern shore.

St. John's college was instituted in 1784, under the care of 24 trustees, empowered to fill up vacancies, and to receive an annual income of 9000 *l.* A permanent fund is assigned this college, of 1750 *l.* a year, out of the monies arising from marriage licences, ordinary licences, fines, and forfeitures on the western shore. This college is established at Annapolis. The two colleges constitute one university, by the name of "the university of Maryland," whereof the governor of the state for the time being, is chancellor, and the principal of one of them vice-chancellor, either by seniority or by election. The chancellor is empowered to call a meeting of the trustees, under certain circumstances, which meeting is styled "the convocation of the university of Maryland," who are to frame the laws, preserve uniformity of manners and literature in the colleges, confer the higher degrees, determine appeals, &c.

The Roman catholics have also erected a college at George-town, on Potomak river, for the promotion of general literature. In 1785, the methodists instituted a college at Abington, in Hartford county, by the name of Cokesbury college, after the name of Thomas Coke, and Francis Asbury, bishops of the methodist episcopal church. The students are to consist of the sons of travelling preachers, the sons of annual subscribers, the sons of the members of the methodist society, and orphans, and are to be instructed in English, Latin, Greek, logic, rhetoric, history, geography, natural philosophy, and astronomy; and when the finances of the college will admit, they are to be taught the Hebrew, French, and German languages. This college was erected, and is supported wholly by subscription and voluntary donations.

The college of William and Mary, in the state of Virginia, was founded in the time of king William and queen Mary, who granted to it 20,000 acres of land, and a penny per pound duty on certain tobaccos exported from Virginia and Maryland, which had been levied by the statute of 25 Car. II. The assembly also gave it, by temporary laws, a duty on liquors imported, and skins and furs exported. From these resources it received upwards of 3000 *l.* The buildings are of brick, and sufficient for the accommodation of about 100 students. By its charter, it was to be governed by 20 visitors, and to have a president and six professors, who were incorporated under this charter; a professorship of the Greek and Latin languages, a professorship of mathematics, one of moral philosophy, and two of divinity, were established. To these were annexed, for a sixth professorship, a considerable donation by Mr. Boyle of England, for the instruction of the Indians, and their conversion to Christianity. This was called the professorship of Brafferton, from an English estate purchased with the monies given. There are now six professorships, one of moral philosophy, natural philosophy, and the belles lettres, one of mathematics, one of law, one of modern languages, and two of humanity. The philosophical apparatus is complete, and the library extensive.

The academy, in Prince Edward county, has been erected into a college, by the name of "Hampden Sydney college."

The legislature of Virginia, while Kentucky belonged to that state, made provision for a college in it, and endowed it with very considerable landed funds. A library was also formed for its use. This college has not flourished of late; another has been established, and considerable funds collected for its support.

The general assembly in North Carolina passed a law in 1789, incorporating 40 gentlemen, five from each district, as trustees of the university of N. Carolina. To this university they gave, by a subsequent law, all the debts due to the state, from sheriffs or other holders of public money, and which had been due before the year 1783. They also gave it all escheated property within the state. A considerable quantity of land has also been given to the university. The trustees have fixed on Chapel hill, in Orange county, for the site of the university. The buildings in this elevated and agreeable situation have been completed, and the academical studies commenced in January, 1795.

In the state of Tennessee they have now three colleges established by law, *viz.* Greenville college in Greene county, between Greenville and Nolychuckey river, instituted by act of assembly in 1794, and placed under the management of a president, who has collected, in money and books for its foundation, about 5000 dollars, and 14 trustees. They have also Blount college, at Nashville, and Washington college in the county of the same name.

Three colleges have lately been incorporated by law in South Carolina; one at Charleston, one at Winnsborough, in the district of Camden, and the other at Cambridge, in the district of Ninety-six.

In the state of Georgia, the charter containing their present system of education, supported with funds arising from about 50,000 acres of land, was passed in the year 1785; in consequence of which, a college, with ample and liberal endowments, was instituted in 1801 at Louisville, a high and healthy part of the country, near the centre of the state. The funds originally designed to support the literary orphan-house, founded by the Rev. George Whitefield, have been vested by the legislature, in 1792, on the demise of the countess of Huntingdon, to whom Mr. Whitefield beqeathed this property as trustee, in 13 commissioners, with independent powers, for carrying on the original intention of Mr. Whitefield into execution; and, in compliment to the countess, the seminary is called Huntingdon college.

In 1791, the legislature of the state of Vermont passed an act for establishing an university at Burlington, on lake Champlain, in a delightful situation, on the south side of the Winouski, or Onion river, and appointed 10 trustees. The sum of 6000*l.* was secured by donation, part of which is to be applied to the erection of buildings, and part settled as a fund for the support of the institution. In the several grants made by this state, about 33,000 acres of land have been reserved for the use of this university.

Dartmouth college, so called after the right honourable William, earl of Dartmouth, one of its principal benefactors, is situated in the township of Hanover, and state of New Hampshire, on a beautiful plain, about half a mile E. of Connecticut river, in N. lat. 43° 33′. It was founded by Dr. Wheelock in 1769, who obtained for it a royal charter, with a view of civilizing and christianizing the children of Pagans. After surviving many embarrassments during the war, it is now one of the most flourishing seminaries in the United States. Its funds consist chiefly of lands, amounting to about 80,000 acres of increasing value. Its revenue arising from the lands, in 1793, amounted annually to 140*l.* and by certain contracts then made, would amount in twelve years to 650*l.* The income from tuition is about 600*l.* per annum. The number of under-graduates, is, on an average, about 150*l.* The students are under the immediate government and instruction of a president, who is also professor of history; a professor of mathematics; a professor of languages; and two tutors. The college is furnished with a handsome library and a philosophical apparatus tolerably complete. A new college built of wood, 150 by 50 feet, and three stories high, was erected in 1786, containing 36 rooms for students. Three other public buildings belong to the college.

In 1801, an act passed for establishing an university in the town of Athens, in the state of Ohio, which now bears the name of the "Ohio University." The corporation is to consist of the governor of the state, for the time being, the president, and not more than 15 nor less than 10 trustees. The present endowment of this institution consists of two townships of land, amounting to 46,080 acres. Congress, in 1787, covenants with the Ohio company to give these lands in perpetuity for the purposes of an university.

Jefferson college, so named after the respectable and intelligent president, is a new foundation in the Mississippi territory.

Bowdoin college is situated in the district formerly called the province of Maine, in the village of Brunswick, upon the river called by the Indian natives Androscoggin, which name it still retains. The legislature, about the year 1794, incorporated certain persons for the purpose of establishing an university or college in the district of Maine, under the name of Bowdoin college, so called after the honourable James Bowdoin, esq. late governor of the Massachusetts. The legislature granted several townships of unsettled lands within the district of Maine to the college as a fund for its support,

ſupport, and the ſon of the gentleman above-named has been a very liberal benefactor to the inſtitution. Buildings have lately been erected for the accommodation of the ſtudents and preſident. The library, apparatus, and profeſſorſhips of the college are yet upon a limited ſcale; but its ſituation is favourable, and the activity of its patrons and friends, among whom we may mention, Benjamin Vaughan and Charles Vaughan, eſqs. cannot fail to promote its growing proſperity.

College, *Chelſea*. See Hospital and Chelsea.

College *of Civilians*, commonly called *Doctors Commons*; a college founded by Dr. Harvey, dean of the arches, for the profeſſors of the civil law reſiding in this city; where uſually, likewiſe, reſides the judge of the arches court of Canterbury, judge of the Admiralty, of the prerogative court, &c. with other civilians; who all uſed to live, as to diet and lodging, in a collegiate manner, commoning together: whence the appellation of *Doctors Commons*.

Their houſe being conſumed in the great fire, they all reſided at Exeter-houſe in the Strand, till 1672; when their former houſe was rebuilt, at their own expence, in a very ſplendid manner. To this college belong, beſides other officers, a number of proctors: who make themſelves parties for their clients, manage their cauſes, &c.: and ſeveral courts, maritime and eccleſiaſtical, as thoſe of arches, admiralty, prerogatives, delegates, and conſiſtory. The doctors are ſuch as having graduated at one of the univerſities, are afterwards admitted of the college of advocates belonging to theſe courts.

College, *Dulwich*. See Allen.

College, *Greſham*, or College *of Philoſophy*, a college founded by ſir Thomas Greſham, and endowed with the revenue of the Royal Exchange, and other premiſſes; one moiety of this endowment the founder bequeathed to the mayor and aldermen of London, and their ſucceſſors in truſt, that they ſhould find four able perſons to read, within the college, divinity, geometry, aſtronomy, and muſic, who are choſen by a committee of the common-council, conſiſting of the lord-mayor and three aldermen and eight commoners, and allowed each, beſides lodging, fifty pounds, per annum. The other moiety he left to the company of mercers, to find three other perſons, choſen by a committee of that company, conſiſting of the maſter and three wardens, during their office, and eight of the court of aſſiſtants, to read law, phyſic, and rhetoric, on the ſame terms; with this limitation, that the ſeveral lectures ſhould be read in term-time, every day in the week, except Sundays: in the morning in Latin, in the afternoon the ſame in Engliſh: but that in muſic to be read only in Engliſh. As the ſettlement of this college could not take place till after the death both of ſir Thomas Greſham and his lady, the two corporations could not proceed to act till the month of December, 1596, after the deceaſe of lady Greſham. Accordingly, in the choice of the firſt ſeven profeſſors, which was completed before the 31ſt of March in the following year, when they took their ſeveral apartments in the manſion-houſe, according to the allotment then made, the electors ſeem to have been deſirous of manifeſting an equal regard to both the univerſities; ſo that three were choſen from Oxford, and three from Cambridge, and the ſeventh, who was a graduate of both, upon the recommendation of queen Elizabeth.

By 8 Geo. III. cap. 32. the building appropriated to this college was taken down, and the exciſe-office erected in its room. Each of the profeſſors is allowed fifty pounds per annum, in lieu of the apartments, &c. relinquiſhed by them in the college, and is permitted to marry, notwithſtanding the reſtriction of ſir Thomas Greſham's will. The lectures are now read in a room over the Royal Exchange; and the city and mercers' company are required to provide a proper place for this purpoſe.

In this college formerly met the Royal Society, that noble academy, inſtituted by king Charles II. and celebrated throughout the world, for their improvements in natural knowledge. See their hiſtory and policy, under Royal Society.

College *of Heralds*, or College *of Arms*, a corporation founded by king Richard III., who, by charter bearing date the 2d of March, in the firſt year of his reign, made the kings, heralds, and purſuivants of arms, one body corporate by the name of "Le garter regis armorum Anglicorum, regis armorum partium auſtralium, regis armorum partium borealium, regis armorum walliæ, et heraldorum, proſecutorum, ſive purſevandorum armorum;" empowered them to have and uſe a common ſeal, and granted to them and their ſucceſſors, for the uſe of the twelve principal officers of the corporation, a houſe with its appurtenances, then called Colde Arbor, and ſituated within the pariſh of All-Hallows the Leſs, in the city of London; they finding a chaplain to celebrate maſs daily in the ſaid houſe, or elſewhere at their diſcretion, for the good ſtate of health of Anne his queen, and Edward, prince of Wales, during their lives, and for their ſouls after their deceaſe.

In conſequence of the Act of Reſumption, paſſed in the firſt year of the reign of king Henry VII., this houſe was ſeized into the king's hands, becauſe it was ſuppoſed to belong perſonally to John Writhe, garter, who then lived in it, and not to the officers of arms in their corporate capacity.

The officers of arms, during the reigns of Henry VII. and Henry VIII., frequently petitioned the throne for a grant of ſome houſe or place wherein to hold their aſſemblies, but without ſucceſs. King Edward VI., however, in a charter dated the 4th of June, in the third year of his reign, and by authority of parliament, endeavoured to make them ſome amends, by confirming to them all their ancient privileges, as to be free and diſcharged from all ſubſidies, in all realms where they make their demoure; as alſo from all tolls, taxes, cuſtoms, impoſitions, and demands, as well from watch and ward, as from the election to any office of mayor, ſheriff, bailiff, conſtable, ſcavenger, church-warden, or any other public office of what degree, nature, or condition ſoever.

Philip and Mary, by their charter bearing date the 18th day of July, in their firſt and ſecond years, re-incorporated the kings, heralds, and purſuivants of arms by their former names; and to the intent that they might reſide together, and conſult and agree amongſt themſelves for the good of their faculty, and for the depoſiting and ſecure preſervation of their records, inrolments, and other documents and papers, granted to them a meſſuage, with its appurtenances, called Derby Houſe, ſituate in the pariſh of St. Benedict and St. Peter, within the city of London, and in the ſtreet leading from the ſouth door of the cathedral church of St. Paul, to a place there called Paul's Wharf, and then late in the tenure of ſir Richard Sakevyle, knight, but theretofore parcel of the poſſeſſions of Edward, earl of Derby, and to be by the ſaid corporation held in free burgage of the city of London.

In the great fire of London, anno 1666, the college was entirely conſumed: but the heralds had the good fortune to ſave all their muniments and books, which were depoſited in the palace at Whitehall; from whence they were afterwards removed into the palace at Weſtminſter, near to the Court of Requeſts, whereupon public notice was given in the

the London Gazette, that the Heralds' Office was there kept. The college was afterwards rebuilt, and, as a regular quadrangular building, is considered one of the best designed and handsomest brick edifices in London, particularly the hollow archway of the great gate, which is esteemed a singular curiosity.

The corporation consists of three kings of arms, Garter, Clarenceux, and Norroy, six heralds, *viz.* Windsor, Chester, Lancaster, Somerset, York, and Richmond, and four pursuivants, *viz.* Portcullis, Rougedragon, Bluemantle, and Rouge-Croix; who all take precedency, according to the dates of their respective patents.

Arms of the college; argent, a cross gules between four doves rising azure.

Crest. On a ducal coronet or, a dove rising azure.

Supporters. Two lions rampant guardant argent, ducally gorged or.

COLLEGE *of Heralds* in Scotland, consists of Lyon king at arms, six heralds, and six pursuivants, and a number of messengers.

COLLEGE *of Justice.* See COURT *of* JUSTICE.

COLLEGE *of Merchants.* See BURSE.

COLLEGE, *Military, Royal,* was instituted in 1799, under the direction of twelve commissioners, a governor, and professor of mathematics. It consists of two departments, the senior, established at Wycombe, and the junior at Marlow, in Buckinghamshire, each under the care of a commandant, superintendant, and adjutant, and under the instruction of a number of professors, in different branches of science and literature.

COLLEGE *of Physicians,* a corporation of physicians in London; who, by several charters and acts of parliament of Henry VIII. and his successors, have certain privileges, whereby no man, though a graduate in physic of any university, may, without licence under the said college seal, practise physic in, or within seven miles of London, under the penalty of paying 5*l.* for every month they practised; with power to administer oaths, fine and imprison offenders in that and several other particulars: to search the apothecaries shops, &c. in and about London, to see if their drugs, &c. be wholesome, and their compositions according to the form prescribed by the said college in their dispensatory. By the said charter they, and their licentiates, are also freed from all troublesome offices: as to serve on juries, be constable, keep watch, provide and bear arms, &c. The project and plan of this institution were formed by Dr. Thomas Linacre, physician to Henry VIII., and patronized by cardinal Wolsey, at whose desire the king granted a charter, Sept. 23d, A. D. 1518, incorporating several persons of the medical class into a body, community, and perpetual college. To this college Henry granted various rights, powers, and immunities by his charter; such as a right to elect a president annually for the government of the college; to have a common seal; to purchase lands to a certain value; to sue and be sued by the name and title of "The president and community of the college of physicians in London;" and to make laws and regulations for the good government of the college, &c. &c. This charter was confirmed by parliament, A. D. 1523, 15 Hen. VIII. This institution was intended and calculated to raise the reputation of the medical profession, and prevent the people from being imposed upon by bold and ignorant adventurers, who sported with their lives, and robbed them of their money. These two acts of parliament, which were for some time strictly executed, had one remarkable effect: by greatly diminishing the number of practitioners, they made the regular practice of physic and surgery exceedingly lucrative. "The most effectual security against poverty," says Erasmus (Oper. t. v. p. 661.) "is the art of medicine, which of all arts is the most remote from mendicity."

The society had anciently a college in Knight-Rider-street, the gift of Dr. Linacre. Since that they have had a house built for them by the famous Dr. Harvey, in 1652, at the end of Amen-Corner, which he endowed with his whole inheritance in his life-time; but this being burnt in the great fire in 1666, a new one was erected at the expence of the fellows, in Warwick-lane; with a noble library, given partly by the marquis of Dorchester, and partly by sir Theodore Mayerne.

Of this college there are at present, a president, four censors, eight electors, a register, and a treasurer, chosen annually in October: the censors have by charter power to survey, govern, and arrest all physicians, or others practising physic, in, or within seven miles of London; and to fine, amerce, and imprison them at discretion.

The number of fellows was anciently thirty, till king Charles II., who renewed their charter in 1663, increased their number to forty; and king James II. giving them a new charter, allowed the number of fellows to be enlarged, so as not to exceed fourscore; reserving to himself and successors the power of placing and displacing any of them for the future. Since that time, they have been limited to no certain number, but remain candidates a year, before their admission as fellows.

The college is not very rigorous in asserting their privileges; there being a great number of physicians, some of very good abilities, who practise in London, &c. without their licence, and are connived at by the college: yet, by law, if any person, not expresly allowed to practise, take upon him the cure of any disease, and the patient die under his hand, it is deemed felony in the practiser.

According to the constitution of the college, or at least of certain by-laws which have been enacted, not, however, invariably adhered to, all physicians, but the graduates of Oxford and Cambridge, are excluded from the fellowship of the college. A late writer, in favour of the licentiates, after citing a variety of strong passages from the speeches of lord Mansfield and other judges, proceeds to remark; "It is asserted then upon the highest legal authority, that the college of physicians are unwarranted in making by-laws, which infringe the design and intention of the crown and parliament in their institution; and it has been proved that the by-laws, which exclude all graduates but those of Oxford and Cambridge from the fellowship of the college, without any investigation of their competency and fitness, are founded in usurpation;—an usurpation which cannot be justified by any possible construction of the charter, or acts confirming it. It is, therefore, demonstrated, that such by-laws are illegal, and that they may be annulled, and their pernicious consequences abolished." The practical conclusion, with respect to those whom the college will at present admit only to the rank of licentiates, is to claim admission to fellowships "under the charter of incorporation itself, on the broad basis of individual qualification, without the least regard to places of study, or to local graduation." The claim, however, has not yet been allowed. See Dr. Ferris's General View of the Establishment of Physic as a Science in England, &c." 8vo. 1795.

COLLEGE, *Royal, of Physicians,* in Scotland, is a corporation of physicians at Edinburgh, established by patent of Charles II. 29th November, 1681. This college consists of a president, two censors, a secretary, and the ordinary society of fellows. They have similar rights and privileges with those of the English college.

In Ireland there is likewise a college of Physicians, consisting of a president, vice-president and censor, treasurer, and a number of fellows.

College *of Singers*, at Rome. It is allowed unanimously by ecclesiastical writers, that it was the learned and active pope Gregory the Great, whose pontificate began in 590, who collected the musical fragments of such ancient hymns and psalms as the first fathers of the church had approved, and recommended to the primitive Christians; and that he selected, methodized, and arranged them in the order which was long continued at Rome, and soon adopted by the chief part of the western church.

The anonymous author of his life published by Canisius, speaks of this transaction in the following words: "This pontiff composed, arranged, and constituted the *antiphonarium*, and chants used in the morning and evening service." And Fleury, in his Hist. Ecclef. tom. viii. p. 150, gives a circumstantial account of the *scola cantorum*, instituted by St. Gregory. It subsisted three hundred years after the death of that pontiff, which happened in 604, as we are informed by John Diaconus, author of his life. The original *antiphonarium* of this pope was then subsisting; and the whip with which he used to threaten to scourge the boys; as well as the bed on which he reclined in the latter part of his life, when he visited the school in order to hear them practise. Two colleges were appropriated to these studies; one near the church of St. Peter, and one near that of St. John Lateran; both of which were endowed with lands.

It seems as if a college of singers for the education and exercise of the singers in the service of the papal chapel had always subsisted at Rome from the time of its establishment by Gregory.

It was from this college that the rest of Europe had masters to instruct the priests and choral singers in canto firmo. We learn from Venerable Bede, and from William of Malmsbury, that Austin the monk, commonly called the English apostle, who was sent from Rome by pope Gregory the Great, to convert the Saxons, instructed them in ecclesiastical music.

Bede tells us, that when Austin and the companions of his mission, had their first audience of king Ethelbert in the Isle of Thanet, they approached him in procession, singing litanies; and that, afterwards, when they entered the city of Canterbury, they sung a litany, and at the end of it, *Allelujah*.

Venerable Bede was himself an able musician; and he informs us, that in 680, John, Præcentor of St. Peter's in Rome, was sent over by pope Agatho to instruct the monks of Weremouth in the art of singing, and particularly to acquaint them with the manner of performing the festival services throughout the year, according to that which was practised at Rome. And such was the reputation of his skill, that "the masters of music from all the other monasteries of the north came to hear him; and prevailed on him to open schools for teaching music in other places of the kingdom of Northumberland."

And Charlemagne, finding the Roman chant superior to that of France, procured masters of pope Adrian, from the college of singers, established by Pope Gregory, to teach his subjects throughout his extensive dominions. And Theodore and Benedict, two chanters of great learning and abilities, who had been instructed by St. Gregory himself, were elected for that purpose. Adrian likewise granted to him *antiphonaria*, or choral books of that saint, which he had written himself in Roman notes.

Adrian; Stephen, monk of Canterbury; friar James, and many others, are celebrated by Bede for their skill in singing after the Roman manner. It was then the custom for the clergy to travel to Rome for improvement in music, as well as to import masters of that art from the Roman college. At length the successors of St. Gregory, and of Austin his missionary, having established a school for ecclesiastical music at Canterbury, the rest of the island was furnished with masters from that seminary.

It would be easy to prove, that good taste in canto firmo, as well as in dramatic music, has at all times been derived from the Italian school. Much has been said by travellers, and writers on music, of the refined and polished manner of performing the famous *miserere* of Allegri, in the pontifical chapel; and it will be easy to judge of the abilities of the singers educated in the Roman college, to do justice to every composition in that service, from the account given by Angellini Bontempi, in his "History of Music," of their education and course of study. "The disciples of the Roman school," says this author, "were obliged to exercise themselves in difficult intonations an hour every day, in order to acquire a facility of execution; another was spent in the practice of shakes; another in rapid passages; another in the study of literature, and another in taste and expression, in the presence of the master, who obliged them to sing before a mirror, in order to avoid every grimace or improper motion of the muscles, either by furrowing the forehead, knitting the brows, or distorting the mouth: and all these studies were but the employments of the morning. In the afternoon, half an hour was spent in harmonics, or the theory of sound; another in counterpoint, upon a plain song; an hour in receiving rules of composition from the master, and putting them in practice on paper; another in the study of languages; and the rest of the day in practising on the harpsichord, in composing a motet or anthem, a song, or in some other kind of writing, suitable to the genius and progress of the scholar: and these were the common exercises on those days, when the students were not allowed to quit the college; but when they were permitted to go out, they frequently went to sing at the echo, without the Porta-Angelica, near mount Marius, where, by listening to the answers, or reflection of the passages, they could judge of their own defects; at other times they were either employed in singing at the musical performances in the churches of Rome on days of festivals, or, at least were allowed to go thither to hear the great professors who flourished in the pontificate of Urban VIII., who reigned from the year 1624 to 1644. At their return to college, they employed the rest of their time in practising after these models, and in giving reasons to the master for what they did; who, in his turn, used to read lectures upon the most refined and useful mysteries of the musical art." Historia Musica, Perugia, 1695

College, *Sion*, or the college of the London clergy; which has been a religious house time out of mind, sometimes under the denomination of a priory, sometimes under that of a spital, or hospital; at its dissolution under 31 Hen. VIII. it was called Elsyn's *Spital*, from the name of its founder, a mercer, in 1329.

At present it is a composition of both, *viz.* a college for the clergy of London, who were incorporated in 1630, in pursuance of the will of Dr. White, under the name of the *President and Fellows of* Sion-College; and an hospital for ten poor men, and as many women.

The officers of the corporation are the president, two deans, and four assistants; who are annually chosen from among the rectors and vicars of London; and are subject to the visitation of the bishop. The fellows of this college are all the incumbents of parishes within the city and its liberties. They have a good library, built and stocked by Mr. Simpson, and furnished by several other benefactors, chiefly for the clergy

clergy of the city, without excluding other ſtudents on certain terms; and a hall, with chambers for ſtudents, generally occupied by the miniſters of the neighbouring pariſhes.

College *of Surgeons, Royal*, was incorporated by charter in 1800, under a maſter, two governors, and 18 aſſiſtants. Its houſe is in Lincoln's Inn Fields. There is alſo at Edinburgh a royal college of ſurgeons of late inſtitution, under a preſident, treaſurer, and honorary fellows. This college is authoriſed for carrying into execution a ſcheme for providing for their wives and children, &c.; and for examining and licenſing, if found qualified, all practitioners in ſurgery, within certain limits.

College *de Propaganda Fide*, was founded at Rome in 1622, by Gregory XV. and enriched with ample revenues. It conſiſts of thirteen cardinals, two prieſts, one monk, and a ſecretary; and was deſigned for the propagation and maintenance of the Roman religion in all parts of the world. The funds of this college have been very conſiderably augmented by Urban VIII. and many private donations. Miſſionaries are ſupplied by this inſtitution, together with a variety of books ſuited to their ſeveral appointments. Seminaries for their inſtruction are ſupported by it, and a number of charitable eſtabliſhments connected with it, and conducive to the main object of its inſtitution.

Another college of the ſame denomination was eſtabliſhed by Urban VIII. in 1627, in conſequence of the liberality of John Baptiſt Viles, a Spaniſh nobleman. This is ſet apart for the inſtruction of thoſe who are deſigned for the foreign miſſions. It was at firſt committed to the care of three canons of the patriarchal churches; but ever ſince the year 1641, it is under the ſame government with the former inſtitution.

College, *Veterinary*, a recent inſtitution formed at St. Pancras, in the vicinity of London, for the reformation and improvement of farriery, under the direction of a preſident, 10 vice-preſidents, a profeſſor, and treaſurer. This inſtitution cannot otherwiſe than be regarded by every reflecting perſon, as an object of national importance as well as of private utility; and in both theſe views merits liberal encouragement.

Colleges *of common law*. See Inns *of Court*, and Chancery.

Colleges *for diſabled ſoldiers, ſeamen, &c.* See Hospitals.

Collegial. See Collegiate.

COLLEGIANS, Collegiani, Collegiants, in *Eccleſiaſtical Hiſtory*, a religious ſect formed among the Arminians and Anabaptiſts in Holland, about the beginning of the ſeventeenth century; ſo called, becauſe of their colleges or meetings, twice every week, where every one, females excepted, has the ſame liberty of expounding the Scripture, praying, &c.

They are ſaid to be all either Arians, or Socinians; they never communicate in the college, but meet twice a year from all parts of Holland at Rhinſbergh, whence they are alſo called *Rhinſberghers*, a village two miles from Leyden, where they communicate together; admitting every one that preſents himſelf, profeſſing his faith in the divinity of the holy Scriptures, and reſolution to live ſuitably to their precepts and doctrines, without regard to his ſect or opinion. They have no particular miniſters, but each officiates as he is diſpoſed. They never baptize without dipping.

At Rhinſberg they have ample and convenient houſes for the education of orphans, and the reception of ſtrangers; and here they remain together during the ſpace of four days, which are employed in hearing diſcourſes that tend to edification, and exhortations that are principally deſigned to inculcate brotherly love, and ſanctity of manners. Thoſe of the brethren that reſide in the province of Frieſland, have an annual meeting at Lewarden, where they adminiſter the ſacraments, as the conſiderable diſtance at which they live from Rhinſberg renders it inconvenient for them to repair thither twice a-year. Their community comprehends perſons of all ranks, orders, and ſects, who profeſs themſelves Chriſtians; though their ſentiments concerning the perſon and doctrine of the divine founder of Chriſtianity be extremely different. It is kept together, and its union maintained, not by the authority of rulers and doctors, the force of eccleſiaſtical laws, the reſtraining power of creeds and confeſſions, or the influence of certain poſitive rites and inſtitutions, but merely by a zeal for the advancement of practical religion, and a deſire of drawing inſtruction from the ſtudy of the holy ſcriptures. In ſuch a community, in which opinion is free, and every one is permitted to judge for himſelf in religious matters, diſſenſions and controverſies can ſcarcely be ſuppoſed to occur. However diſſenſions took place, the conſequence of which was a diviſion of the collegiants into two parties, which held their aſſemblies ſeparately, at Rhinſberg. This diviſion happened in the year 1686; but it was healed about the commencement of the following century, by the death of thoſe who had principally occaſioned it; and then the collegiants returned to their former union and concord. Moſh. E. H. vol. v.

COLLEGIATE, or Collegial *churches*, are thoſe which have no biſhop's ſee, yet have the ancient retinue of the biſhops, the canons, and prebends. Such are, among us, Weſtminſter, Rippon, Windſor, &c. governed by deans and chapters.

Of theſe collegiate churches, there are two kinds; ſome of royal foundation, others of eccleſiaſtical foundation; each of them, in matters of divine ſervice, regulated in the ſame manner as the cathedrals.

There are even ſome collegiate churches which have the epiſcopal rights. Some of theſe churches were anciently abbeys; which, in time, were ſecularized. The church of St. Peter's, Weſtminſter, was anciently a cathedral; but the revenues of the monaſtery being, by act of parliament, 1 Eliz. veſted in the dean and chapter, it commenced a collegiate church.—In ſeveral cauſes, the ſtyling it cathedral, inſtead of collegiate church of Weſtminſter, has occaſioned error in the pleadings.

Collegiate *auditors*. See Auditor.

Collegiate *churches, vergers of*. See Verger.

COLLEONE, Bartholomew, in *Biography*, was born in the year 1400, of a family of diſtinction at Bergamo, in Italy. He was famous among the ſoldiers of fortune, having been trained from his youth in the military art. He firſt ſerved under Bracchio de Montone, and then entered into the ſervice of the queen of Naples, who was indebted to him for the recovery of her dominions. He rendered important ſervices to the Venetians, by whom he was handſomely rewarded; but owing to a quarrel with a noble Venetian, he went over to the duke of Milan, and ſerved with great reputation, firſt under Viſconti, and then under Francis Sforza. He again enliſted in the Venetian ſervice; and was in 1458, made their generaliſſimo; an office which he held twenty years with the higheſt reputation to himſelf, and to the terror of the enemies of the republic. Colleone was a patron of literature, and was fond of the company of learned men, to whoſe diſcuſſions on philoſophical ſubjects he always paid the moſt marked attention. He founded monaſteries, built churches, and inſtituted various charities. But notwithſtanding theſe inſtances of his liberality, he amaſſed great wealth, which he bequeathed to public purpoſes. He died in 1475,

at

at his castle of Malpaga; and the senate of Venice erected an equestrian statue to his memory. In his youth, Colleone was distinguished as well for his courage, as for bodily strength and agility; and it is asserted that when completely armed, he could run faster than the lightest footman, and without arms he could surpass a horseman on full gallop. This vigour he preserved to almost the last. In the latter part of his life he was held in so much estimation, that no prince or person of rank, however exalted, who travelled in the part of the country in which he lived, ever neglected to pay him a visit. On his dying bed, he gave it, as advice to the Venetians, that they should never give so much power to a general as he had possessed. After his death 4000 soldiers refused to obey any other chief, and served 15 years without a leader, diligently practising the discipline he had taught them. Moreri.

COLLEONI, Girolamo, a painter of Bergamo, whose style so much resembled that of Titian, that his picture of the marriage of St. Caterina in the gallery of the Carrara family, was for a long time considered the work of that great master; till at length the inscription Hieronymus Colleo, 1555, was discovered, and the credit of the performance restored to its right owner. It is said of this master, that having found inferior artists and strangers preferred to the honour of executing public works, whilst he himself was passed by unnoticed, he formed the resolution to quit his ungrateful country, and sought an asylum at the court of Madrid. Before, however, he departed, he painted the figure of a horse, of the merit of which no idea can now be formed, except from the prodigious encomiums bestowed upon it by various writers: under the picture was this proverb: *nemo propheta in patria*. Besides the picture above-mentioned in the Carrara gallery, there are still some remains of his fresco in Bergamo. He flourished as early as 1532. Lanzi. Storia Pitt.

COLLET, John, an English painter, whose pictures of ludicrous subjects, in the manner of Hogarth, are well known. Heinecken mentions several prints from his works, and two were etched by himself; one of which represents antiquarians smelling at the chamber-pot of queen Boadicea; and the other, a monkey, who is pointing to a very dark picture of Moses striking the rock, probably in ridicule of the connoisseurs of that period, who thought every piece deserving of notice, in proportion as it was black and unintelligible. Strutt says, that Collet flourished in 1760, and Heinecken informs us, that he died in 1780.

Collet, Philibert, was the son of a notary, and was born at Chatillon les Dombes, in 1643. He pursued his studies at Lyons, in the college of the Jesuits, of which order he became a noviciate, but quitted their society at the age of 22, and dedicated himself to the profession of the law. By the liberality of sentiment which he displayed in his writings, he excited an ill-founded suspicion, that he was an enemy to religion. This imputation has, indeed, been in all ages the lot of those who have impugned ecclesiastical abuses, and could not fail to be levelled at Philibert, who attacked the power of the priests, in a "Treatise on Excommunications;" a "Tract on Usury;" "Discourses on Tythes and Alms," and on the "Cloystering of Nuns." He died in 1718, after a solemn declaration, that he did not repent of any of these publications which had excited against him no ordinary degree of prejudice.

Collet, Richard, a performer on the violin with a full tone and strong hand. He was leader of the band at Vauxhall, from its first opening to the death of Jonathan Tyers, where he executed the compositions of Corelli, Handel, Geminiani, very accurately, but without taste or expression; so that he always remained an inelegant player.

Collet, Thomas, a second rate violoncello player, in a much lower form than his brother. He was lame upon one of his legs; and upon his instrument his hand could hardly be said to be otherwise.

Collet, Peter, a priest and doctor of theology, was born in the year 1693, at Ternay, a town in the province of Vendome, in France. His works, which treat chiefly on subjects of controversial divinity, are very voluminous, but not very valuable. The principal of them are "Theologia Moralis Universa," in 17 vols. 8vo.; "Institutiones Theologicæ," in 7 vols. 12mo.; and the "Life of St. Vincent de Paul," in 2 vols. 4to. He died in 1770, having sustained, through a long and active life, the character of a pious and learned divine.

Collet, in the *Glass Trade*, that part of a glass vessel which, in the manufacture, sticks to the hollow iron by which the metal is first taken out of the melting pot. This is broken off before the vessel is fashioned, and is never seen in the least mark, when finished.

These they throw together, and afterwards grind down, and put into the green glass metal, for the purest green glass, but never into any other, though they be the product of the finest virgin metal.

Collet, among *Jewellers*, the small horizontal plane, or face, at the bottom of the brilliant.

Collet *de Canon*, the smallest or most diminished part of the cannon, lying between the astragal and muzzle.

Collet-de dezes, *le*, in *Geography*, a town of France, in the department of the Lozere, and district of Mende, 12 miles S. of Villefort.

COLLETIA, in *Botany*, (so named from Collet, a French botanist.) Lam. Ill. 359. Willd. 411. Juss. 380. Vent. 3. 472. Class and order, *pentandria monogynia*. Nat. Ord. *Rhamni*, Juss. *Rhamnoideæ*, Vent.

Gen. Ch. *Cal.* one-leafed, pitcher-shaped, permanent at the base, furnished on the inside with five squamiform plaits, called petals by Ventenat; border five-cleft; segments egg-shaped, reflexed. *Cor.* none. *Stam.* Filaments five, awl-shaped, very short, inserted at the top of the calyx between the segments of the border; anthers egg-shaped. *Pist.* Germ superior, trigonous; style cylindrical; stigma three-lobed. *Peric.* Capsule tricoccous, seated on the permanent base of the calyx; cocci somewhat kidney-shaped, cohering at the inner side. *Seeds* solitary.

Eff. Ch. Calyx pitcher-shaped, five-cleft, with five squamiform plaits on the inside. Corolla none. Capsule tricoccous, with three seeds.

Sp. 1. C. *spinosa*. Lam. Illust. tab. 129. Joseph Jussieu. Commerson. "Leaves oblong-elliptical, entire or slightly toothed at the tip." A very spinous, much-branched shrub. *Branches* nearly opposite, without leaves on the upper part, and furnished with long lateral and terminal spines. *Leaves* near the bottom of the branches, small, on short petioles. *Flowers* lateral, nodding; peduncles short, one-flowered, solitary, or two together, generally at the base of the spines. A native of Peru and Brazil. 2. C. *serratifolia*. Vent. Choix des plantes. "Leaves oblong, obtuse, acutely serrated; flowers without petals, *i. e.* without the squamiform plaits." A shrub, with the habit of a lycium. 3. C. *ephedra*. Vent. Choix des plantes. "Leafless; branches erect, implicated, ending in a spine; flowers glomerated at the knots of the branchlets." The two last species are natives of Peru, discovered by Dombey. Not having present access to Ventenat's splendid work, we have taken the specific characters from the Annals of Botany.

COLLETICS,

COLLETICS, Colletica, from κολλητικος, something that has the virtue of gluing together, of κολλα, *gluten*, in *Medicine*, such remedies as join and glue together the separated parts, or lips, of a wound or ulcer; and thus re-establish them in their natural union.

Among colletics are ranked litharge, aloes, myrrh, &c. See Agglutinant.

COLLI, Le, in *Geography*, a town of Naples, in the province of Abruzzo Ultra; 15 miles west of Celano.

Colli *interspinales*, in *Anatomy*. See Interspinales.—*Intertransversales*. See Intertransversales.—*Transversalis*. See Transversalis.

COLLICLÆ, is used by some, as Steno, for the carunculæ *lacrymales*.

COLLIER, Jeremy, in *Biography*, an English nonjuring bishop, was born at Stow Qui, or Quire in Cambridgeshire, Sept. 23, 1650. He was educated by his father, a clergyman, and some time master of the free-school at Ipswich, and in 1669 he was admitted a poor scholar of Caius college, under the tuition of Mr. John Ellys. Here he took his degrees, and was afterwards successively ordained deacon and priest, by the bishops of Ely and London. For some time he officiated as chaplain to the countess dowager of Dorset at Knowle; he was afterwards presented with the living of Ampton, in Suffolk, where he resided till 1685, when he resigned on being appointed lecturer at Gray's Inn. After the revolution he refused to take the oaths, and became a zealous partizan of the abdicated sovereign. On account of a pamphlet entitled "The Desertion discussed," which he published in 1688 in opposition to one by Dr. Burnet; he was imprisoned in Newgate, from whence he was discharged without trial, and between this period and the year 1692, he published several other pamphlets which rendered him an object of extreme jealousy to the crown. He became still more obnoxious to government by a journey at this time into Kent, which led to a suspicion that he held a correspondence with the exiled James; he was accordingly arrested, examined before the earl of Nottingham, and committed to the Gate-house. He was again released for want of evidence of any criminal designs, and was admitted to bail. So strict, however, were Mr. Collier's principles, that he shortly after condemned his own want of consistency in giving bail; upon which he surrendered himself before lord chief justice Holt, in order that he might free his sureties, and was committed to the King's Bench, but upon the application of his friends, that excellent and upright judge discharged him in a few days. He then published a justification of himself, in a work entitled "The Case of giving Bail to a Pretended Authority examined." This was followed by several other tracts, which, though hostile to the new order of affairs, do not appear to have excited the attention of government. But, in 1696, he openly, in conjunction with two other nonjuring clergymen, absolved, at the place of execution, sir John Friend, and sir William Perkins, who had been convicted of engaging in the assassination plot. For this he was prosecuted to outlawry, in which state of legal incapacity he remained unmolested through the remainder of his life. Between the years 1697 and 1707, Mr. Collier published three volumes of essays on moral subjects, which obtained a very favourable reception by his contemporaries, but they are now fallen into disrepute. In 1698, he obtained a large share of celebrity for his piece entitled "A short View of the Immorality and Prophaneness of the English Stage, together with the Sense of Antiquity on this Argument." Mr. Collier in this work attacked most of the dramatic writers of the day, with so much force and ability, that those who ventured to engage with him in the controversy, were, in the public opinion, completely defeated. Without noticing the other tracts which he wrote on this subject, we pass on to his translation of Moreri's Great Historical Dictionary, which consisted of four volumes folio, published at different times, with the addition of a great number of new articles. During the reign of queen Anne, several ineffectual attempts were made to reconcile Mr. Collier to the existing government. Preferment in the church was offered to him, which he rejected, and he maintained his principles to the last. In 1702, he published the first volume "Of an Ecclesiastical History of Great Britain," which he followed by a second in 1714. This work, on which he bestowed great pains, was not remarkable for the impartiality, which it behoves the faithful historian to maintain in all subjects of dispute. His attacks on the principles and conduct of some of the most active promoters of the reformation, and of others who held opposite opinions to those which he had himself embraced, exposed him to the censures of literary characters of the first respectability, particularly of the bishops Nicholson, Burnet, and Kennet. Previously to the appearance of the second volume of his history, Mr. Collier had been privately consecrated a bishop by Dr. Hickes. In 1725 he published "Discourses upon Practical Subjects," which was his last work of any moment, and on the 26th of April, in the following year, he died of the stone, a disease to which he had been subject many of the last years of his life.

Bishop Collier was a man of intrepid courage, indefatigable industry, and of the most unsullied integrity. It is much to be regretted that a person of such talents, and possessed of so great a degree of ardour, had not embarked in a better cause, and thus have been distinguished on the side of civil and religious liberty, on which the best interests of man depend. Biog. Brit.

Collier, in *Geography* a town of America, in North Carolina; 11 miles N.E. of Wilmington.

Collier *Rouge*, of Buffon's *Natural History*, the white-tailed humming-bird, *trochilus leucurus*. Gmel.

Collier's *Reach*, in *Geography*, a place on the borders of the Black-water river in Essex, at which the Chelmer and Black-water navigation up to Chelmsford commences. See Canal.

COLLIERS, are vessels employed to carry coals from one port to another; and serving as an excellent nursery for seamen.

COLLIERY. Under the article Coal we have recently given the history of its mines and trade in Britain, its laws, the classification and description of different sorts of coal, the practice of coal-mining, and some of the principles to be observed in searching for coals; this last part admitting of farther and more general elucidation, we shall resume the subject in this place, and treat of the different opinions which naturalists have held, respecting the origin and formation of coals.

Mr. Richard Kirwan, a most indefatigable collector of facts relating to geology, when speaking of carboniferous soils or coal measures (Geological Essay, p. 290, &c.), states these to be either chiefly argillaceous or arenilitic, or both together, or of the trap kind, or calcareous; the circumstances of these, and of the coal found among them most worthy of notice, he states to be the following; *viz.*

1°. They commonly form distinct strata, or beds, one over the other to a great depth. The strata of coal are usually called *seams* (beds); it is very seldom found in irregular heaps (pipe-veins, bellies, nests), or veins (loads, fissures, rake veins, &c.).

2°. These seams are scarcely ever found *single*, but those whose thickness does not exceed 14 or 15 inches, are rarely worked.

worked. At Whitehaven five were lately worked, at Newcastle three, at Liege 20. The highest seams, and next the surface, are generally the worst (see §. 7°), but the deepest are not always the best.

3°. The thickness of different beds of coal is variable, from half an inch or less to 5 or 6 feet; but not unfrequently it amounts to 25 or 30 feet, and in some rare instances to 80 feet or more. No such seam as this last has occurred in Great Britain.

4°. Seams of coal generally occupy a considerable extent both in length and breadth, and whatever the thickness of each may be, it is commonly constant for a considerable space, as a mile or two miles; instances of a contrary kind seldom occur, unless the seam be disturbed by some obstruction (see § 16°), or at the extremities of a coal-soil, (coal-measures), or in an extent exceeding two miles.

5°. In the same stratum (seam) if exceeding 3 or 4 feet in thickness, the coal is seldom exactly of the same quality.

6°. Different seams of coal are separated from each other, by at least one, but generally by several strata of earth or stone (See article COAL); these, in a considerable extent, preserve also an uniform thickness.

7°. The uppermost seam of coal is commonly soft and dusty; it is vulgarly called *smut*.

8°. Seams of coal, and also their concomitant strata, are generally parallel to each other, unless an uncommonly thick stratum of earth, 150 or 200 feet thick, intervenes. Their number and order are also similar, to a considerable extent, yet variable in the same district and soil.

9°. In many of the concomitant strata, particularly of shale, bituminous shale, indurated clay, and sand-stone, particles of coal are found interspersed.

10°. The strata that immediately cover coal, and thence called its *roof* (crop), are shale, bituminous shale, or sand-stone; rarely any other. But they are also often found at a great distance above it.

11°. The strata on which coal reposes, and thence called its *floor*, *sole*, or *pavement*, are also sand-stone, shale, indurated clay, or semi-protolite (a reddish sand-stone or breccia). This last would, says Mr. Kirwan, in most cases, be found in its floor, if the mines were sunk deep enough to reach it. Granite has also been found in its floor in a few instances. In trap soils, trap or basalt is said to form sometimes the roof, and sometimes the sole of a seam of coal, but, in strictness, it is believed, shale mostly intervenes.

12°. Impressions of plants, particularly of the cryptogamic and culmiferous kind, are most frequently found in shale and bituminous shales that accompany coal, or which are found in coal mines, sometimes on sand stone, but very rarely on the coal itself. Roots also frequently appear in the indurated clay. Trees carbonated, or bituminated, sometimes repose on coal, or are found under it. Fluviatile (or river) shells, muscles, and land-snails, often occur; sea-shells seldom.

13°. Argillaceous iron ore is sometimes met with among the carboniferous strata of an argillaceous soil; and martial pyrites, either found, or much oftener oxygenated, and mixed with the substance of the coal.

14°. The *stretch* or *course* (drift, run) of seams of coal, and of their attendant strata, is commonly between E. and W. or N.E. and S.W. There are, however, a few exceptions to this rule.

: The *dip* (or pitch) of coal is exceedingly variable, sometimes nearly horizontal, sometimes from 25° to 45°, sometimes 75°, rarely approaching still more to the perpendicular.

16°. The uniform course (or plane) of seams of coal, and of the strata that accompany them, is frequently interrupted by obstructions, called *slips*, *dykes*, *troubles*, *faults*, (hitches, traps, breaks, fissures, loads, knots). These never fail to elevate (rise, upcast, uptrap) or depress (sink, downcast, downtrap) the strata beyond them; or rather, the strata on each side of them are found at different heights. This observation is general, being found to hold good in every part of Britain, as well as on the continent. The inequality of the height amounts from a few inches to 120 feet, but so great an inequality is rare, and has been found only in Derbyshire. In Germany it seldom exceeds, and scarcely amounts to, 50 feet.

17°. It has been observed in Britain, that if the *slip*, &c. overhangs (hades) on one side, and consequently forms an acute angle with the seam of coal which it cuts, the continuation of the stratum will be found *lower* on the other side of the slip, and consequently, *vice versâ*, if it recedes from (underlays), or forms an obtuse angle with the seam of coal on the one side; the continuation of the seam will be found higher on the other side, as in *Plate* I. *fig.* 1. of *Geology*, where *a* and *b* denote the interrupted seam of coal, and *c c*, the obstruction or *slip*, &c.

18°. These *slips*, &c. (or the matter filling them) sometimes consist of indurated clay, sometimes of sand-stone, both different from such as form the strata, but more frequently of some species of stone that never compose the strata of coal-mines, except, perhaps, rocks of the trap species; their thickness amounts in various mines, from a few inches to several yards. Nodules of coal are sometimes found in the slips, and water is frequently lodged in them. They often descend from the surface to the greatest known depths.

19°. The disposition of the strata below the surface seldom conforms to the figure of the surface. The former is often regular, when the latter is broken and uneven, and *vice versâ*; very frequently the strata dip into a hill, against the rise of the surface, or cross it in a right or diagonal line.

20°. The deepest mines known are those of Namur, some of which are said to descend 2400 feet, or 400 fathoms.

21°. The seams of coal, where in contact with their *roof*, *floor*, or *slip*, have a smooth, polished, glistening surface, which shews they were originally soft.

To the above we have, in parenthesis, added several synonyms for rendering them more intelligible in different districts; we subjoin other general conclusions of this ingenious author, relative to coals, with occasional synonyms of our own, and number them in a series following the above, for the convenience of reference: *viz.*

22°. That the quantity of earthy or stony matter in the most bituminous coal, bears no proportion to the weight of that coal; bituminous coal is capable of being charred (see COKE); and then it is a substance almost entirely resembling vegetable charcoal, which, on combustion, scarcely leaves $\frac{1}{70}$th of its weight of argil or stony matter. Geol. Ess. p. 316.

23°. That mines of *wood-coal* (brown-coal, Bovey-coal, surturbrand) have no uniformity in the thickness of their seams of wood-coal (as in § 4°); on the contrary, in the most considerable of these, an uniform decrease of thickness from the place in which the wood was first heaped, is observed. Ibid 321.

24°. That seams of real mineral coal, and those of earth or stone that accompany them, are observed to preserve their parallelism (noticed § 8°) even after an interruption by a slip or dyke, whether elevated or depressed. But in mines of wood-coal, no such parallelism, nor even any distinct number of strata prevail, but the whole appears to be one stratum, irregularly divided by masses of clay or stone. Ibid.

25°. That mines of wood-coal present sudden elevations or depressions in the same stratum; mines of real mineral coal never. Ibid 322.

26°. That

26°. That there are no flips or dykes in wood coal mines; thofe of genuine coal abound in them. Ibid.

27°. That wood-coal is frequently covered with round fragments of quartz; genuine coal never. Ibid.

28°. That there is in the mufeum of Florence, a cellular fand-ftone, the cells of which are filled with genuine mineral coal. Could this have been wood?" Ibid.

29°. That genuine coal is feldom found in plains, but wood-coal frequently is, according to Voight Pract. Ibid. 323.

30°. That the impreffions obferved on real coal, are thofe of herbaceous plants, as fern, &c.; the impreffions of refiniferous plants have never been difcovered on the ftrata that accompany coal, and the trees found are commonly birch or oak. Ibid. 318.

31°. That the traces of land vegetables, and not of marine vegetables, are found on the ftrata that cover feams of coal, or on thofe on which thefe feams reft, or on both. Sea-fhells are fcarcely ever found among them, and much lefs the bones of fifh: that, on the contrary, reeds or rufhes, and fluviatile fhells, have been found in the ftrata that cover coal. Ibid. 323.

32°. That common falt is never found in coal-mines, except when in the neighbourhood of falt fprings; but on the contrary, alum and vitriol. Ibid. 324.

33°. That carbonaceous ftrata never prefent a conic elevation on both fides of a difruptured ftratum, as would be the natural refult of an impreffion from below. Ibid. 337.

34°. That coal is never to be expected in primeval mountains, as granite, gneifs, &c., but that on the fides of thefe, particularly if very high, or in the hanging level that flopes from them to fome river or valley, it may be fought. Ibid. 347.

35°. That there is ftill a greater probability of finding it in the neighbourhood of mountains of argillaceous porphyry. Ibid.

36°. That it may be fought with probability of fuccefs in fand-ftone mountains, if fand-ftone and clay alternate, or fand-ftone, clay, and argillaceous iron ore. Ibid. 348.

37°. That in any elevated land in which fand-ftone and fhale with vegetable impreffions, or indurated clay and fhale, or bituminous fhale, form diftinct ftrata, or clay, iron ore, and fhale, with or without ftrata of fand, coal may well be expected. Ibid.

38°. That if fand-ftone be found under lime-ftone, or if they alternate with each other, and, particularly, if indurated clay and fhale form any of the ftrata, they afford a probable indication of coal; otherwife coal is very rarely found in, or under lime-ftone. Ibid.

39°. That coal is very feldom found with argillite, and fuch as has been is of the uninflammable kind. Ibid.

40°. That where trap, or whin and clay alternate, and more efpecially trap and fand-ftone, coal may be expected; it is often, but not regularly, found under bafalt; wood-coal is fometimes found under both. Ibid.

41°. That coal frequently burfts out on the furface, or on the fides of hills, in a withered ftate, which diffufes itfelf to a diftance from its origin, and requires an experienced miner to trace it truly to the feam to which it belongs. Ibid.

Such are the valuable obfervations of Mr. Kirwan, on the probable exiftence of coal in certain fituations, and on its pofition and relation to the adjoining ftrata, &c. Thefe obfervations are for the moft part unexceptionably true, and will be found confiftent with what we have delivered on this fubject, under the article COAL; but a few of them feem to require fome remarks in this place.

§ 3°. Under the names of different collieries we fhall take occafion to mention fuch feams of coal as are remarkable for their thicknefs, or other properties. The limitation of two miles, as the extent of regularity in coal feams, mentioned in § 4°, feems inconfiftent with the multiplied obfervations of Mr. Smith and other recent obfervers; fometimes two or more veins of coal which are feparated only by thin beds of fhale, or other bituminous matter unfit for ufe, are found to unite, owing probably to the diffufion of the earthy matter more generally among the coal, inftead of its forming diftinct layers therein; but generally, in purfuing the feam further, the coals feparate again; the extremities of a coal foil, can, in our opinion, only be found in the regular ending or out-crop of the meafures, (fee *Ending of* STRATA); or, where the ftrata on one fide of an obftruction or fiffure have been carried away by an abrafion or denudation of the elevated ftrata, of which we fhall give fome account, and mention feveral curious inftances in England, under the term DENUDATION. We are not inclined to think, that thick intervening meafures are more likely to alter the parallelifm of feams of coal, as mentioned § 8°, than thin ones; the contrary opinion has probably in fome cafes arifen from comparing the feam on different fides of a fault or fiffure, which hades or declines confiderably from a vertical pofition. Under the article COAL, we have explained how different borings or finkings in the fame diftrict, may differ materially, or perhaps entirely, owing to one being begun higher up on the meafures or feries of ftrata than the other, otherwife, we believe, that *the fame* ftratum will be found to have the fame fucceffion of ftrata under it. And here it may be neceffary to note, that a place being *higher up* on the feries of ftrata, has no relation to its actual elevation compared with the centre of the earth, or with a level line, as truly obferved by Mr. Whitehurft, (Enquiry p. 153,) but the loweft known ftrata in many diftricts are feen on the greateft heights; this we fhall amply illuftrate by examples, in the progrefs of our work. See *Order of the* STRATA.

The femiprotolite, mentioned § 11°, certainly has no exiftence in a large portion of the Britifh coal-mines, if it exifts in any of them; the theory adopted by our author, of granite forming the foundation in every inftance, and generally with a breccia or femiprotolite upon it, is difproved in innumerable inftances by Mr. Smith's maps and fections, fhewing the actual fucceffion of ftrata throughout the country.

We are of opinion with M. Blumenbach (Hanbuch der Natur. Gefch 703), that moft, if not all, of the vegetable foffil remains are *incognita*, and cannot be identified with any recent or known plants of the prefent race (§ 12° and 30°). The recent determinations of M. Cuvier declaring moft of the offeous remains from the ftrata, hitherto difcovered, to be *incognita*, will probably, we think, when the proper diftinction is made between the regular ftrata foffils, and thofe which ought, according to our remark under the article COAL, to be confidered as *gravel*, as *recent*, or as *peat* foffils, be much further extended, perhaps fo far as to include every animal remain which is found actually lodged in the ftrata; the diftinction, therefore, between *river* fhells and *land* fnails as accompaniments of coal, nearly to the exclufion of *fea* fhells or marine remains, we confider a mere hypothefis, as we fhall take future opportunities of fhewing.

It is not univerfally true, as mentioned § 16°, that *flips*, *dykes*, &c. never fail to elevate or deprefs the ftrata, or to occafion an inequality in their levels; (fee our defcription of dykes in the article COAL); the inftances being numerous both in the coal meafures and other ftrata, where a fiffure of confiderable width makes no fenfible alteration in the continuity of the planes of the ruptured ftrata. The alterations of level which fiffures occafion, are alfo much greater in numerous

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ous inſtances, than our author admits; beſides thoſe mentioned, (COAL), we might ſtate on the authority of Mr. Martin, that down-caſts of 40 to 100 fathoms are not uncommon in the ſtrata of what he denominates the Mineral Baſon of South Wales. (Phil. Trans. 1806. p. 342). That the diſlocations of the ſtrata (§ 17°) have been gentle and gradual, (Geol. Eſſays, 333), we cannot ſuppoſe, much leſs that the extraneous matters which fill the fiſſures (§ 18°) were of prior origin to the ſtrata themſelves, and occaſioned the overhanging or hading of the fiſſures, as our author has ſuppoſed, page 334. We have reaſon to hope, that theſe and ſeveral other hitherto unexplained phenomena of the ſtrata, will be fully made out by the new lights which we ſhall be enabled to throw on the ſubject, ariſing out of the diſcoveries of Mr. Smith, above alluded to.

That ſome rare inſtances have occurred of the ſtrata underneath, dipping in a contrary direction to thoſe near the ſurface, § 19, muſt be admitted, and of which the Somerſetſhire coal-mines deſcribed in the Philoſophical Tranſactions, N°. 360 and 391, by Mr. John Stracey, ſeem an inſtance; but in general it will be found, that the plane of the ſtrata beneath, conforms to any *regular plane* which is to be found on the ſurface, either of a hill or vale, excepting only in the firſt caſe, inſtances where a perfectly ſtraight and ſmooth fracture of the ſtrata has happened, and, in the latter caſe, where ſtagnant water has in times long poſterior to the formation of the ſtrata, made depoſits of mud, &c. in regular horizontal layers, or nearly ſo. This circumſtance is of the utmoſt conſequence to be attended to in tracing the ſtrata of a country, as alſo to note carefully the diſtinction between theſe original planes or facettes of a hill, and the curious curving ſurfaces occaſioned by the ending of ſtrata, or the leſs regular curving of the ſurface, occaſioned by the fracture (generally oblique or hading) and ſubſequent abraſion or rounding of the top and edges of the ſtrata by the action of moſt violent currents of water. The circumſtance mentioned by our author, of the ſtrata dipping into a hill, is obſervable at the endings of moſt of the ſtrata, and on the ruptured ſide of a large portion of hills and mountains, where the break or fiſſure occaſioning the hill was in the run or courſe of the ſtrata, as it lies at preſent, which, according to the obſervations of Charpertier, p. 80, is very generally the caſe; but where the preſent dip is in the direction of the fiſſure, or is inclined in any acute angle thereto, the ſtrata will croſs the riſe of the hill, direct or obliquely as the caſe may be.

The probability will be ſhewn hereafter, that ſome of the diſturbances, or ruptures in the ſtrata, have been confined to a certain number of the upper ſtrata, without affecting thoſe below, and hence regular ſtrata may ſometimes be found, under thoſe which are broken and uneven, as mentioned in this ſection; and the Somerſetſhire coal ſtrata above mentioned may perhaps thus be accounted for. We have never been able to diſcover any thing, in the upper or under ſurface of a ſeam of coal, which demonſtrates its having originally been ſoft, as mentioned § 21°; the gliſtening appearance of the ſurface in ſome partings, ſhews only the great regularity and truth of the planes or lamina, in which the ſtrata were at firſt depoſited. The poliſhed or rather rubbed ſurfaces of the ſlips or dykes in coal mines, and indeed in the ſtrata generally, is a circumſtance which ſeems moſt ſurpriſingly to have been overlooked by writers on this ſubject. Mr. Kirwan only gives it the curſory notice contained in § 21°. This rubbing ſeems to have ariſen from violent mechanical preſſure, and motion to and fro againſt each other, and this ſeems not confined to fiſſures or joints, where the ſtrata are lower on one ſide than on the other, ſo as to be explicable, as the effect of the ſlip, or mere ſinking down of one part, when in cloſe contact with the other; but this apparent wear in the ſurfaces, of even the ſmaller fiſſures, is as obſervable in marl and chalk pits, and all tolerably ſoft ſtrata, where no alteration of the level of the ſtrata has taken place, as where ſuch depreſſion of one ſide of the fiſſure is viſible. See Philoſophical Magazine, vol. xxv. p. 45 and 46, and vol. xxviii. p. 120. See alſo *Elevation of* STRATA. The facts and obſervations of Mr. Kirwan on coal, in ſections 23° to 25° above, agree with our remarks under the article COAL, on the unequal and apparently accidental diffuſion of the wood-like ſubſtances which have formed the ſtrata, or rather accumulations of wood-coal. That ſlips or dykes have never been obſerved in wood-coal mines, (§ 26°), can only, we think, have ariſen, from the limited extent of theſe accumulations in the ſtrata, at leaſt of ſuch as are worked; while the excavations in the planes of the ſtrata, as well as vertically in ſhafts, have been incomparably greater in the proper coal diſtricts, than in any other, and therefore it is, that the dykes &c. have there been beſt aſcertained; and from coal-working it has been, that almoſt all our knowledge of the ſtrata has been derived; they were the objects which firſt awakened Mr. Smith's attention to the ſubject of the ſtratification, and by obſervations in the next moſt extenſive field for theſe obſervations, *viz.* the cutting of navigable canals, he was enabled to generalize and extend the important facts, at preſent ſo little known, but to coal-miners, within their own particular diſtrict.

Genuine coal is now very ſeldom worked at its out-crop, as before obſerved, owing to the ſuperior quality of the ſame ſeam, when deeper covered; but wood-coal is generally worked ſo near to the ſurface, as to be opened at top, or uncallowed, inſtead of being mined for; it is no wonder therefore that gravel has been obſerved in contact with it, as obſerved § 27°.

Perhaps the ſpecimen mentioned § 28°, did not contain genuine coal in its cells; we conjecture this, from having ſeen ſpecimens of a reddiſh ſoft ſand-ſtone, which Mr. Farey brought laſt ſummer from the foot of the cliff on the ſea beach, about two miles eaſt of Haſtings in Suſſex, from the vicinity of a cottage called the Grovers, which contained ſo many detached pieces of bitumenized wood, that were an augre-hole to be bored into it, and ſupplied with water, &c. ſomething like the appearance of penetrating a coal vein, might be had in the borings; and it is this ſtratum, dipping under Bexhill, ſituate about 6½ miles to the weſtward, which in the opinion of Mr. F. has been there miſtaken in the borings for a ſeam of coals, but which the improved boring apparatus of Mr. Ryan, mentioned under COAL, would have detected, and ſaved, perhaps, a moſt unparallelled waſte of money, in the meaſures now purſuing.

The remark in § 29°, that genuine coal is ſeldom found in plains, is by no means true; the coal-ſtrata about Bedworth in Warwickſhire, Whibſey Slack near Bradford in Yorkſhire, and numerous other places which we could mention, form extenſive plains; a contrary remark to the above, would perhaps be much nearer to the truth.

It will readily be gathered, from our remarks on § 12°, that we have our doubts, on the diſtinctions between reſiniferous and non-reſiniferous plants, land and marine vegetables, and river and ſea ſhells, as accompaniments of coal, § 30 and 31, and that we incline to the opinion, that further ſearches will claſs all or moſt of them among the incognita of a prior ſtate of aquatic exiſtence.

Impreſſions from below the ſtrata § 33, eſpecially from elaſtic fluids, muſt have formed conic elevations or craters in making their eſcape, and could not have produced that univerſal breaking of the ſtrata which we find; which is indeed ſo univerſal, that a ſingle acre of the ſurface can ſcarcely be found

found without one, and sometimes numerous fissures through it, although the original plane of the strata is still maintained by its fragments, facts which had a material influence on the writer's reasonings upon this subject, which we have hinted at above. The seven following sections being stated, as consequences of Mr. Kirwan's particular tenets, which we shall mention presently, on the origin of coal, we shall pass them without comment for the present, and proceed to state the principal among the various opinions which have been given, on the origin of the invaluable substance, which is the subject of our present inquiry. In stating the opinions which have been held as to the origin of coal, we shall begin with that of Arduino and some others, who have supposed coal to originate from the fat and unctuosity of the numerous tribes of animals which have peopled the ocean; which matter being accumulated on the bottom of the sea, became covered by various strata, in consequence of the different changes which the surface of the earth and bottom of the seas have undergone. The most obvious objections to this hypothesis arise, from the total dissimilarity of coal to animal fat, and the levity of the latter compared with water, which should have occasioned it rather to rise to the top of the water and float, than to dispose itself in such extremely regular beds at the bottom, as to form strata of coal. The existence of a few shells in or near to coal, in some places, which resemble some of the recent sea shells, we conceive to be as far from proving it to be of marine origin (as contended by the author of this hypothesis) as the supposed resemblance of ferns, reeds, rushes, &c. and land and river shells, with the absence of bones of fish and sea salt in other places, proves it to be of land origin, § 30 and 31 of Mr. Kirwan's observations above, and Geol. Ess. 323.

The next opinion which we shall mention is that of M. Gensanne and others, who, from the specific gravity and hardness of some kind of coal, and its large quantity of bituminous matter, have concluded pit-coal to be a peculiar earth of the argillaceous genus, penetrated and impregnated with petroleum. To this opinion Mr. Kirwan opposes the remark in the 22° § above, and adds, that some known species of coal, that of Kilkenny for instance, contain no petrol or other bitumen in their composition, and are thence called natural carbon. See Mr. Kirwan's Mineralogy ii. 49.

M. Tingry, Dr. Darwin, and others, have imagined, that heat generated by the fermentation of immense beds of vegetable matters, have distilled or separated there from the oils, naphtha, asphaltum, &c. which condensed between the strata, and have formed seams of coal, and bituminous schists. On this fanciful theory it can scarcely be necessary to comment.

Dr. Hutton imagines coal to be formed by the slow depositions of oily and bituminous matters at the bottom of the sea, which matters he supposes to have originated in the dissolution of the various animal and vegetable bodies, which are continually perishing on the surface of the earth, and in the waters of the ocean. The fuliginous matter which is separated during the combustion of various bodies on the surface of the earth, he supposes, is washed off the surfaces on which it falls by the rain, and, being thus made to flow into the rivers, is carried off by them into the sea; where it also adds, by its deposition, to the mass which is accumulating at its bottom. Another source whence he supposes this matter to be derived, is the water draining from peat mosses, which, according to his ideas, is charged with bituminous matter, very much resembling fossil coal, when precipitated. The depositions of these matters in the sea are supposed by the Doctor to be so regular, as to produce strata, which, becoming covered by an immense weight of superincumbent earth, must thereby become exceedingly compressed and condensed, and finally consolidated, by the powerful influence of subterranean heat; and ultimately, by the progressive change of sea into dry land, these become seams of coal, such as we now find in the bowels of the earth. Granting that oily and bituminous matters are thus conveyed by the rivers into the sea, but which Mr. Kirwan has shewn does not take place, there is a manifest absurdity in supposing these matters to sink to the bottom of the water; while it is scarcely possible to conceive, that distinct beds or strata of coal and earth; especially such regular and extended ones as we find of them, can be formed by deposition in an ocean constituted as our present one is. The operation of heat upon these coal strata has been shewn by Mr. Kirwan and others, to be inconsistent with all the circumstances attending them. It is true that sir James Hall (Transactions of the Royal Society of Edinburgh, vol. vii.) has endeavoured to remove the force of these objections, by shewing, in the detail of his chemical experiments, and by the specimens presented to the British Museum in June 1806, that wood, or even horn, may be converted to a substance resembling coal, by the action of an intense heat applied under a very immense pressure. Valuable and satisfactory as we think sir James's experiments to be, in proving the possibility of carbonat of lime being fused without decomposition, and of vegetable and animal substances being melted or reduced to a coal-like substance, under the heat and confinement, as well as pressure which he applied, yet we think, the difficulty of Dr. Hutton and other Plutonists to be still nearly as great as ever in shewing, that such a degree of heat ever has existed in strata, not obviously volcanic; certainly, lava, however hot we may admit it to have been, could never by its mere protrusion under beds of sea-shells, as sir James Hall endeavours to explain, in his imaginary section of a volcanic mountain and adjoining sea, (*fig.* 41. in the Transactions,) have heated their whole mass, in the degree which his own experiments have shewn to be necessary for the formation of lime-stone; nor is it conceivable, that the supposed superincumbent strata, much less any depth of water, could have so effectually retained the carbonic gas, as he himself has shewn to be necessary, to form lime-stone or marble out of shells or chalk; or the other gasses, so as to effect the conversion of wood and vegetables into pit coal.

The ingenious Mr. Kirwan supposes, that a large class of primeval rocks and mountains, containing carbon and petrol in their composition, have been either totally destroyed, or their heights and bulk considerably lessened by disintegration and decomposition; and that by the equable diffusion of the disintegrated particles, successively carried down by the gentle trickling of the numerous rills that flowed from those mountains, the seams of coal and their attendant strata were formed, in lakes at their feet, we suppose, but this circumstance it is difficult to gather from Mr. K's account; according to which, the decomposed feltspar and hornblende formed clay, the particles of bitumen were set free, and these, when united, sunk through the moist pulpy, incoherent, argillaceous masses, and formed the seams of coal beneath them. Mr. Parkinson (Organic Remains I. 248.) has commented on the absurdity of such a light substance as bitumen, being supposed to descend through a pulp of argillaceous matters, and deposit itself in a stratum below it.

The next hypothesis which we have to mention, and which has numerous adherents, ascribes the formation of coal to forests of antediluvian trees, and to peat bogs, and other vegetable productions of the dry land of that period, buried during the supposed violences of the Mosaic deluge, under the strata which are found covering them

them in the ſtate of coal at this day. This hypotheſis we ſhall examine, and ſtate ſome of the objections to which it ſeems liable; and firſt, they are mines of wood-coal, deſcribed in §s. 23° to 29° above, which alone have the appearance of being formed by depoſitions of floating wood and other matters, in the irregularity of their extent, and the variable thickneſs of the ſeam, circumſtances extremely rare in regular coal-ſeams, or in the matters alternating with them. Some, we are aware, have contended, that this uniformity in the thickneſs of regular coal ſeams has ariſen, from the maſs of depoſited wood and vegetables having, ſince they were covered by the ſuperincumbent ſtrata, been liquified, or nearly ſo, by ſome proceſs, the exact nature of which has never been agreed upon by the advocates of this hypotheſis, and that in this ſoft ſtate (§ 21° above) they were preſſed into an uniform ſeam, or continued ſtratum. An obvious objection to this explanation, of the uniformity obſerved in the thickneſs of a real coal-ſeam ariſes from the fact, that all coal-ſeams preſent themſelves at the ſurface in the endings of the ſtrata, and frequently alſo in the ſides of hills, occaſioned by diſlocations of the ſtrata (§s. 19° and 41°); and here it will be difficult, if not impoſſible, to conceive, how the coal, when in a ſoft ſtate, was prevented from ſqueezing out by the weight of the ſuperincumbent ſtrata, and forming maſſes of that ſubſtance at the ſurface, of which no traces are obſervable; for, the diffuſion of the withered coal or ſmut, below the out-crop of coal ſeams (§ 41) has no ſuch appearance, but in all its circumſtances agrees, with the withered remains or rubble of other ſtrata at their outcrop. We incline to the opinion, that real wood, or other recent vegetable ſubſtances, have never been found in the coal ſeams, or in their accompanying meaſures or ſtrata: a large portion of the bitumenized vegetable impreſſions there found certainly bear no reſemblance to known woods, or plants of the preſent race; while moſt, if not all of ſuch remains, that have been denominated after recent plants, have been ſo named without that care which a botaniſt would exerciſe, in claſſing or naming a new recent plant which was preſented to him for examination. Hence the ſuppoſed reſemblance to land plants, rather than to aquatic plants in theſe curious remains, has, as we conceive, ariſen. Our next objection to the above hypotheſis is founded, on the improbability of the accumulation of ſuch immenſe quantities of trees and vegetable matter in the antediluvian world, in leſs than 17 centuries, when more than 42 centuries ſince have accumulated ſo little: if they had remained on the ſurface of the dry land and not decayed, a very large portion of the earth muſt have been thereby incumbered and rendered unfit for the habitation and uſe of men or animals; it is highly improbable, that they were progreſſively removed from the dry land to the antediluvian ſea, and there preſerved until the deluge. The probable quantity of growing trees and vegetables exiſting at the commencement of the Moſaic deluge, ſeems quite inſufficient to account for even the Britiſh coal ſtrata, when it is conſidered how much the bulk or maſs of the vegetable matter has, in all probability, been reduced, by its converſion into real coal: and this laſt ſuppoſition is alſo denied us, by the Moſaic account of this event, from which (Geneſis, vi. 7. 17. 19. 20; vii. 2, 3, 4. 8, 9. 14. 21, 22, 23; viii. 11. 17. 19; ix. 3. 20.) we gather, that the exiſting trees and vegetables (as well as fiſh) were not deſtroyed by the deluge. (See DELUGE.) Some writers on the formation of coal have ſpoken of it, as the remains of vegetable matters, either growing in, or that were depoſited in the ſea, in very diſtant periods, and which have been immured under layers of earth, &c. by certain convulſions and deluges (whether the Moſaic or others, ſome of them have not explained) which have ſince occurred: inſuperable difficulties will, we apprehend, be found to attend any hypotheſis, which ſuppoſes the burial of the matters compoſing coal, at any period ſince the earth has been divided into ſea and dry land as at preſent, let the origin of thoſe matters be ſuppoſed whatever they may.

The writer of this article begs leave to ſtate another opinion, which the recent diſcoveries of Mr. Smith and himſelf ſeem to render, in his judgment, moſt probable, on the origin of mineral coal. This writer has ſeveral times taken occaſion to mention the probability, that the ſurface of the earth, and as far below it as concerns us at preſent to conſider, originally conſiſted of parallel laminæ of different matters, not concentric to the earth, but inclined, or dipping towards the eaſt, and ending towards the weſt; each ſucceeding lamina, in aſcending the ſeries, being generally ſhorter towards the weſt than the eaſt, in the ſame manner as the very minute laminæ of cryſtals are now admitted to be, and thereby to form the ſlope, or inclination of the cryſtalline ſurface; but with theſe differences, that the laminæ of the earth, or the different ſtrata were diſpoſed to form indented or fingered endings, inſtead of the ſtraight lines ſo generally aſſumed in cryſtals of a ſmall ſize, and that the terreſtrial laminæ are of very unequal thickneſſes. Various circumſtances, beſides the immenſe maſſes of unbroken ſhells and other matters nearly ſimilar to the ſea ſhells, corals and other marine productions of the preſent time, ſhew theſe ſtrata to have been depoſited under quieſcent and probably very deep water, anſwering, as he conceives, to the ſtate of the earth as deſcribed by the ſacred hiſtorian, prior to the ninth verſe of the firſt chapter of Geneſis, or in the two firſt grand periods metaphorically called days, after which God ſaid "Let the waters under the heavens be gathered together into one place; and let the dry land appear." Abundant evidence will, as he apprehends, be furniſhed by an examination of the various organic remains lodged in or between the ſtrata, that the animals, at leaſt thoſe of the teſtaceous, cruſtaceous, and zoophytic kinds, whoſe remains they are, lived in the particular places where each is now found, at the time that the ſtrata, on or in which they are lodged, formed the bottom of the univerſal ocean above-mentioned; each newly depoſited ſtratum being a proper nidus for the production, and probably a pabulum for the nouriſhment of the animals peculiar to it, and which apparently in moſt inſtances ceaſed to exiſt, when new matter in proceſs of time began to be precipitated, for the production of a new ſtratum upon the former one, which, alſo, in turn had its own peculiar animals, as their remains in ſuch numerous inſtances teſtify.

The opinions of that able naturaliſt, M. Cuvier, in his recent report to the national inſtitute of France on the tranſactions of that learned body in 1806, are in favour of the animal incognita of the ſtrata, having lived where their bones are now found: and from an examination of the accounts from more than 600 places, where bones reſembling thoſe of elephants and rhinoceroſes have been dug up, belonging principally to the claſs of *gravel foſſils*, we believe, this able anatomiſt is of opinion, that all theſe differ eſſentially from the recent animals of theſe kinds and are of ſpecies now quite extinct.

Apparently, after long periods of ſucceſſive depoſition and animal exiſtence, ſuch ceaſed for a time altogether, or nearly; and the ſtrata produced an immenſe variety and quantity of vegetables, moſt of them quite unlike the vegetable tribes of the preſent race; the immenſe foreſts of of weeds which have been difcovered at the bottom of the prefent ocean, in fome places, probably bear no proportion to the thicknefs and magnitudes of many of thefe vegetable productions of the primitive or univerfal ocean, as fome of them probably exceeded our trees in fize; their arboriferous trunks, fo clofely imitating wood, as not hitherto to have been diftinguifhed therefrom; but the greater part of the vegetables appear to have been of a fmall fize, efpecially on ftrata, which feem to have been depofiting fo faft as to have immured them fingly, as is often the cafe with the bituminous or coal fhales, mentioned under COAL, of which the moft beautiful, various, and minute fpecimens, might be obtained in many coal workings. The fucceffive depofitions in thefe vegetable, or carboniferous foils, appear to have differed, as we have ftated thofe of the animal, or epizootic, to do, in their fitnefs for producing different kinds, and a fimilar appearance and difappearance of different vegetable remains will be obferved, in examining a feries of coal meafures, or ftrata, upwards or downwards; and, often, ftrata will be found intervening fuch, which contain no vegetable impreffions, but in fome rare inftances, thofe of animals will therein be found, which obfervations, of too limited an extent, as we fufpect, have denominated land and river exuvia, § 12° and 30° above.

It is to beds of fub-aqueous vegetables, fuch as have been mentioned above, uniformly and thickly covering large extenfions of the planes of ftrata, if not their whole extent, that the writer of this article can alone look, in his view of the fubject, for the true origin of vegetable coal; and according, perhaps, to the nature of thefe vegetables, as well as to the kind or quantity of the mineral depofits, made during their growth, will the quality of different feams of coal be found to vary, while their different thickneffes has depended, on the quantity of vegetable matter accumulated, either dead, as in our peat bogs, or then actually growing, when a depofition began to happen, either fo copious or different, as to put a period to their growth, and ultimately to immure them. That vegetable impreffions are rarely found in the fubftance of a coal-feam, as remarked by Mr. Kirwan in the paffage (§ 12°) above quoted, may, we think, be perfectly accounted for, when the peculiar kind of cryftallization, which all good mineral coals feem to have undergone, is taken into confideration; a change which feems to have effectually deftroyed the organization of the plants compofing the coal, but without a liquefaction having happened, as in fome ftony cryftallizations, which have of late years been noticed by mineralogifts.

Mr. Parkinfon endeavours to account for this change, which vegetable matters undergo in paffing into coal (Organic Remains, p. 253.) by a procefs which he calls *bituminous* FERMENTATION, which fee. According to the obfervations of this gentleman, foffil coal has alfo, in this change, had numerous fepta, or thin fibres of uninflammable matter, interpofed between the particles of pure bituminous matter, of which it principally confifts, which has modified its inflammability in the degree which renders pit coal fo well fitted for the purpofes to which it is applied. In the fpecimens which Mr. P. examined, the inclofed particles of bitumen were in form of rhomboids, or parallelepipeds, and the feparating pellicles, or fepta, were formed of fulphate of lime, containing a fmall portion of alumine, and fometimes of fulphuret of iron alfo. Organ. Rem. 269.

The new opinions which we have ventured to prefent, if fuch they are, relating to the origin and formation of coal, in that and the prefent article, will, as we truft, be candidly received by our readers, and fubmitted to that fovereign teft, an unprejudiced comparifon with the phenomena, by which it is our fincere wifh that they fhould either ftand or fall, as it is alfo of the gentlemen above alluded to, through whofe valuable labours and communications, we were enabled to give them.

The moft remarkable colliery, or coal-work, that we have ever had in this ifland, was that wrought at Burrowftonenefs, under the fea. The veins of coal were found to continue under the bed of the fea in this place, and the colliers had the courage to work the vein *near half way over*; there being a *mote* half a mile from the fhore, where was an entry that went down into the coal-pit, under the fea. This was made into a kind of round key, or mote, as they call it, built fo as to keep out the fea, which flowed there twelve feet. Here the coals were laid, and a fhip of that draught of water, could lay her fide to the mote, and take in the coal.

This famous colliery belonged to the earl of Kinkardin's family. The frefh water which fprung from the bottom and fides of the coal pit, was always drawn out upon the fhore by an engine moved by water, that drew it forty fathom. This coal pit continued to be wrought many years to the great profit of the owners, and the wonder of all that faw it; but, at laft, an unexpected high tide drowned the whole at once, and the labourers had not time to efcape, but perifhed in it. Phil. Tranf. No. 98.

COLLIGAT, in *Ancient Geography*, a town of Ethiopia near Egypt, feated on the bank of the Nile, according to Pliny.

COLLIGENDUM *bona defuncti*, *letters ad.* See ADMINISTRATION.

COLLIGUAJA, in *Botany*, Lam. Encyc. Molin. Chil. p. 158. Clafs and order, *monœcia octandria*. Nat. Ord. *Euphorbiæ*, Lam.

Gen. Ch. *Flowers* in a catkin. *Males*. *Calyx* four-cleft. *Stam.* Filaments eight. *Females* below the males. *Cal.* as in the males; ftyles three. *Peric.* Capfule triangular, elaftic. *Seeds* three, round, the fize of a pea.

Sp. C. *Odorata*. A fhrub. *Stem* five or fix feet high, much branched. *Leaves* oppofite, lanceolate, on fhort petioles, toothed, one-nerved, fmooth, flefhy, permanent. *Flowers* on fhort peduncles. A native of Chili.

COLLIMATION *of a Telefcope*, in *Optics*, is that line which paffes through the tube, and cuts both the focus of the eye piece and alfo the centre of the object glafs; the derivation of the term is from *col*, *con*, or *cum*, *with*; and *lima*, *a file*, in confequence of the exactitude with which it ought to be adjufted, at right angles to the axis of a telefcope, that is moveable on pivots in any aftronomical inftrument. It is in this line that the middle wire of the eye-piece ought to be exactly placed, in any telefcope for celeftial obfervations; which pofition may be afcertained by reverfing the ends of the axis, and noticing, in both fituations, a point in a diftant object that is bifected by the faid wire; the deviation from true bifection being always double to the error in collimation, when the line of collimation is at right angles to the axis of motion of the telefcope. The lateral fcrews of adjuftment, at the focus of the eye-piece, in the beft inftruments, will readily bring the middle wire into the true line of collimation with but little trouble.

COLLINS, JOHN, in *Biography*, a mathematician of confiderable eminence, was born at Wood Eaton, in Oxfordfhire, in March 1624. He was educated by his father, a diffenting minifter, and at the age of 16 was bound apprentice to a bookfeller at Oxford, but foon after the beginning of the civil wars he was made a junior clerk of the prince of Wales's kitchen. In this fituation he was under the fuperintendence of Mr. Marr, a good mathematician, and famous for the dials with which he adorned the gardens of king Charles. From hence young Collins embarked in the fea fervice, and having already made fome progrefs in mathematical

mathematical purſuits, he employed all his leiſure time in improving himſelf in the practical branches of ſcience. Upon his return to England he taught mathematics, and in the year 1652 publiſhed an "Introduction to Merchants Accounts." From this period he frequently preſented the public with treatiſes in various departments of ſcience, which were all well received, and to a certain degree popular. In 1667 Mr. Collins was made accountant to the Exciſe Office, and choſen member of the Royal Society. He had not been long a member of this learned and reſpectable body, when he laid before it ſome papers on the ſubject of chronology, and in 1699, a diſſertation of his was publiſhed in the "Tranſactions," on the reſolution of equations in numbers, in which are ſeveral important hints on the doctrine of differences, and other topics. He was nominated by lord Shafteſbury in divers references concerning ſuits in Chancery, to aſſiſt in ſtating intricate accounts; and was ſoon after appointed accountant to the Royal Fiſhery Company. Mr. Collins, by many publications, ſhewed how deeply he was verſed in the principles of trade and commerce. His works are numerous, and they diſplay the features of a liberal mind and a clear head. Beſides thoſe already noticed we have treatiſes on the "Mariner's Plane Scale," on "Geometrical Dialling;" on "Arithmetic;" on "The Quadrant;" on "Salt and Fiſhery," and divers papers in "The Philoſophical Tranſactions." Mr. Collins was a great promoter of the works of others, and the world is indebted to him for Barrow's "Optical and Geometrical Lecture;" his edition of "Archimedes;" and of "The Conics of Apollonius;" "Wallis's Hiſtory of Algebra," and many other excellent works. He died in London, November 1683, of conſumption, produced it was thought by drinking cyder while he was hot from great exerciſe. His papers were, after ſeveral years, put into the hands of Mr. William Jones, F. R. S., and it was from theſe that the claims of ſir Iſaac Newton to the invention of fluxions was eſtabliſhed, in the "Commercium Epiſtolicum D. Johannis Collins, et aliorum, &c." Mr. Collins was indefatigable in the purſuit of uſeful truths, and ſpared no pains in the promotion of real ſcience. Natural knowledge is greatly indebted to him, for while he excited ſome to publiſh uſeful inventions, he employed others to improve them; but his own merit was not ſufficiently rewarded by thoſe who had the means of patronizing him. Biog. Brit.

Collins, Richard, an engraver, native of Luxemburgh, who ſtudied at Rome at the ſame time with Sandrart, and engraved ſeveral plates for his work entitled "The Academy." Upon his return from Italy he eſtabliſhed himſelf at Antwerp, and ultimately at Bruſſels, where he aſſumed the title of engraver to the king of Spain. According to an inſcription copied by Heinecken from one ſurrounding his portrait, he was born in 1627. The dates on his prints are from 1664 to 1685. He made ſeveral indifferent engravings of portraits, as well as other prints from the pictures of Rubens, Murillo, S. Bourdon, and others. Heinecken.

Collins, Samuel, doctor in medicine, was educated at Cambridge, and made fellow of King's college in that univerſity. In 1650 he was admitted of New college in Oxford, by favour of the viſitors, Anthony Wood ſays. He ſoon after went to Ruſſia, and reſided at the court of the czar for nine years. On his return to England he was made fellow of the Royal College of Phyſicians in London. In 1671 he publiſhed a "Hiſtory of the Preſent State of the Court of Ruſſia, in a Letter to a Friend," illuſtrated with engravings, and in 1685, "A Syſtem of Anatomy, treating of the Body of Man, Beaſts, Birds, Fiſh, Inſects, and Plants," with numerous figures drawn from the life, 2 vols. folio. In the comparative anatomy, incomparably the moſt valuable part of the work, he received much aſſiſtance from Dr. Edward Tyſon, particularly in the anatomy of fiſhes and birds, in which he excelled. "Nemo Collino melius de ea eſt meritus," Haller ſays. The work is now, however, little noticed. There is a beautiful head of Collins, drawn and engraved by Faithorne, which gives it value to collectors of prints. Wood's Faſti Oxon. Haller's Bib. Curat.

Collins, John, an engraver of Antwerp, who ſpent ſome time in Rome, and afterwards, according to Mr. Strutt, reſided in England. There are ſome indifferent portraits by this artiſt, one of which, repreſenting Keay Nabe Naia Wi-praia, principal ambaſſador from the Sultan Abdulcahar, king of Suroſoan, is dated 1682. He likewiſe engraved the "Funeral Proceſſion of George, Duke of Albemarle," and ſeveral other prints from various maſters. Other artiſts of the name of Collins are mentioned by Heinecken.

Collins, Anthony, a writer of conſiderable eminence, was born at Heſton, Middleſex, on the 21ſt of June 1676. He was educated in grammar learning at Eton, and from thence he was removed to King's college Cambridge, under the tuition of Mr. Hare, afterwards biſhop of Chicheſter. When he quitted the univerſity he entered himſelf a ſtudent in the Temple, but, diſguſted with the purſuits of the law, he quickly relinquiſhed all thoughts of that profeſſion. In 1698 he married, and being poſſeſſed of conſiderable property, devoted himſelf to literary purſuits. In 1703 and 1704 he maintained an epiſtolary correſpondence with the celebrated Mr Locke, who conceived for him a very high regard, and in 1707, he publiſhed his "Eſſay concerning the Uſe of Reaſon, &c." a work containing many valuable obſervations, but which diſcovered ſtrong prejudices againſt divine revelation. About the ſame period Mr. Collins engaged in the controverſy carried on by Mr. Dodwell and Dr. Clarke, concerning the natural immortality of the ſoul. See Clarke. In 1709 he publiſhed "Prieſtcraft in Perfection, &c." and other controverſial pieces; and in the following year "A Vindication of the Divine Attributes," in anſwer to a ſermon, by the archbiſhop of Dublin, on "Divine Predeſtination, conſiſtent with the Freedom of Man's Will." He ſpent a conſiderable part of the year 1711 on the Continent, where he cultivated the acquaintance and regards of M. Le Clerc and other men of eminence. In 1713 he publiſhed "A Diſcourſe on Free Thinking," in which he vindicated the univerſal right of unlimited freedom of inquiry, and expoſed the tyranny exerciſed by the abettors of prieſtcraft; this was the profeſſed object of the work, but the author's ſecret intention was undoubtedly to attack revealed religion; it therefore called forth ſome able replies from Mr. Whiſton, Dr. Hoadly, and Dr. Bentley. Mr. Collins now paid another viſit to Holland, and from thence he proceeded to Flanders, in both which countries he was received by men of letters with the moſt marked attention. On his return he ſettled in the county of Eſſex, where he exerciſed the important duties of magiſtrate and deputy lieutenant of that county. About the year 1715 he publiſhed his "Philoſophical Inquiry concerning Liberty," which is unqueſtionably one of the beſt treatiſes on that ſubject; it is highly methodical and very conciſe, and its illuſtrations are ſimple and perſpicuous. On this ſmall tract Dr. Clarke made ſome remarks, of which Mr. Collins took no notice. In the year 1718 he was choſen treaſurer of the county, an office which he executed

executed with exact fidelity, to the great relief of numerous claimants on the county rates. In the year 1724 he published an "Historical and Critical Essay on the Thirty-nine Articles," and a "Discourse of the Grounds and Reasons of the Christian Religion;" this last work, being an evident attack upon Christianity, was answered by many of the leading men of that day, both of the established church, and among the dissenters. His work entitled "The Scheme of Literal Prophecy," &c. called forth also the pens of some able advocates for the truth of revelation, and it may be safely affirmed that the controversies excited by Mr. Collins redounded to the honour and firm establishment of the cause which he hoped to undermine. After a life of activity, in which his talents had been frequently and zealously employed for the advantage of his countrymen, Mr. Collins died of a severe attack of the stone, a disorder which had for some years been sapping away the principles of his constitution. As a writer his works will speak for him, some of which, besides his "Inquiry concerning Human Liberty," are still held in considerable estimation. As a man, his moral conduct was exemplary for the virtues of temperance, humanity, benevolence, and patient industry. In the exercise of his magisterial functions he was active, upright, and impartial, and in domestic life he was a tender husband, a kind parent, a good master, and a true friend. In the cause of true liberty he was an ardent votary, and whatever his particular sentiments might be on certain topics, he appears to be sincerely attached to the investigation of truth, so that on his dying bed he could appeal to his maker for the rectitude of his intentions, declaring that he had always endeavoured, to the best of his ability, to serve his God, his country, and his sovereign. By some of his contemporaries, and some of those who engaged in controversy with him, he was charged with atheism, for which there seems to have been no foundation. It must be admitted that he paid little regard to accuracy in the mode of his quotations, adapting them, without scruple, to his own purposes, however contrary they might be to the meaning of the authors cited, or the connection which the passages referred to stood. "So many facts" says the amiable Dr. Kippis, "of this kind were undeniably proved against him by his adversaries, that he must ever be recorded as a flagrant instance of literary disingenuity." Biog. Brit. Hollis's Memoirs, and Collins's different Treatises.

Collins, William, a poet of distinguished eminence, was born at Chichester in 1720 or 1721. His father, who carried on the trade of a hatter in that city, sent him to Winchester school, where he made considerable proficiency in the learned languages. From Winchester he went to Queen's college, Oxford, whence in 1741 he removed to Magdalen's. During his residence at the university he published his Oriental Eclogues which were not received by the public with any extraordinary favour. This circumstance did not, however, discourage him from relying on his pen for subsistence, and in 1744 he repaired to London in the character of a literary adventurer. Soon after his arrival in the metropolis he published proposals for a "History of the Revival of Literature," a work which he certainly never accomplished, and which in all probability was never begun. In 1746 he produced his "Odes Descriptive and Allegorical," which so little suited the taste of the day that their immediate sale did not indemnify his publisher for the expence of printing. Indignant at the insensibility manifested by the literary public to the merit of some of the finest compositions in the English language, and alarmed by the pursuit of his creditors, he secretly withdrew into the country. Not being sufficiently secure in his retirement he fled into Germany, when he put himself under the protection of his uncle, lieut. colonel Martin, who was with the army. On the death of that relation, which occurred soon after, Collins inherited by his will a legacy of 2000*l.* He now thought himself rich, and after honourably discharging his debts, resolved to live in decent retirement upon the remainder of his capital. But fortune favoured him at too late a period. The vexations which he had experienced in early life, and the occasional irregularities of his conduct, had gradually induced such a depression of spirits, that, though his intellectual faculties were unimpaired, he was utterly deprived of the power of exertion. After struggling in vain to overcome his malady by a journey into France, he became so much worse that his friends deemed it expedient for a time to confine him in an asylum for lunatics. Having derived some little benefit from the medical aid which was administered to him at this place, he was removed to Chichester, where his distresses were soothed by the tender assiduities of his sister, in whose arms he expired in the year 1756.

Thus short and melancholy was the career of a poet, who united in his compositions the brilliancy of a vivid imagination and the correctness of classic taste. The tardy justice of posterity has made amends for the contemptuous neglect of his contemporaties, and the poems of Collins are now acknowedged to abound in lofty flights of fancy, and in the most touching expression of a feeling heart.

Collins's *Quadrant.* See Quadrant.

COLLINSON, Peter, in *Biography*, an eminent naturalist and antiquary, was born January 14, 1693-4, most probably in London. He was of a quaker family, originally from Westmoreland. He carried on the business of a wholesale woollen-draper, or man's-mercer, in Grace-church-street, as his father appears to have done before him, and acquired an ample fortune. This enabled him, about the year 1740, if not earlier, to indulge in the luxury of a country house and botanic garden, situated at Mill Hill, in the parish of Hendon, ten miles north of London, as well as to gratify his prevailing taste by an extensive foreign correspondence, and the acquisition of specimens of natural history, and books, from various quarters. He very early obtained the notice and friendship of the most eminent naturalists and philosophers of his age and country, as well as of foreigners. Among the former are to be reckoned, Derham, Woodward, Dale, Lloyd, Sloane, and Ellis; among the latter, Klein and the celebrated Linnæus. Persons in a superior station to his own, treated him with familiarity and respect; as sir Charles Wager, through whose active exertions in the cause of natural science, at the suggestion of Mr. Collinson, innumerable exotic productions were, from time to time, brought to enrich the public and private museums of this kingdom; and the famous earl of Bute, whom he frequently visited at Caen wood, in his way to Mill Hill, and some of whose botanical letters to Mr. Collinson are in the hands of the writer of this article. With America he had many connections; and was long the principal channel through which the learned and scientific discoveries of Europe were conveyed to that rising country. He had the honour of communicating to the great Franklin the first knowledge of the electrical discoveries of that day. With Mitchell, Colden, and other American botanists, he maintained a constant correspondence, and had a principal hand in encouraging the indefatigable John Bartram in his botanical travels through the southern provinces of North America. Hence, as well as from the north of Europe, his garden derived ample supplies. At the time of his death, and even for 30 years afterwards, many rare American and Alpine plants, accommodated with every possible contrivance for shade, moisture, and a suitable exposure, were, in a manner, naturalized there, flourishing in the greatest luxuriance; till an ignorant and tasteless purchaser of this classical spot, rooted out its choicest treasures, and felled some of its finest trees, of species scarcely to be seen in perfection elsewhere. At length, however, it has found an owner who knows its value; and many flowering Cembra pines, with several American trees, are happily preserved from destruction.

In December, 1728, Mr. Collinson became a fellow of the Royal Society. Of the society of antiquaries he was a fellow from its first institution. The publications of both these learned bodies are enriched with his writings. He was also associated with the academy of Berlin; and, through the recommendation of his friend Linnæus, with that of Stockholm.

One of the inquiries, relating to natural history, which most interested him was the migration of swallows, for which he strenuously contended, in opposition to the opinion, as strenuously maintained by several other naturalists, of their remaining through the winter under water. At length, however, in a letter to Linnæus, dated September 15, 1763, he professes to be convinced by his illustrious correspondent that these birds do live under water all winter; subjoining nevertheless so many hints respecting the anatomical inquiries requisite to establish this wonderful fact, and so much dissatisfaction with what had hitherto been done, that he rather betrays the doubt than the conviction of his own mind.

Concerning antiquarian studies, certain round towers, in Ireland, of whose original use and design the learned are still doubtful, engaged his attention. But his most valuable communication in this line related to some Tartarian antiquities, described in the Archæologia.

Nor were Mr. Collinson's studies devoted merely to speculative or amusing objects. No philosopher ever combined utility with science more than himself. The management of sheep in Spain, of which he procured and published an account in the Annual Register, and Gentleman's Magazine, for 1764, given at length in the Biographia Britannica, is one of the most valuable documents of which we are possessed on that subject. All improvements in planting and gardening were studied and pursued by him with indefatigable zeal. His favourite luxury was fruit, and his passion, flowers. He writes with great complacency to Linnæus, the result of an observation made in his own garden, which proved the nectarine to be, as Linnæus had thought, a variety of the peach, a nectarine tree having sprung up at Mill Hill from a stone of the latter fruit. In the same letter, dated "Ridgway House, on Mill Hill, March 16, 1767," he thus details the progress of an English spring in the flower garden: "The hellebore, snowdrop, aconite, violet, &c. these," says he, "bloom in frost and snow, like the good men of Sweden. Then a tenderer tribe succeeds, and the garden is covered with more than 20 different species of crocus, *produced from sowing seeds*; and *iris persica, cyclamen vernum*, and polyanthos. Now plenty of *hyacinthus cæruleus* and *albus* in the open borders, and anemonies; and now *my favourites*, the great tribe of Narcissus, and polyanthos, shew all over the garden and fields. We have two species wild in the woods, that now begin to flower. Next the *tulipa præcox* is near flowering, and so Flora decks the garden with endless variety, ever charming. The progress of our spring to the middle of March, I persuade myself, will be acceptable to my dear baron." In the sequel of this letter, the last he ever wrote to Linnæus, he adverts to various subjects, not forgetting the swallows, and subscribes, "P. Collinson, now entered into my 73d year, in perfect health and strength of body and mind. God Almighty be praised and adored for the multitude of his mercies!"

His happy and useful life terminated on the 11th of August, 1768, in consequence of a suppression of urine, with which he was seized while on a visit in Essex, to his excellent friend lord Petre, a nobleman for whom, and for his father, both distinguished promoters of botany, Mr. Collinson had the highest regard. One of his letters to Linnæus is partly occupied with a long account of the character and pursuits of the last-mentioned lord, who died at an early age, in 1742.

Mr. Collinson married, in 1724, Mary, the daughter of Michael Russell, esq. of Mill Hill, with whom he lived very happily till her death, in 1753. He left issue, a son, named Michael, who resided at Mill Hill, and died a few years since, whose son is still living; and a daughter, Mary, married to the late John Cator, esq. of Beckenham, in Kent. Both his children inherited much of the taste and amiable disposition of their father. Biog. Brit. Fothergill's account of the late Peter Collinson. P. Collinson's MS. letters to Linnæus. S.

COLLINSONIA, in *Botany*, (so called in honour of Peter Collinson, F.R.S. a very active promoter of botanical studies, by whom the first species was introduced into the English gardens.) Linn. Gen. 40. Schreb. 51. Willd. 64. Lam. Ill. 51. Gært. 405. Juss. 112. Vent. ii. 331. Class and order, *diandria monogynia*. Nat. Ord. *Labiatæ*, Juss. Vent.

Gen. Ch. *Cal.* one-leafed, tubular, two-lipped, short, permanent; upper lip three-cleft; segments reflexed, broader; lower lip bifid; segments awl-shaped, more erect. *Cor.* monopetalous, unequal; tube funnel-shaped, many times longer than the calyx; border somewhat two-lipped; upper lip very short, four-toothed; lower lip very long, cloven into numerous capillary segments. *Stam.* Filaments two, bristle-shaped, erect, very long; anthers simple, incumbent, compressed, obtuse. *Pist.* Germs four, superior, three of them abortive, with a largish gland beneath them. *Style* bristle-shaped, the length of the stamens, inclined to one side; stigma bifid, acute. *Peric.* the permanent calyx. *Seed* one, globular.

Ess. Ch. Corolla unequal; lower lip with numerous capillary segments. Seed only one; three of the germs constantly abortive.

Sp. 1. C. *canadensis*. Linn. Sp. Pl. Mart. 1. Willd. 1. Cold. Noveb. 8. Kalm. It. ii. 317. Eng. Ed. i. 197. Lam. Ill. tab. 21. Gært. tab. 66. (C. serotina, Walt. Car. 65?) "Leaves egg-shaped, smooth; stems smooth." *Root* perennial. *Stems* three or four feet high, annual, erect, quadrangular. *Leaves* about six inches long, opposite, on very short petioles, acute, bluntly serrated, wrinkled. *Flowers* yellowish, numerous, peduncled, in panicled racemes with opposite ramifications. A native of North America. It has a peculiar, very strong, but agreeable scent; and is reputed to be an excellent remedy against pains in the limbs, occasioned by a cold, if the parts affected be rubbed with it; a decoction of it is also said to have cured the bite of the rattlesnake. In New York it is called horseweed, because the horses eat it in the spring before any other plant comes up. 2. C. *scabriuscula*. Mart. 2. Lam. Ill. 2. Willd. 2. Hort. Kew. i. 47. (C. præcox. Walt. Car. 65?) "Leaves somewhat

ſomewhat cordate-egg-ſhaped, rather hairy; ſtems ſomewhat hairy, ſcabrous." *Root* perennial. A native of Eaſt Florida, obſerved by Bartram, cultivated by Dr. Fothergill in 1776.

Propagation and Culture. The firſt ſpecies may eaſily be propagated by parting the roots in October. Theſe ſhould be planted three feet diſtant from each other in a warm ſheltered ſituation, and duly watered. With this treatment the plants will thrive in the open ground, and if regularly watered, will ripen their ſeeds in good ſeaſons. The ſecond ſpecies is more tender, and requires the protection of the green-houſe.

COLLIOURE, in *Geography*, a town of France, in the department of the Eaſtern Pyrenées, and chief place of a canton, in the diſtrict of Ceret, with a ſmall port on the Mediterranean; defended by a caſtle on a rock, and inhabited chiefly by fiſhermen. Near this town the Spaniards were defeated by the French in May, 1794; in conſequence of which the national convention decreed, that a column ſhould be erected as a memorial, that "7000 Spaniards laid down their arms before the republicans;" 5 leagues S.E. of Perpignan, and 5 E. of Ceret.

COLLIPO, in *Ancient Geography*, a municipal town of the Luſitanians, at ſome diſtance from the ſea, N. of Scalabis.

COLLIQUAMENTUM denotes a very tranſparent fluid obſervable in an egg two or three days after incubation, containing the firſt rudiments of a chick. It is incloſed in its own proper membrane, diſtinct from the *albumen*. Harvey calls it *oculus*.

COLLIQUATION, from *colliqueo, to melt*, in *Pharmacy*, the action of melting together two or more ſolid ſubſtances; or rendering them liquid by fuſion, or diſſolution; as wax, mucilages, &c. by heat; gums, &c. by moiſture.

COLLIQUATION is alſo uſed to expreſs ſuch a temperament, and diſpoſition of the animal fluids, as proceeds from a too lax compages; whereby they flow off through the ſeveral glands, and particularly through thoſe of the ſkin, faſter than they ought; which occaſions fluxes of many kinds, but moſtly profuſe, greaſy, clammy ſweats.

If this *colliquation* continue, it generally terminates in an hectic fever, and is uſually a concomitant of one.

The curative intention in this caſe is the giving a better conſiſtence to the juices by balſamics and agglutinants; and the hardening of the ſolids by ſubaſtringents. Hence,

COLLIQUATIVE *fever* is a fever attended with a diarrhœa, or profuſe ſweats, from too looſe a contexture of the fluids.

COLLISEUM. See COLISEUM.

END OF VOL. VIII.

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