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TREASURE ROOM

THE

OBSERVER AND RECORD

OF

AGRICULTURE, SCIENCE, AND ART.

VOLUME I.

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TREASURE ROOM

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OF AGRICULTURE, SCIENCE, AND ART.

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The object of this paper is to concentrate and preserve, in a form suitable for future reference, the most useful and interesting articles on the aforesaid subjects. Each number will contain sixteen octavo pages, printed on good paper, and when a sufficient amount is published to form a volume of convenient size, an alphabetical table of contents will be published and forwarded to subscribers, in order for binding. The first number, (of which this forms a part,) shows the general plan of the work.

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From Sir Humphrey Davy's Elements of Agricultural Chemistry.

AGRICULTURAL CHEMISTRY.

AGRICULTURAL CHEMISTRY has for its objects all those changes in the arrangements of matter connected with the growth and nourishment of plants; the comparative values of their produce as food; the constitution of soils; the manner in which lands are enriched by manure, or rendered fertile by the different processes of cultivation. Inquiries of such a nature cannot but be interesting and important, both to the theoretical agriculturalist and to the practical farmer. To the first, they are necessary in supplying most of the fundamental principles on which the theory of the art depends. To the second, they are useful in affording simple and easy experiments for directing his labours, and for enabling him to pursue a certain and systematic plan of improvement. It is scarcely possible to enter upon any investigation in agriculture without finding it connected, more or less, with doctrines or elucidations derived from chemistry.

If land be unproductive, and a system of ameliorating it is to be attempted, the sure method of obtaining the object is by determining the cause of its sterility, which must necessarily depend upon some defect in the constitution of the soil, which may be easily discovered by chemical analysis.

Some lands of good apparent texture are yet sterile in a high degree; and common observation and common practice afford no means of ascertaining the cause, or of removing the effect. The application of chemical tests in such cases is obvious; for the soil must contain some noxious principle which may be easily discovered, and probably easily destroyed.

Are any of the salts of iron present? they may be decomposed by lime. Is there an excess of siliceous sand? the system of improvement must depend on the application of clay and calcareous matter. Is there a defect of calcareous matter? the remedy is obvious. Is an excess of vegetable matter indicated? it may be removed by liming, paring, and burning. Is there a deficiency of vegetable matter? it is to be supplied by manure.

A question concerning the different kinds of limestone to be employed in cultivation often occurs. To determine this fully in the common way of experience, would demand a considerable time, perhaps some years, and trials which might be injurious to crops; but by simple chemical tests the nature of a limestone is discovered in a few minutes; and the fitness of its application, whether as a manure for different soils, or as a cement, determined.

Peat earth of a certain consistence and composition, is an excellent manure; but there are some varieties of peats which contain so large a quantity of ferruginous matter as to be absolutely poisonous to plants. Nothing can be more simple than the chemical operation for determining the nature, and the probable uses of a substance of this kind.

There has been no question on which

more difference of opinion has existed than that of the state in which manure ought to be ploughed into the land; whether recent, or when it has gone through the process of fermentation?' and this question is still a subject of discussion; but whoever will refer to the simplest principles of chemistry cannot entertain a doubt on the subject.

As soon as dung begins to decompose it throws off its volatile parts, which are the most volatile and most efficient. Dung which has fermented, so as to become a mere soft cohesive mass, has generally lost from one third to one half of its most useful constituent elements. It evidently should be applied as soon as fermentation begins, that it may exert its full action upon the plant, and lose none of its nutritive powers.

It would be easy to adduce a multitude of other instances of the same kind; but sufficient I trust has been said to prove that the connection of chemistry with agriculture is not founded on mere vague speculation, but that it offers principles which ought to be understood and followed, and which in their progression and ultimate results, can hardly fail to be highly beneficial to the community.

A view of the objects in this course of lectures, and of the manner in which they are to be treated, will not, I hope, be considered as an improper introduction. It will inform you what you are to expect; it will afford a general idea of the connection of the different parts of the subject, and of their relative importance; it will enable me to give some historical details of the progress of this branch of knowledge, and to reason from what has been ascertained concerning what remains to be investigated and discovered.

The phenomena of vegetation must be considered as an important branch of the science of organized nature; but though exalted above inorganic matter, vegetables are yet in a great measure dependant for their existence upon its laws. They receive their nourishment from the external elements; they assimilate it by means of peculiar organs: and it is by examining their physical and chemical constitution, and the substances and powers which act upon them, and the modifications which they undergo, that the scientific principles of agricultural chemistry are obtained.

According to these ideas, it is evident that the study ought to be commenced by some general inquiries into the composition and nature of material bodies, and the laws of their changes.

The surface of the earth, the atmosphere, and the water deposited from it, must, either together or separately, afford all the principles concerned in vegetation; and it is only by examining the chemical nature of these principles, that we are capable of discovering what is the food of plants, and the manner in which this food is supplied and prepared for their nourishment.

The principles of the constitution of bodies consequently, will form the first object of our consideration.

By methods of analysis dependent upon chemical and electrical instruments discovered in late times, it has been ascertained, that all the varieties of material substances may be resolved into a comparatively small number of bodies, which, as they are not capable of being decompounded, are considered in the present state of chemical knowledge as elements.

The bodies incapable of decomposition at present known, are forty-seven. Of these, thirty-eight are metals; six are inflammable bodies; and three substances which unite with metals and inflammable bodies, and form with them acids, alkalies, earths, or other analagous compounds.

The chemical elements acted upon by attractive powers combine in different aggregates.

In their simpler combinations, they produce various crystaline substances, distinguished by the regularity of their forms. In more complicated arrangements they constitute the varieties of vegetable and animal substances, bear the higher character of organization, and are rendered subservient to the purposes of life. And by the influence of heat, light, and electrical powers, there is a constant series of changes; matter assumes new forms; the destruction of one order of beings tends to the conservation of another; solution and consolidation, decay and renovation, are connected; and whilst the parts of the system continue in a state of fluctuation

and change, the order and harmony of the whole remain unalterable.

After a general view has been taken of the nature of the elements, and of the principles of chemical changes, the next object will be the structure and constitution of plants. In all plants there exists a system of tubes or vessels, which in one extremity terminate in roots, and at the other in leaves. It is by the capillary action of the roots that the fluid matter is taken up from the soil. The sap in passing upwards becomes denser, and more fitted to deposited solid matter: it is modified by exposure to heat, light, and air in the leaves; descends through the bark; in its progress produces new organized matter; and is thus in its vernal and autumnal flow, the cause of the formation of new parts, and of the more perfect evolution of parts already formed.

In this part of the inquiry, I shall endeavour to connect together in a general view, the observations of the most enlightened philosophers who have studied the physiology of vegetation.

Those of Grew, Malpighi, Sennebier, Darwin, and above all, of Mr. Knight. He is the latest inquirer into these interesting subjects, and his labours have tended most to illustrate this part of the economy of nature.

The chemical composition of plants has within the last ten years, been elucidated by the experiments of a number of chemical philosophers, both in this and in other countries; and it forms a beautiful part of general chemistry; it is too extensive to be treated of minutely; but it will be necessary to dwell upon such parts of it as afford practical inferences.

If the organs of plants be submitted to chemical analysis, it is found that their almost infinite diversity of form, depends upon different arrangements and combinations of a very few of the elements; seldom more than seven or eight belong to them, and three constitute the greatest part of their organized matter; and according to the manner in which these elements are disposed, arise the different properties of the products of vegetation, whether employed as food, or for other purposes and wants of life.

(To be continued.)

From the Philosophical Magazine.

IODINE IN MINERAL WATERS.

Dr. Cantu has proved the existence of Iodine, in the state of hydriodate, in the sulphurous mineral waters of Castelnouve d'Asti. He infers, as a probability, from his experiments, that iodine is a constituent part of all sulphurous waters which contain muriates; and to this he attributes the medical efficacy of these waters in diseases of the glandular and lymphatic systems. (*Giornale di Fisica.*)—*Dublin Phil. Journ.*

From the same.

ACCOUNT OF PATENT SUBSTITUTE FOR LEATHER, INVENTED BY MR. THOMAS HANCOCK.

In a former patent, Mr. Hancock proposed to form a substitute for leather, by depositing caoutchouc in a fluid state, upon loose fibres of wool, cotton, or flax, felted or matted together. In the present patent, he uses a *woven cloth*, made of wool, cotton, or flax. When this cloth is stretched upon a flat surface, the composition to be presently described is spread over it. Above the composition, a uniform layer of wadding, made of cotton, flax, wool, silk, or hair, is to be laid, and the whole pressed between a pair of rollers, in order to force the fluid composition among the fibres. It is then to be dried at a temperature not exceeding 80° or 90° of Fahrenheit.

Mr. Hancock has given us the following compositions to be used according to circumstances:

First composition.—Dissolve two pounds of caoutchouc in one gallon of oil of turpentine and highly rectified coal tar. Add six ounces of black resin, two pounds of strong glue size, and one pound of yellow ochre, whitening or powdered pumice.

Second composition.—Dissolve 1 1-2 pounds of caoutchouc as before, and having melted and mixed one pound of glue size and resin in a steam bath, add the dissolved caoutchouc to it, stirring while mixing them. The whole must then be strained through a sieve.

The *first* of the above compositions must be used when a cheap and stiff substance is required, and the proportions may be one-third whitening or glue; but

when a strong and pliant substance is wanted, the *second* composition, in which the caoutchouc predominates, is to be preferred.

A substance like leather may be formed by joining together several thicknesses before they are dry. When leather for the soles of shoes is required, Mr. Hancock proposes to use as the groundwork, wool and cotton in equal quantities. For pipes, straps, &c., he proposes chopped hemp and cotton or flax; and when smooth surfaces are wanted, the substance must be pressed between polished metallic plates. —*Edinburgh Journ. of Science.*

From the Edinburgh New Philosophical Journal.

CONNECTION BETWEEN METEOROLOGY AND VEGETATION.

M. Bousingault has addressed a note to the *Academie des Sciences* of Paris, which is entitled *Comparative examination of the Meteorological circumstances under which our common grains, (the Cerealia) Turkey-wheat, maize, and potatoes, vegetate at the Equator, and in the temperate zone.*—In this examination the author has first made investigations into the time which elapses between the first springing of the plant and its full maturity. He then determined the temperature of the space of time which separates these two extreme epochs of vegetable life. By comparing these data concerning any given plant which is cultivated both in Europe and America, he arrives at this curious result; that the number of days that separates the commencement of vegetation from its maturity, is more considerable in proportion as the mean temperature, under the influence of which the plant grows, is less; the duration of the vegetation will be equal, however different the climate may be, if this temperature is identical in the two places; and it will be shorter or longer according as the mean heat of the period of time necessary for the accomplishment of the vegetation, is itself greater or less, in other words, the duration of the vegetation appears to be in the inverse ratio of the mean temperatures. So that if you multiply the number of days during which any given plant vegetates in these distinct climates, by the mean temperature of the actual period of its vegetation, you will obtain numbers which are very nearly equal. This result is not only remarble, inasmuch as it seems to indicate that, under all climates the same annual plant receives, in the course of its existence, an equal quantity of heat; but it leads also to a practical result, in enabling us to decide upon the possibility of introducing any particular vegetable into a country as soon as we know the mean temperature of the month there.—

From the same.

TROPICAL NIGHTS.

By the by, I travelled by night to avoid the mid-day vertical sun, and I now from experience, advise my friends never to follow my example. No evaporation takes place, you perspire copiously, with which, and the excessive dew, your clothes get saturated, hanging on you like wet leather, impeding every motion, and thus increasing your fatigue. Your breathing is less free, and you get an occasional puff of cold damp air, which instead of refreshing, only adds to your discomfort; in short, you become completely oppressed. But in the sun, what a change; evaporation rapidly progresses, your dress acts like a wine-cooler, you get rid of the oppressive sense of heat, become stimulated, and march on excessively relieved. One point however must never be neglected, to keep a considerable thickness of clothing upon your head, you may then bid defiance to mere heat. On the subject of tropical nights, it occurs to me that there is a rather singular affection to which the human frame is subject, and several medical gentlemen to whom I have spoken, seem to me to entertain rather erroneous views as to its origin. I allude to what is vulgarly called *moon-struck*. Dr. Wells, in his admirable Essay on Dew, has shown that a mutual interchange of radiated heat takes place, in ordinary circumstances, between all bodies, and that on this depends the preservation of temperature. On brilliant moonlight and other cloudless nights, however, all exposed bodies do not receive a quantity equal to that which they shed forth. The want of clouds prevents them receiving that vast quantity which would otherwise be shot back from the sky in consequence; equality of temperature is not maintained. All those bodies which lie favourably, some more than others, be-

come much cooled down, and, among other effects, moisture is deposited from the little portion of air, cooled by contact in the immediate vicinity of the bodies. The human body, when exposed offers no exception to the law, and if the circumstances of the case are such as to preclude the generation copiously of animal heat, the consequences are very serious; persons who incautiously sleep, sentries on duty, &c. become occasionally even victims. When attentively examined in this state, they seem like icicles, cold and wet, shrunk and livid, all the blood has left the superficial vessels, and become engorged in the large veinous trunks; congestion takes place in the brain, producing a state precisely similar to that from apoplexy, which occurs in persons perishing in snow storms, and I have known cases where apoplectic condition has terminated in paralysis either of the face or of the limbs, and in one instance in death. When interrogated, those who have suffered slightly from it state the consciousness of extreme cold against which they could not make head, then insensibility to cold, and afterwards a drowsiness, which gradually overpowered them: —a description which tallies exactly with that of Banks and Solander, in relation to their suffering from excessive cold in South America, and to which the latter nearly fell a victim The means, also, of recovering them is precisely similar, a gradual approach to natural temperature, with a cautious use of stimulants. Officers on night duty in India, leaving their warm quarters on pickets, have sometimes suffered similarly from the carrying power of the damp air, in which they have been forced to remain for some time, serious illnesses have been entailed on them. May not this be looked upon as a primary, or at least as an auxiliary agent in the production of agues, from its tendency to lower the animal powers?

From the same.

ON THE PROPORTION OF NITROGEN IN DIFFERENT VARIETIES OF WHEAT. BY M. PAYAN.

The Philomathic Society of Paris having been consulted by the Agricultural Society of La Marne, concerning the quality of four different kinds of wheat which are cultivated in the same manner and on the same lands. M. Payan explained to the society that he had discovered very considerable differences in the proportions of the nitrogenous matter, as well as in the distribution of that substance in relation to the mass of *perisperm* or the integument of the seed. The maximum of gluten and of two other nitrogenous matters in the varieties which were of moderate hardness, is concentrated in the parts which adhere to the integuments or which approach it the most; whilst in the centre of the grain the nitrogenous substances are in the smallest proportion.

The author has also determined the relation between the weight of the external integument, and that of the mass of the grain; and finally, he has ascertained that between the most nitrogenous grains, and those which are least so, the proportion of nitrogen varies from 0.022 to 0.029. The varieties thus experimented upon were the *Polish* wheat, the *March* wheat, the wheat *de la Trinite* and *de pays*. M. Payan being desirous of investigating, if still greater differences could be found in the hardest corns, and those which are the softest, subjected to analysis the wheat of Taganrock, of Odessa, and of Poland, on the one hand, and the whitest wheats that are employed in La Mennerie of Paris on the other; and he found that the former contained from 0.029 to 0.031 of nitrogen, whilst the others only gave from 0.019 to 0.020. M. Payen adds, that he means to continue these researches on the maxima and minima of nitrogen, by procuring samples of the hardest corns of southern countries, and the softest that are raised in the northern regions.

From the Journal of the Franklin Institute.

CULTURE OF BEETS IN LOMBARDY.

There have been some remarkable peculiarities in the cultivation of sugar beets in this country during the three past years. Its light and sandy soil suits them well, if the temperature, which undergoes a sudden change on the first rains, do not too long protract the sowing. Excessive droughts are also injurious, causing the portion of the root which is above the ground, to become green and acrid. Irrigations, so easily made in this country, and so favourable to rice, wheat and corn,

injure beets, because they submerge the plants and prevent the unfolding of the leaves. To remedy these inconveniences, M. Pagen has advised the sowing of the seeds in beds, and then transplanting the roots in raised beds enriched with good fine manure, immediately after the early rains. The roots will soon strike into this deep soil, and will be less exposed above ground. Water may be conveyed into the furrows between the beds without any risk of submerging the plants, and the produce will be more certain. Last year, the temperature and moisture being unusually favourable, beets were sown early with the drill, and the gathering was abundant. The juice marked 5° on Baume's acrometer, after being clarified. The raw sugar had a more agreeable taste, and the molasses was very sensibly less acrid than similar products in the north of France.

A large portion of land having been covered with the alluvial sands of the Adda, the beets sown upon it were unusually flourishing, but the juice was sulphurous, and furnished but little sugar.—*Bulletin d'Encour. Mai.*

From the same.

NEW PROCESS OF EXTRACTING SUGAR FROM BEETS. BY M. SCHUZENBACH OF CARLSRUHE.

This process consists in converting the beets into powder or dry flour, by a method which operates at once upon large masses and at little expense. The sugar is extracted from this farina, by a very small quantity of water, which comes out clear and limpid, and so concentrated, that in order to obtain a given quantity of sugar, only two or three times its weight is necessary of this concentrated and limpid fluid. The subsequent manipulation, crystalization, &c., are thereby facilitated. The greatest quantity of crystalized matter contained in the beet, is thus also procured, and but little molasses produced.

The author asserts that the expense by this method, is much less than by that commonly pursued, and that his apparatus occupies but little room.—*Ib.*

From the same.

BEET SUGAR.

It appears to have been proved by M. Parrayon, beet sugar manufacturer at Merignies, France, that by adding diluted sulphuric acid to the pulp, as much juice can be obtained by two cold presses as by hot pressure; and that any injurious effect of the acid is completely removed by filtering the juice cold through animal charcoal properly prepared. It passes from the filter with an alkaline rather than an acid re-action.

After being filtered it undergoes clarification by the ordinary methods, requiring, however, rather less lime than usual. The syrup is remarkably white. One litre of it (2.1135 pints) produced 970 grammes, (= 31 oz. Troy,) whereas the same quantity, by measure, of the ordinary syrup, yields only 750 grammes.—*Ib.*

[From the London Journal of Arts and Sciences.

LIZAR'S METHOD OF ENGRAVING.

Turpentine varnish, coloured with lamp-black, serves as an ink to draw on copperplates, as a substitute for wood engraving. When the varnish is thoroughly dry, diluted nitric acid (or aqua-fortis) is poured upon it, and the interstice of course removed by the action of the acid.

The more the plate is covered with the drawing, the more perfect will the engraving be. This seems to possess the advantage of both common copper engraving and that of wood.

Copper is found the best metal for the purpose.

From the Farmer's Register.

BEST DRINK IN HARVEST.

Water, molasses, ginger, and acid, made palatable.

From the United States Gazette.

PROPER TIME TO CUT TIMBER TO PREVENT DRY ROT.

The month of June is said to be the best time, and in proportion as we recede from this period the danger increases.

Wood cut in the winter and heated will give out sap or moisture, most the nearer to the centre, and in June the most will issue near the surface.

From the Journal of the American Institute.

MANNER OF MAKING INDIAN INK.

A number of lighted wicks are put into a vessel full of oil. Over this is hung a dome or funnel-shaped cover of iron, at

such a distance as to receive the smoke. Being well covered with lamp-black, this is brushed off and collected on paper. It is then well mixed in a mortar with a solution of gum or gluten, and then reduced to the consistence of paste; it is then put into little moulds, where it receives those shapes and impressions with which it comes to this country. It is occasionally manufactured in a great variety of forms and sizes, and stamped with ornamental devices, either plain or in gold, and various colours.

Slips of glove leather boiled to a glue, and mixed with black produced from the burning of a candle, will (it is said) make a good substitute for Indian Ink also.

From the Journal of the Franklin Institute.

An *isometrical* mode of *drawing*, consists in making all the right angles of a cube or other figure, on a plane at 60° or 120°. The sight of a person viewing it, meets the vertical and horizontal parts at the same angle. This mode of drawing is well calculated for describing machinery; the eye is supposed to be at an infinite distance; sometimes called *military perspective.*

Charcoal chalks for drawing.—Saw the finest charcoal into slips of the size wanted, and put them into a vessel of melted bees-wax; put them near a slow fire for half an hour; take them out, and when they are perfectly cool, they are fit for use. The advantages of these pencils are, (it is said) that they can be made at the most trifling expense, and the drawings made with them are as permanent as ink.

The above process will harden both red and black chalks, and also make them permanent.

From the Philosophical Magazine and Journal.

Extract from an experimental inquiry into the Laws of Vital Functions; with some observations on the Nature and Treatment of Internal Diseases. By A. P. Wilson Philip, M. D. F. R. S. E.

He says "I cannot help regarding it as almost ascertained, that in those diseases in which the derangement is in the nervous power alone, where the sensorial functions are entire, and the vessels healthy, and merely the power of secretion, which seems immediately to depend on the nervous system, is in fault, galvanism will often prove a valuable means of relief."

OF ASTHMA AND DYSPEPSIA.

The following observations relate chiefly to affections of the lungs:

Of the effects of galvanism in Dyspepsia, the principal experience which I have yet had has been in cases where it was complicated with asthmatic breathing. When the effect of depriving the lungs of a considerable part of the nervous influence is carefully attended to, it will be found, I think, in all respects similar to a common disease, which may be called habitual asthma; in which the breathing is constantly oppressed; better and worse at different times, but never free, and often continues to get worse in defiance of every means we can employ, till the patient is permanently unfitted for all the active duties of life. The animal in the above experiment, is not affected with the croaking noise and violent agitation, which generally characterize fits of spasmodic asthma. This state we cannot induce artificially, except by means which lessen the aperture of the glotis. We have seen from repeated trials, that both the oppressed breathing and the collection of phlegm, caused by the division of the eighth pair of nerves, may be prevented, by sending a stream of galvanism through the lungs. That this may be done with safety in the human body, we know from numberless instances, in which galvanism has been applied to it in every possible way.

Such are the circumstances which led me to expect relief from galvanism in habitual asthma. It is because that expectation has not been disappointed, that I trouble the reader with the following account of its effects:

Although the effects of galvanism in habitual asthma have been witnessed by many other medical men, I have mentioned nothing in the following pages which did not come under my own observation.

I have employed galvanism in many cases of habitual asthma, and almost uniformly with relief. The time, during which the galvanism was applied, before

the patient said that his breathing was easy, has varied from five minutes to a quarter of an hour. I speak of its application in as great a degree as the patient could bear without complaint. For this effect I generally found from eight to sixteen four-inch plates of zinc and copper, the fluid employed being one part of muriatic acid, and twenty of water sufficient.

Some require more than sixteen plates, and a few cannot bear so many as eight; for the sensibility of different individuals to galvanism, is very different. It is curious, and not easily accounted for, that a considerable power, that perhaps of twenty-five or thirty plates, is often necessary on first applying the galvanism, in order to excite any sensation; yet, after the sensation is once excited, the patient shall not perhaps, particularly at first, be able to bear more than six or eight plates. The stronger the sensation excited, the more speedily in general is the relief. I have known the breathing instantly relieved by very strong power.

I have generally made it a rule, to begin with a very weak one, increasing it gradually at the patient's request, by moving one of the wires from one division of the trough to another, and moving it back again when he complained of the sensation being too strong. It is convenient for this purpose to charge with the fluid about thirty plates.

The galvanism was applied in the following manner:—Two thin plates of metal, about two or three inches in diameter, dipped in water, were applied, one to the nape of the neck, and the other to the pit of the stomach, or rather lower. The wires from the different ends of the trough* were brought into contact with these plates, and as observed above, as great a galvanic power maintained, as the patient could bear without complaint.

In this way the galvanic influence was sent through the lungs as much as possible in the direction of their nerves. It is proper, constantly to move the wires upon the metal plates, particularly the negative wire, otherwise the cuticle is injured in the place on which they rest. The relief seemed much the same, whether the positive wire was applied to the nape of the neck, or the pit of the stomach. The negative wire generally excites the strongest sensation. Some patients thought that the relief was most speedy when it was applied near the pit of the stomach.

The galvanism was discontinued as soon as the patient said that his breathing was easy.

In the first cases in which I used it, I sometimes prolonged its application for a quarter of an hour, or twenty minutes, after the patient said he was perfectly relieved, in the hope of preventing the early recurrence of the dyspnœa; but I did not find that it had this effect. It is remarkable, that in several who had laboured under asthmatic breathing for from ten to twenty years, it gave relief quite as readily as in more recent cases; which proves, that the habitual difficulty of breathing, even in the most protracted cases, is not to be ascribed to any permanent change having taken place in the lungs.

With regard to that form of asthma which returns in violent paroxysms, with intervals of perfectly free breathing, I should expect little advantage from galvanism in it, because as I have just observed, I found that the peculiar difficulty of breathing which occur in this species of asthma. cannot be induced in animals except by means of lessening the aperture of the glotis.

It is probable, that in the human subject, the cause producing this effect is spasm, from which indeed the disease takes its name, and we have no reason to believe, from what we know of the nature of galvanism, that it will be found the means of relaxing spasm. The spasmodic asthma is fortunately a very rare disease; so much so, that but one case has occurred to me, since I have employed galvanism in asthma, while I have had an opportunity of employing this remedy in about forty cases of the habitual form of the disease. I cannot therefore, from experience, speak with certainty of the effect of galvanism in the former. In the above case it was twice employed in the paroxysm, and I could observe no relief from it. In both instances the patient said that, had it not been used, the symptoms would have been more severe.

In this patient, the spasmodic paroxysm

* I found a trough of the old construction better than the improved pile, which is much superior for most purposes.

was often succeeded by a state of habitual asthma, for several weeks, in which galvanism gave immediate but temporary relief.

Of the above cases of habitual asthma, many occurred in the work-people of the town where I reside, who had been obliged to abandon their employments in consequence of it, and some of them from its long continuance, without any hope of returning to their regular work. Most of them had tried the usual means in vain. By the use of galvanism they were relieved in different degrees, but all sufficiently to be restored to their employments. I have seen several of them lately, who although they have not used the galvanism for some months, said they had continued to work without any inconvenience. Some, in whom the disease had been wholly removed, remain quite free from it; some have had a return of it, and have derived the same advantage from the galvanism as at first.

I have confined the application to asthmatic dyspnœa. I think there is reason to believe, from the experiments which have been laid before the reader, that in inflammatory cases it would be injurious, and in cases arising from dropsy, or any other mechanical impediment, little or nothing, it is evident, is to be expected from it.

Habitual asthma is often attended with a languid state of the biliary system, and some fulness and tenderness on pressure near the pit of the stomach. If the last is considerable, it must be relieved previous to the use of the galvanism. In a paper which the Medico-Chirurgical Society did me the honour to publish in the seventh volume of their transactions, I have endeavoured to show that a species of pulmonary consumption arises from a disease of the digestive organs, many of the observations there made apply to certain cases of asthma.*

I believe to cases of every species of this disease, but particularly of that we are here considering, many cases of habitual asthma will yield to the means recommended in the above paper; but I have learned from a pretty extensive experience, that a large majority of such cases will resist them: yet readily admit of relief from galvanism. If there is little tendency to inflammation, galvanism seems also to be a means of relieving the affection of the digestive organs. I have repeatedly seen from it the same effect on the biliary system which arises from calomel; a copious bilious discharge from the bowels, coming on within a few days after its employment. This seldom happens except where there appears to have been a failure in the secretory power of the liver, or a defective action in the gall tubes.

I have not found that the presence even of a severe cough, which is common in habitual asthma, in which there is always more or less cough, counter-indicates of the use of galvanism.

(To be continued.)

* See the observations on the state of these organs in asthma, in Dr. Bree's work on this disease.

PROCESS RECOMMENDED FOR THE CURE OF CANCER.

Ashes of red oak bark boiled down to the consistence of molasses, and cover the cancer with it. In about an hour afterwards cover it with a plaster of tar, which must be removed after a few days; and if any protuberance remain in the wound, apply more pot ash and the plaster again, until this shall disappear.

From the Repertory of Arts.

Febrifuge discovered by M. Armond Sequin, is *Gelatine*, taken the moment the cold fit begins to be felt. The patient should be well covered and take no violent exercise. Keep his room on the day of the paroxysm, abstain as much as possible from liquid food of all kinds, and from fruits, spices, and spirituous liquors; live principally on thick soups and meat of the best quality boiled or preferably roasted; and above all, drink extremely little however thirsty he may be. Eat moderately. Taken also morning and evening while the fever lasts, and even for a certain time after it is over. Eat nothing for an hour after the cessation of the paroxysm, or an hour after the application of the remedy, if it is taken in the intermission. The patient must not counteract the sweats. Children under 1 year from 24 grains to 1 dram at an application; from 1 to 3 years, from 48 grains to 2 drams; from 3 to 7 years, from 1 to

4 drams; from 7 to 12 years, from 2 to 6 drams; from 12 to 16 years, from 2 to 12 drams, and all above that from 2 drams to 3 ounces. The *discoverer* aforesaid, took eight ounces at once, without inconvenience, except a slight fatigue and drowsiness. Where the patient is much reduced at commencement, the doses should be gradually increased till the fever is cured, and then mix a draught of cinnamon and sugar infused in good wine, with a dose of from 4 to 8 ounces per day. In obstinate fevers, the dose to be so large as to produce more exhaustion and more pain in his head for 24 hours, than would have been from the paroxysm alone; but in succeeding paroxysms it is proper to administer large doses in the intermissions, and much smaller ones at the beginning of the paroxysms. *Quin quina* should on no account be used at the same time. When fever is accompanied with worms and other disorders, other medicines should also be used.

Preparation.—Select the most dry and transparent gelatine; dissolve it in a sand bath in three parts water, add equal parts of sugar and some drops of orange flower water. The sugar and orange flower water, serve to disguise in some degree, the insipidity of the gelatine. The gelatine may also be prepared in cakes and kept for any length of time, as follows, viz: Transparent gelatine and sugar, equal weight of each, or one part of each and three parts or weight of water. A small quantity of orange flower water, and pour it into a glass mould which contains as many superficial inches as there are drams of jelly in the mixture. When it becomes hard take it out of the mould and lay it on a wire grating, formed in like manner of squares of an inch each. When it is almost dry, cut it according to its divisions. When these cakes are wanted for use, nothing more is necessary than to dissolve them in the smallest quantity of water, and thus to take them in a liquid form, or they may be suffered to melt in the mouth.

From the Philosophical Transactions.

INCREASE OF VELOCITY IN MACHINERY.

The most advantageous mode of increasing velocity by a series of wheels, is to adjust them so that the multiplication of velocity will proceed in a geometrical progression.

TO MAKE LITHOGRAPHIC PENCILS.

Mix the following ingredients: Soap, three ounces; tallow, two ounces; wax, one ounce; when melted smooth, add a sufficient quantity of lamp-black, and pour it into moulds.

From Silliman's Journal.

STEREOTYPE METALOGRAPHIC PRINTING.

Take two plates of very soft iron of moderate dimensions, give one face of each a very true and fine polish, so that when applied by these surfaces, they will uniformly fit and adhere together. Moisten two slips of printed newspaper, or parts of a leaf from a book of the size of the plates, apply one to the polished face of each plate, and interpose between them a fold or two of silk paper, and then clamp the plates together. Give them a gentle heat over the fire, then place them in a vice and apply a strong power; on separating them and gently removing the paper the letters will be seen distinctly formed on the faces of the two plates. As printers ink is formed of lamp black and oil upon which acid acts very little, the faces of the plates may be slightly touched over with diluted sulphuric or nitric acid, which if skilfully applied, acts on the iron and leaves the letters raised. When the printers' ink contains some bees-wax the experiment is more complete. These plates when once formed may be converted into steel on the plan of Mr. Perkins, after which they would probably print 10,000 or 20,000 copies without being materially defaced. An expert mechanic with proper machinery, could in a day or two, form a sufficient number of plates to print off 20,000 copies 500 pages of an octavo volume. Other metals as copper, brass and type-metal, with slight variations can all have letters transferred to them in the same manner, and can be used as printing plates, but none of them will have the durability of Iron.

From the Encyclopædia Americana.

SEA BATHING.

SEA BATHING IS BENEFICIAL in all diseases of the glands of all kinds, and of the skin in scrofula and a scrofulous pre-

disposition, exhausting sweats, and tendency to catarrhs, chronic nervous diseases, particularly hysteric attacks, epilepsy, St. Vitus' dance, also, sometimes in Chronic Rheumatism.

Injurious, in plethora, inclination to congestions and discharges of blood, diseases of the heart, tendency to pulmonary consumption, obstruction and induration of internal organs.

A floating bath where patients may undress, is preferable to going in with the clothes on.

From the Mechanics' Magazine.

IMITATION OF GOLD.

Take of linseed oil three ounces, Tartar two ounces, yolk of eggs boiled hard and beaten two ounces, Aloes half an ounce, Saffron five grains, Turmeric two grains. Boil all these together in an earthen vessel and with it wash the iron, and it will look like gold. If there be not linseed oil enough, you may add more.

From the Mechanics' Magazine.

TO TEMPER STEEL EDGE TOOLS.

If it should be too hard, melt a sufficient quantity of lead to immerse the edge of the tool, having previously brightened its surface, then plunge it into the melted lead for a few minutes, till it gets sufficiently hot to melt a candle, with which rub its surface, then plunge it in again and keep it there till the steel assumes a straw color (but be careful not to let it turn blue;) when that is the case take it out, rub it again with the tallow and let it cool. If it should be too soft wipe the grease off and repeat the process without the tallow, and when sufficiently hot, plunge it in cold spring water or water and vinegar mixed. By a proper attention to these directions and a little practice, every workman will have it in his power to give a proper temper to the tools he may use. If a saw be too hard it may be tempered by the same means. If you are near a plumber's shop you may repeat the process conveniently and without expense, when they are melting a pot of lead. In other cutting tools you must wait till the steel just begins to turn blue, which is a temper which will give it more elasticity, and at the same time, sufficient hardness.

From the Retrospect of Philosophical, Mechanical, Chemical, and Agricultural Discoveries.

ON THE MEANS OF REMOVING THE EFFECTS OF THE BITE OF THE ADDER.

BY W. N. ——.

[Dickson's Agricultural Magazine, No. 7.]

As many farms are infested with this poisonous reptile, which affords a remedy for its own bite, more efficacious than any medicine, the writer conceived he should be usefully employed in pointing out the means of removing the effect of the bite, the success of which he had four times experienced in its application to a pointer, which had been stung by the venomous reptile. The mode of cure recommended by him is to procure as many adders as possible in the month of May, and to take the fat from them, and simmer this fat over a fire to extract the oil, (which at that time they yield in the greatest plenty), and to preserve the same in a phial for use. When any animal is stung by the adder, he advises opening several places in the swelled parts, with a phleme, to discharge the corrupted blood, and then to moisten the wound several times with the viper's oil, till the swellings begin to decrease; when it should be healed by the application of an ointment, composed of half a pound of pork suet, half a pound of turpentine, half a quarter of a pint of oil of turpentine, two ounces of linseed oil, two ounces of bees-wax, two ounces of rosin, and three table-spoonsful of honey, which are boiled well together, and strained through a piece of crape; and half an ounce of powdered verdigris to be stirred in till the whole becomes cool.

It is added that this ointment is also extremely serviceable among horses, for collar and saddle chafes, as well as for kicks, cuts, &c.

Observations.—The remedy recommended for the curing of the venomous bite of the adder, is in unison with the opinion of the most experienced medical men on the subject, and ought to be always kept in readiness in those parts where this noxious reptile abounds. The ointment is well calculated for all wounds from whatever cause produced.

From the same.

HINTS AND REMARKS ON HARVEST WORK, AND THE SMUT IN WHEAT. BY A. B.

[Dickson's Agricultural Magazine, No. 11.]

The remarks on harvest work approach

too near to a controversy, and are too personal to be here noticed; those on the smut in wheat, point out "washing the seed very clean, pickling it, and encrusting the grains with quick-lime," as the only preventives of the smut hitherto known or practised. The writer considers it very immaterial which of these operations produce the effect, so long as it is certain that the seed thus treated has yielded a crop free from smut, while the same seed, sown without any preparation, has had smut balls.

Observations.—If treating wheat, previous to sowing, in the manner here recommended, be only a popular prejudice, as many have asserted, it is worthy of recollection, that the error is on the safe side of the question.

From the same.

ON THE SUITABLE REMEDIES FOR THE MOST PREVALENT DISEASES OF SHEEP, (IN FRANCE) Read at a meeting of the Royal Medical Society of Paris, by Professor DAUBENTON. *Farm. Mag. No.* 33.

The Professor, who kept a flock of sheep in the northern extremity of Burgundy, observes that in France, sheep are not affected by any intemperature of the air, but only by the violent heat of the sun, as the wool defends them from the most intense cold, the heaviest and longest continued rains and snows, or the severest frosts, were productive of no disease, while the heat of the sun caused many to die in the field, and more would have fallen victims to it, had not proper precautions been speedily observed.

This disease, which from its cause, is denominated *the heat*, is stated most frequently to attack those sheep which are most free in blood, best fed, and most robust; the animal attacked by it gasps for breath, foams at the mouth, and bleeds at the nose; the eye-balls become red, the animal droops its head, staggers, and soon falls dead. After death, all the parts of the head and throat are of a mixed colour of red, and somewhat blackish, and the blood-vessels there, appear much swelled on dissection. All these symptoms, he remarks, naturally suggests blood-letting as a remedy, which he has always found to effect a speedy cure if administered in time. He proceeds to enumerate the several parts of the body in which sheep are occasionally bled, and the different mode of performing the operation. But as in this disease the bleeding of the sheep must be performed quickly, and the vessel opened by the operation be so large as to give a sufficient quantity of blood, and be situated in a part of the body where there is no wool, he recommends bleeding in the cheek, as a method equal and simple, and prefers it to all others This is described as done on the spot where the fourth cheek-tooth is situated, which is marked on the external surface of the bone of the upper jaw, by a tubercle, sufficiently prominent to be very sensible to the finger when the skin of the cheek is touched. His words are, "to let blood in the cheek, the shepherd begins by placing an open lancet between his teeth; he then puts the sheep between his legs, and squeezes it so as to hold it fast; his left knee is rather more advanced than the right; he places his left hand under the head of the animal, and grasps the under jaw, so that his fingers are under the right side of that jaw near its hinder extremity, in order to press the angular vein which passes in that place, and to make it swell, the shepherd then touches with the other hand the right cheek of the sheep, at the spot near equi-distant from the eye and the mouth; he there finds the tubercle which is to guide him; he can only feel the angular vein swelled below this tubercle. He then takes in his right hand the lancet, which he holds in his mouth, and makes the incision from below upwards half an inch in length, below the middle of the projection, which serves to guide him.

(*To be continued.*)

TO TAKE IMPRESSIONS FROM RECENT MANUSCRIPTS.

This is done by means of fusible metals. In order to show the application of it, paste a piece of paper on the bottom of a saucer, and allow it to dry; then write upon it with common writing ink and sprinkle some finely powdered gum arabic over the writing, which produces a slight relief. When it is well dried, and the adhering powder brushed off, the fusible metal is poured into the saucer and is

cooled rapidly ; to prevent crystalization ; the metal then takes a cast of the writing, and when it is immersed in slightly warm water to remove adhering gum, impressions may be taken from it as from *copper plate.*

ANOTHER METHOD.

Put a little sugar into common writing ink, and let the writing be executed with this upon common paper, sized as usual.

When a copy is required, let unsized paper be taken and slightly moistened with a sponge. Then apply the wet paper to the writing, and passing lightly a flat iron of moderate heat, such as is used by laundresses, over the unsized paper; the copy will be immediately produced: this method requires no machine or preparation, and may be employed in any situation.

TO TAKE IMPRESSIONS ON PAPER FROM DESIGNS MADE ON STONE.

The stone should be close grained, and the drawing or writing should be made with a pen dipped in ink formed of a solution of lac, in leys of pure soda, to which some soap and lamp-black should be added for colouring.

Leave it to harden for a few days; then take impressions in the following manner: dip the surface in water, then dab it with the printer's ink and printer's balls : the ink will stick to the design and not to the stone; and the impressions may be taken with wet paper, by a roller or screw press, in the ordinary way ; several hundred copies may be taken from the same design in this simple manner.

From the Retrospect of Philosophical, Mechanical, and Agricultural Discoveries.

ON THE BLIGHT IN WHEAT.

By Mr. Thomas Davis of Harringsham, (deceased). *Bath Society's Papers, Vol. II.*

Mr. Davis commences by observing, that the opinion which he had formerly given to the Society, that the blight in wheat was a *plant*, and not an insect, had been since fully confirmed by the microscopical observations of Sir Joseph Banks, who describes the manner in which the minute seeds of this plant are carried by the wind, and lodged on the growing stalks of wheat, where they take root and vegetate, and like all parasitical plants, rob the plant to which they attach, of all its nourishment, to support themselves. The effect is too well known: it absorbs the farina or flower of the fairest and plumpest grain, and reduces it to a mere shell of bran. The remedy, however, he adds, is not so easily found, and with all due deference to Sir Joseph Banks, he thinks it very doubtful whether the evil can be eradicated by pulling up the diseased plants, or even by burning up all the straw of the blighted crop; for the seeds of this destructive plant are too minute and abundant, and capable of being wafted to too great a distance, to be totally destroyed; a single acre of blighted wheat being sufficient to supply a whole district, and botanists have admitted, that a blight grows and flourishes on other plants besides wheat.

It is not therefore conceived to be within the power of man, totally to prevent the ravages of this destructive enemy to agriculture, though it may be obviated in a very considerable degree, by ascertaining the cause, which peculiarly predispose and prepare the wheat plant for its attacks, and these are summed up in one word, namely, *weakness.*

(*To be continued.*)

From the same.

ON THE DISEASES IN DOGS CALLED THE DISTEMPER.

By a Kincardinshire Freeholder.—*Farmer's Magazine, No.* 35.

As a farmer generally values his dog next to his wife and his horse, any apology is held unnecessary for obtruding this paper upon an agricultural publication. It is noticed that the disease called the distemper, is more accurately described by Dr. Blane than by any other writer, and that his medicines have proved more successful than those of any other person ; but they yet very often fail of producing a cure, and the valuable animal dies a miserable and lingering death. The gentleman who communicated this paper to the Magazine, had administered the doctor's medicines to a favourite pointer, but with no avail; the unvarying symptoms had come on, when the poor animal crawled into the field and fell among some grass, attempting, but in vain, to eat it. He fol-

lowed the suggestion of nature, and ordered a handful of grass to be cut in shreds of about half an inch long; and when mixed with butter to be put down the animals throat; the dose was repeated three times in every twenty-four hours, and a visible amendment almost immediately took place, which terminated in recovery.

He admits the case to be a solitary one; but as the remedy appeared to him to be pointed out by nature, he considered it to merit attention and made it public, that the efficacy of this simple medicine might obtain a fair and unprejudiced trial.

Observations.—The remedy suggested in this article for a disease which so often proves fatal as a distemper, and deprives both the farmer and sportsman of a valuable attendant, is deserving of a trial whenever an opportunity is afforded of administering it. It is certain that it can do no harm; and nature not unfrequently works the greatest effects by the simplest means.

From the same.

ON FARM BUILDINGS,

With an account of a new species of Roof.

By Mr. John Graham.—*Farmer's Magazine, No.* 33.

The observations on farm buildings are mostly relative to the question in political economy, whether the expense ought to fall on the landlord or on the tenant, and are therefore little adapted to a publication which professes to confine itself to new discoveries or new applications of those already known; but the account of a new species of roof is a proper subject for the *Retrospect.*

It is well known that few merchant vessels are sheathed with copper, and that their hulls are preserved from the worms by covering them with paper, manufactured for the purpose, called sheathing paper, which is nailed on upon the wood, and the paper itself is secured by being covered with a coat of thin deal; and though the worms penetrate this outer deal, yet the paper coated with tar prevents them from penetrating into the hull of the vessel. The new species of roof, mentioned in this paper, is formed by a covering of this paper laid on boards, previously nicely fitted, without any intervals between them, the paper being first saturated with tar, and afterwards coated over with the same material. This roof is said to be equal to slates in durability, though executed at about half the expense. The practice is stated to have been introduced about twenty years ago, by a Mr. Wood, a ship-builder, in Grenock, whose example was "long gazed upon in stupid silence." But last summer a pile of buildings for preparing alum, and a village, containing about fifty families, were erected with paper roofs of this description, which have been found to answer.

(*To be continued.*)

From the same.

ON THE CHINESE METHOD OF PROPAGATING FRUIT TREES BY ABSCISSION.

By Dr. James Howison.—*Trans. Soc. of Arts, Vol.* 25.

It is stated that the Chinese do not raise fruit trees from seeds or grafts, as is customary in Europe, but in the following method:

They select a tree which they wish to propagate, and fix upon a branch which will disfigure it the least by the removal, and round this, as near as conveniently as may be to its junction with the trunk, they wind a rope made of straw, besmeared with cow-dung, until a ball is formed five or six times the diameter of the branch. This is intended as a bed into which the young roots may shoot; and immediately under the ball the bark is divided down to the wood, for nearly two-thirds of the circumference of the branch: a cocoa-nut shell, or small pot, is then hung over the ball, with a hole in the bottom, so small, that water put therein will only fall in drops, by which means the rope is constantly kept moist; a circumstance necessary for the ready admission of the young roots, and for the supply of nourishment for the branch. When the vessel has been supplied with water for three weeks, one-third of the remaining bark is cut, and the former incision carried deeper into the branch, as by this time some roots have struck into the rope, and assist in giving support. After a similar interval, the operation is again repeated, and in about two months from the commencement of the process, the roots are generally seen intersecting each other on

the surface of the ball; which indicates that they are sufficiently advanced to admit of the separation of the branch from the tree; and this is best done by sawing it off at the incision; taking care that the rope, which must have become nearly rotten, is not shaken off by the operation; and then the branch is planted as a young tree.

(*To be continued.*)

From the same.

APPARATUS FOR THE DECOMPOSITION OF THE ALKALIES UNDER NAPHTHA, BY GALVANISM. By Mr. W. H. PEPYS.—*Phil. Mag. No.* 124.

To a bottle without a bottom, a glass stopper is accurately ground. The stopper is perforated through its axis, and a wire that is passed through this perforation, serves to connect a plate of platina lying on the internal surface of the stopper, with a plate of copper that serves for a foot to the inverted vessel, and is brought into contact with the positive end of the galvanic trough.

The alkali, slightly moistened, is placed on the platina plate; the inverted bottle is filled with naphtha, and covered with a wooden cover, through which a platina wire, with a disc of the same metal at the lower end, is allowed to slide. This wire communicates with the negative end of the trough, and the bottom being brought into contact with the alkali, the latter is decomposed; the produced metal sometimes floats, but the greatest portion is found imbedded in the alkali. The gasses evolved during the process, may be collected by a slight variation of the apparatus.

From the same.

PROCESS EMPLOYED IN INDIA FOR FALSE GILDING AND WHITEWASHING.—*Buchanan's Journey through the Mysore country, &c.*

The gilding in the palaces at Seringapatam is false, and prepared from lead only. An oil, called gurra oil, is made by boiling about 18 pounds of linseed oil for two hours in a brass pot, to which about 6 pounds of aloes being added, the boiling is continued for four hours more. Another pot being made hot, 12 pounds of an elastic gum called chunderásu, prepared from the milky juices of the ficus glomerata, ficus gonia, and several other trees,) is melted in it. A cloth being tied over the mouth of a third pot, the linseed oil is first strained into it, and kept warm, while the elastic gum is gradually added; after which the oil is strained for use.

Three parts of English glue, dissolved in water, are added to 24 of very fine leaf lead, and the whole beat together for a-day. The mass is then cut into cakes and dried in the shade. These cakes are dissolved in water, and the metal spread thin with a hair brush upon paper, which after being dried is polished with a stone till it acquires the metallic lustre. The edges are then pasted down on a board and rubbed with the palm of the hand, previously smeared with the above gurra oil, and exposed to the sun. On the two following days the operation is repeated, when it acquires a brass yellow colour.

(*To be continued.*)

Thenard's and Blainvilles Lithographic Ink.—Soap, one-fourth; mutton suet, one-half; yellow wax, one part; mastic, in tears, one half, and as much lamp-black as necessary.

VALUABLE ACID FOR ENGRAVERS.

M. Deleschamps says the best acid for engraving for every kind of biting, produce a clear and deep line, *without eating away the sides of the subject*, he uses a composition of acetate of silver and hydrate of nitrous ether. The acetate is precipitated into the lower part of the furrow, where it produces a rapid and energetic action, the upper parts of the furrow are occupied by the nitrous ether and preserved by its presence.—*Jour. Frank. Institute.*

From Rees' New Cyclopædia, (reference to plates not given.)

WIND-MILL IN MECHANICS,

A machine which is put in motion by the force of the wind. Wind-mills are in general applied to the purpose of grinding corn, but are occasionally used to give motion to machines for raising water, sawing-mills, or for other purposes. We shall in this article consider the wind-mill as a first mover, or *primum mobile*, which may be applied to many purposes.

The invention of wind-mills is not of a very remote date. According to some authors, they were first used in France in the sixth century; while others maintain

that they were brought to Europe in the time of the Crusades, and that they had long been employed in the East, where the scarcity of water precluded the application of that powerful agent to machinery.

The wind-mill though a common machine, has some things in it more ingenious than is usually imagined. Add that it is generally allowed to have a degree of perfection, which few of the popular engines have attained to, and which the makers are but little aware of: though the aid of mathematics has furnished ample matter for its improvement.

The vertical wind-mill, which is the kind in most common use, consists of an axis or shaft, placed in the direction of the wind, and usually inclining a little upwards from the horizontal line. At one end of this, four long arms or yards are fixed perpendicular to the axis, and cross each other at right angles; into these arms small cross bars are morticed at right angles, and other long bars are joined to them, which are parallel to the length of the arms, so that the bars intersect each other in the manner of lattice work, and form a surface, on which a cloth can be spread to receive the action of the wind. These are called the sails; they are in form of a trapezium, and are usually nine yards long and two wide.

The circular motion is produced by the obliquity of the planes of these surfaces, from the plane in which all the four arms are situated; by these means, when the wind blows in the direction of the axis, it does not impinge upon the sails at right angles to their surfaces, but strikes obliquely; hence the effort of the sail to recede from the wind, causes it to turn round with the common axis, and the four sails are all made oblique in the same direction, so as to unite their efforts for the common object.

(*To be continued.*)

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OBSERVER AND RECORD
OF AGRICULTURE, SCIENCE, AND ART.

EDITED BY D. PEIRCE.

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The object of this paper is to concentrate and preserve, in a form suitable for future reference, the most useful and interesting articles on the aforesaid subjects. Each number will contain sixteen octavo pages, printed on good paper, and when a sufficient amount is published to form a volume of convenient size, an alphabetical table of contents will be published and forwarded to subscribers, in order for binding. This number, shows the general plan of the work.

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SILK WORM AND SILK MANUFACTURE.

THE caterpillar or larva, emphatically known by the title of the silk worm, is, when full grown, nearly three inches long and of a yellowish gray colour; on the upper part of the last joint of the body is a horn-like process, as in many of the spinges. It feeds, as every one knows, on the leaves of the white mulberry, in defect of which may be substituted the black mulberry, and even in some instances, the lettuce and a few other plants. The silk worm remains in its larva state about six weeks, changing its skin four times during that period, and, like other caterpillars, abstaining from food for some time before each change. When full grown the animal entirely ceases to feed, and begins to form itself a loose envelopment of silken fibres in some convenient spot, which it has chosen for that purpose; and afterwards proceeds to enwrap itself in a much closer covering, forming an oval yellow silken case or ball, about the size of a pigeon's egg, in which it changes to a chrysalis, and after lying thus enclosed for about the space of fifteen days, gives birth to the moth.—This however is always prevented when the animals are reared for the purpose of commerce; the moth greatly injuring the silk of the ball by discharging a quantity of coloured fluid before it leaves the cell; the silk-balls are therefore exposed to such a degree of heat as to kill the enclosed chrysalides, a few only being saved for the breed of the following year. The moth, when hatched is a short-lived animal, breeding soon after its exclusion; and when the females have laid their eggs, they, as well as the males, survive but a very short time.

The length of the silken fibre or thread drawn by the silk-worm may be supposed to differ considerably in different silkballs. According to Boyle, as quoted by Durham, a lady, on making the experiment, found the length of the ball to be considerably more than 300 yards, though the weight was only two grains and a half.

The Abbe La Pluche informs us, that of two balls, one measured 924 feet, and the other 930. It may be proper to add that the silk throughout its whole length is double or composed of two conjoined or agglutinated filaments.

Silk as spun by the animal, is in the state of fine threads, varying in colour from white to a reddish yellow. It is very elastic, and has considerable strength if we consider its small diameter. It is covered with a varnish, to which its elasticity is owing. This varnish is soluble in boiling water; but alcohol does not act upon it. Hence it has been compared to a gum, though it approaches much nearer to a gelatine; since Berthollet has shown that it is precipitated by Tan, and by Muriate of Tin. It differs however, from gelatine in several particulars. Alum throws it down of a dirty white; Sulphate of Copper, of a dark brown, and Sulphate of Iron, of a brown colour.

When the water is evaporated, the varnish is obtained of a black colour, brittle,

and of a shining fracture. Its weight is nearly one third of the raw silk from which it was extracted. It may be separated from silk by soap as well as water, and the soap leys containing it, soon putrefy.

Besides the varnish, silk contains another substance to which it owes its yellow colour, this substance possesses the properties of Resin. It is yellow, soluble in Alcohol, and in a mixture of Alcohol and Muriatic Acid. Beaume, has ascertained that by this last mixture, it may be separated completely, and the silk deprived of it assumes a fine white colour.

The chemical properties of silk itself, have been but imperfectly examined. It is not acted on by water or alcohol, has no taste, and is but imperfectly combustible; though fire rapidly blackens and decomposes it. When distilled, it yields according to Newman, an uncommonly great proportion of ammonia. The fixed alkalies dissolve it by the assistance of heat, and it is not unlikely that they form with it, an animal soap. It is dissolved likewise, by sulphuric and muriatic acids, and by nitric acid.

By the action of this last acid, Bartholet obtained from silk some oxalic acid, and a fatty matter which swam on the surface of the solution. By a similar treatment Welter obtained fine yellow crystals, very combustible, to which he gave the name of yellow bitter principle.

Silk is very little susceptible of putrefaction. Dr. Wilson, of Falkirk, says that a ribbon was lately found in the church yard of that town, wrapt round the bone of the arm. It was uninjured, though it had lain eight years in the earth. We know at the same time, that when silk is kept in a damp place it rots (to use the common language,) in a much shorter time.

—

Manufacture, or Preparation of Silk.

When the silk worms have completed their balls or cocoons, they are collected and put into little baskets, and thus exposed to the heat of an oven to kill the insect, which without this precaution would not fail to open itself to go away and use those new wings abroad, it has acquired within; ordinarily, they only wind the more perfect balls; those that are double, or too weak or too coarse, are laid aside, not altogether useless, but that, being improper for winding they are reserved to be drawn out into skeins. The balls are of different colours; the most common are yellow orange colour, Isabella, and flesh colour; there are some also of a sea-green, others of a sulphur colour, and others are white; but there is no necessity of separating the colours and shades apart, to wind them, as all the colours are to be lost in the future scouring and preparing of the silk. The goodness of silk is best distinguished by its lightness. The organzine silk is the best of any made in the country of Piedmont, and two threads are equal in fineness, that is, in smoothness, thickness and length, for the thread of the first twist. For the second it matters not whether the single thread be strong before the two are joined, unless to see whether the first twist proves well. It is necessary, that the silk be clean; and it is to be observed that the straw coloured is generally the lightest, and the white the heaviest of all; the skeins should be even, and all of them of an equality, which shows that they were wrought together; otherwise we may with justice suspect that it is refuse silk, and cannot be equally drawn out and spun, for one thread will be shorter than the other, which is labour and loss.

It will also be requisite to search the bale more than once and take from out of the parcels a skein to make an essay; for, unless it is known by trial, there is the greatest danger of being cheated in this commodity. To wind silk from off the balls two machines are necessary; the one a furnace with its copper, the other a reel or frame, to draw the silk: the winder then seated near the furnace, throws into the copper of water over the furnace (first heated and boiled to a certain degree, which custom alone can teach) a handful or two of balls, which have been first well purged of all their loose furry substance. The winder then stirs the whole very briskly about with birchen rods, bound and cut like branches; and when the heat and agitation have detached the ends of the silk of the cocoons, which are apt to catch on the rods, the ends of the silk are to be drawn forth and joined ten or twelve, or even fourteen of them together, and formed into threads according to the size

required, to the works they are designed for; eight ends sufficing for ribands; and velvets requiring no less than fourteen.

(*To be continued.*)

COLOURING MATTER AND PRINCPLES OF DYING.

The substances commonly employed for clothing may be reduced to four, namely, wool, silk, cotton and linen.

Permanent alterations in the colour of cloth can only be induced two ways; either by producing a chemical change in the cloth, or by covering its fibres with some substances which possess the wished for colour.—Recourse can seldom or never be had to the first method, because it is hardly possible to produce a chemical change in the fibres of cloth, without spoiling its texture and rendering it useless. The dyer, therefore when he wishes to give a new colour to a cloth, has always recourse to the second method.

The substances employed for this purpose are colouring matters, or dye-stuffs. They are for the most part extracted from animal and vegetable substances, and have usually the colour which they are to give to the cloth.

Since the particles of colouring matter, with which cloth when dyed is covered are transparent, it follows that all the light reflected from dyed cloth, must be reflected, not by the dye-stuff itself, but by the fibres of cloth below the dye-stuff. The colour therefore does not depend upon the dye alone, but also on the previous colour of the cloth. If the cloth be black, it is clear that we cannot dye it any other colour whatever; because as no light in that case is reflected, none can be transmitted, whatever dye-stuff we employ. If the cloth be red, blue, or yellow, we could not dye it any colour except black; because, as only red, or blue, or yellow rays are reflected, no other could be transmitted. Hence the importance of a fine white colour when cloth is to receive bright dyes. It then reflects all the rays in abundance, and therefore any colour may be given, by covering it with a dye-stuff which transmits only some particular rays. If the colouring matters were merely spread over the surface of the fibres of cloth by the dyer, the colours produced might be very bright, but they could not be permanent; because the colouring matter would be very soon rubbed off; and would totally disappear whenever the cloth was washed, or even exposed to the weather. The colouring matter then, however perfect a colour it possesses, is of no value, unless it also adheres so firmly to the cloth that none of the substances usually applied to cloth, in order to clean it, &c. can displace it. Now this can only happen, when there is a strong affinity between the colouring matter and the cloth, and when they are actually combined together in consequence of that affinity. Dying then, is merely a chemical process and consists in combining a certain colouring matter with fibres of cloth. This process can in no instance be performed, unless the dye-stuff is first reduced to its integrant particles; for the attraction of aggregation between the particles of dye-stuffs, is too great to be overcome by the affinity between them and the cloth, unless they be brought within much smaller distances than is possible while they both remain in a solid form. It is necessary therefore, previously to dissolve the colouring matter in some liquid or other, which has a weaker affinity for it than the cloth has. When the cloth is dipped into this solution, the colouring matter, reduced by this contrivance to a liquid state is brought within the attracting distance, the cloth therefore acts upon it and from its stronger affinity takes it from the solvent, and fixes upon itself. By this contrivance too, the equlity of the colour, is in some measure secured, as every part of the cloth has an opportunity of attracting to itself the proper proportion of colouring particles. The facility with which cloth imbibes a dye depends upon two circumstances, namely, the affinity between the cloth and the dye-stuff, and the affinity between the dye-stuff and its solvent. It is directly as the former and inversely as the latter.

It is of importance to preserve a due proportion between these two affinities as upon that proportion much of the accuracy of dying depends. If the affinity between the colouring matter and the cloth be too great, compared with the affinity between the colouring matter and the solvent, the cloth will take the dye too rapidly, and it will be scarcely possible to prevent its colour from being une-

qual. On the other hand, if the affinity between the colouring matter, and the solvent be too great, compared with that between the colouring matter and the cloth, the cloth will either not take the colour at all, or it will take it very slowly and very faintly.

Wool has the strongest affinity for almost all colouring matters, silk the next strongest, cotton a considerably weaker affinity, and linen the weakest affinity of all.

In order, therefore, to dye cotton, or linen, the dye-stuff should in many cases be dissolved in substances for which it has a weaker affinity than for the solvent employed in the dying of wool or silk. Thus we may use oxide of Iron dissolved in sulphuric acid, in order to dye wool: but for cotton or linen, it is better to dissolve it in acetous acid. Were it possible to procure a sufficient number of colouring matters, having a strong affinity for cloth to answer all the purposes of dying, that art would be exceedingly simple and easy. But this is by no means the case; if we except indigo, the dyer is scarcely possessed of a dye-stuff which yields of itself a good colour, sufficiently permanent to deserve the name of a dye.

This difficulty, which at first sight appears insurmountable has been obviated by a very ingenious contrivance. Some substance is employed which has a strong affinity both for the cloth and the colouring matter. This substance is previously combined with the cloth which is then dipped in the solution containing the dye-stuff. The dye-stuff combines with the intermediate substance, which being firmly combined with the cloth secures the permanence of the dye. Substances employed for this purpose are denominated mordants. The most important part of dying is undoubtedly the proper choice, and proper application of mordants; as upon them, the permanency of almost every dye depends. Every thing which has been said respecting the application of colouring matters applies equally to the application of mordants. They must be previously dissolved in some liquid, which has a weaker affinity for them than the cloth has, to which they are to be applied; and the cloth must be dipped; or even steeped in this solution, in order to be saturated with the mordant. Almost the only substance used as mordants are earths, metalic oxides, tan and oil. Of earthy mordants the most important and most generally used, is alumina. It is used either in the state of common alum, in which it is combined with sulphuric acid or in that of acetate of alumina. Alum when used as a mordant, is dissolved in water, and very frequently a quantity of tartar is dissolved along with it.

Into this solution the cloth is put, and kept in it till it has absorbed as much alumina as is necessary. It is then taken out, and for the most part washed and dried. It is now a good deal heavier than it was before, owing to the alumina which has combined with it. The tartar serves two purposes; the potass which it contains combines with the sulphuric acid of the alum, and thus prevents that very corrosive substance from injuring the texture of the cloth, which otherwise might happen, the tartarous acid on the other hand, combines with part of the alumina and forms a tartrate of alumina which is more easily decomposed by the cloth than alum. Acetate of alumina has also been used in dying. This mordant is now prepared by pouring acetate of lead into a solution of alum; a double decomposition takes place, the sulphurous acid combines with the lead, and the compound precipitates, in the form of an insoluble powder, while the alumina combines with the acetous acid, and remains dissolved in the liquid. This mordant is employed for cotton and linen, which have a weaker affinity than wool for alumina. It answers much better than alum; the cloth is much easier saturated with alumina and takes in consequence, both a richer and more permanent colour.

(*To be continued.*)

PROCESS OF CONVERTING BEETS INTO SUGAR.

Barruel's Method.

1*st. process.* *To wash the roots and cut off the tops.*

2. *To reduce the root to a pulp,* this may be done in various ways; two indented cylinders, one working within the other is considered the best.

3. *To express the juice.* This should be done as speedily as possible, for the

juice alters very rapidly, and becomes more and more mucilaginous, to the injury of the future operations. 100 parts of beets give from 65 to 70 of juice.

4. *To neutralize the acid and evaporate.* When the juice begins to boil, some chalk is stirred in as long as there is any effervesence. It is then scummed, boiled down sufficiently and the syrup transferred to conical moulds for six or seven days to deposit its earthy salts.

5. *To clarify and boil down.* The syrup is clarified either with skimmed milk or blood, and then strained and boiled down.

6. *To crystallize the sugar.* This is the longest process. It is done in square shallow earthen, or tinned iron vessels, kept in a stoved chamber, the heat of which is steadily maintained at 90° to 95° Fahr.

The sugar does not begin to crystallize in less than six or seven days. The crystals form a crust at the top of the liquor and the sides of the vessels, which continue to form as long as the liquor retains any sugary taste. In about 25 or 30 days the crystallization ceases, and the fluid which remains has a saline and unpleasant flavour. The crystallized crusts are collected and cautiously pressed in a sack, and then yield the first rough Muscovado which is stoved for ten or twelve hours, and is fit for the common uses of Musco cane sugar.

By these processes 74 kilogammes of Muscovado is obtained from 5000 kilogrammes of beet root. (The kilogramme is equal to about 35¼ oz. avoirdupoise or 2.205 lbs.) The Muscovado is then fit for further refining by claying, &c. in the usual manner, in which it loses about 1-8 of its weight to be reduced to saleable loaf sugar.

Some observations may be added on the cultivation of the beet. It requires a light dry sandy soil. The seeds are sown in April or May, and the plants require much weeding and thinning.

When they have acquired their full size, which is from October to November, the tops are headed off, and serve as fodder for cattle, and the earth is turned down from round the top of the root to give access to the sun, which improves the quality of the juice. The root is then dug up and left for a few days on the surface before it is stored. It should be kept in a dry place. One *arpent* of ground should produce at least 15000 kilogrammes of roots.

The expense of cultivating the beet and manufacturing sugar in the *great way* (including machinery buildings, labour, rent of land &c. &c. estimating the interest of the cost of building and machinery and wear or annual depreciation,) is considered to avarage 98 centimes *(100 centimes make a franc)* for each killogramme of Muscovado, and every killogramme of refined sugar will cost one frank 40 centimes.

PROCESS TO CONVERT STARCH INTO SUGAR.

Kirchoff's Method.

Take 100 pounds of starch, 400 of water, 1 lb. of sulphuric acid, and sufficient powdered charcoal and chalk. First mix half the water with the sulphuric acid and boil it in a well tinned copper; rub the starch with the rest of the water; pass it through a sieve; and add it by six ounces at a time, to the boiling dilute sulphuric acid. When the whole is added, continue the boiling for thirty-six hours, adding more water in the room of that which is boiled away, then add some charcoal powder, and chalk sufficient to saturate the acid, and pass the liquor through a linen cloth, which is now clear and sweet. Evaporate it by a gentle heat to the consistence of syrup, when the sulphate of lime will crystallize. Again strain the liquor, and set it by to crystallize, when the sugar will separate in about three days. Press the rough sugar with care so as to free it from the syrup, and by re-dissolving and again crystallizing the raw sugar, it will become very fine and good.

Sulphuric acid in any proportion will convert starch into sugar, but if the quantity of acid is increased more water must be added, and especially the boiling should be continued longer which in every case remarkably promotes the subsequent crystallization. The nitric, muriatic, and oxalic acids, will equally convert starch into sugar, but not the acetous, phosphoric, or tartarous acids.

Another Process is thus described:

Buillon La Grange's Method.

Some starch is first well washed with cold water to remove any accidental saccharine or extractive matter, and well dried. Two kilogrammes of this starch rubbed down with eight kilogrammes of river water acidulated with forty grammes of concentrated sulphuric acid, are boiled for thirty-six hours in a silver basin. For the first hour the mixture is stirred constantly to keep it from burning, but afterwards, as it becomes thinner, only occasionally. Water is from time to time to be added, to supply the waste by boiling. After boiling, the whole is clarified with charcoal and chalk, and filtrated through a woollen cloth. The liquor is then evaporated nearly to a syrup, and let cool, to allow some of the sulphate of lime to settle; after which the clear syrup is boiled down to a thick consistence. This syrup is much clearer and sweeter when prepared in a silver vessel than in one of tinned copper; indeed, the latter material can hardly be used on account of the action of the acid upon the tin by the long boiling; but a leaden boiler may be employed with advantage. The quantity of rich syrup given in this process is about equal to that of the starch employed; and M. Vogel obtained the same results with twice the proportion of acid and only eight hours boiling. As several vegetable substances have a decidedly sweet taste but without containing any real sugar that can be extracted from them, M. Vogel tried to produce the vinous fermentation in the starch sugar. A quantity of it was mixed with warm water and leaven, the fermentation soon took place, much carbonic acid was given out, and the fermented liquor gave by distillation, a sensible quantity of alcohol. The most highly saccharine starch syrup, slowly stoved in tin plate moulds, gave a perfectly transparent elastic matter like the paste of jujubes, which attracted moisture from the air. A similar saccharine gummy mass was obtained from potato starch. This mass was further analysed by boiling with alcohol, which left undissolved about a fifth of the whole as a very viscous matter, that became friable when dry, and again dissolved by cold water into a thick mucilage insoluble in alcohol. In these properties it closely resembled gum-arabic but differed from this gum in not forming the mucous acid when treated with nitric acid. The gummy matter of the starch syrup has been considered by some as a compound of starch, water and sulphuric acid; but M. Vogel shows clearly that it does not contain any of this acid, neither, indeed, does the saccharine part, soluble in alcohol, give any indications of sulphuric acid. These experiments led the author to examine the action of the diluted mineral acids upon other substances. Sugar of milk was selected, as being in its natural state incapable of entering into the vinous fermentation: one hundred grammes of sugar of milk were boiled for three hours with four hundred grammes of water and two grammes of strong sulphuric acid, adding water to supply the waste. The excess of acid was then neutralized by chalk, and the liquor when strained was clear, but slightly coloured. Slowly evaporating, it left a thick brown syrup which in a few days thickened to a crystalline mass of a rich sweet taste, much more than the sugar of milk itself, and soluble in alcohol, in which too it differs from sugar of milk. This crystalline mass very readily entered into fermentation, when properly diluted, and the fermented liquor yielded a considerable proportion of alcohol. The experiment was repeated with 3, 4, and 5 parts of sulphuric acid, and with equal success, the crystalline mass being always highly saccharine and fermentable.

Muriatic acid was found to have the same effect with the Sulphuric, in changing the sugar of milk into an extremely rich, sweet, fermentable syrup.—Nitric Acid on the other hand, and radical vinegar, produce no change.—Such are the facts of the singular conversion of starch or sugar of milk into an intensely sweet fermentable saccharine mass, though it does not appear that perfect crystallized sugar has yet been obtained in this way. The theory of this operation is very difficult of explanation. Some have thought that the mere continuance of heat effected the change, but the author boiled starch and water alone for four successive days, and at the end, a very liquid mass was obtained, which when slowly dried left a thick bitter mucilage without the smallest saccharine

taste. It becomes a question whether the Sulphuric Acid is decomposed in the process. For this purpose M. La Grange, took a given weight of sugar of milk, and Sulphuric Acid and water, boiled them for three hours in a retort, and the distilled liquor was carefully examined by Barytes, Litmus, and other tests, but neither the sulphuric acid, sulphurous, acetic, nor carbonic acid was produced, the liquor being pure water. Afterwards on saturating the acid contents of the retort with a known weight of potash, and evaporating the whole to dryness, the dry mass was less by about an eighth part, than the united weights of the sugar of milk and the sulphate of potash, produced by the Sulphuric Acid and the alkali employed. This loss of weight must therefore be accounted for, in the water distilled over, as no gas whatever was generated in the process.

Hence La Grange supposes, that the operation of the Sulphuric Acid is to disengage from the starch or sugar of milk, so much hydrogen and oxygen, as will produce water, and that the loss of these principles, converts the remainder into a saccharine matter.

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On the Sugar from Potato Starch.

By Dr. Tuthill.

A very interesting experiment on this subject is related by Dr. Tuthill. One pound and a half of potato starch was mixed with six pints of distilled water, and a quarter of an ounce by weight, of common sulphuric acid, in a common covered earthen vessel.—The mixture was kept boiling for thirty-four hours without intermission, fresh water being occasionally added to supply the waste by evaporation. At the end of twenty-four hours the liquor had become sensibly saccharine, and this quality continued to increase as the boiling was prolonged.

At the end of thirty-four hours, half an ounce of finely powdered charcoal was added, and the boiling continued two hours longer. The acid was then saturated by lime, and the boiling continued for another half hour, after which the liquid was strained through calico, and the residue in the filter washed with warm water. This residue, when dry, weighed $\frac{7}{8}$ of an ounce, and was charcoal and sulphate of lime. The clear liquor was then evaporated in a water bath to the consistence of syrup, and set aside to crystallize. In eight days it congealed into a crystalline mass, tasting like common brown sugar with treacle. One pound of this sugary matter was then redissolved in four pounds of water, a quarter of an ounce of yeast added, and the mixture set to ferment. In ten days the fermented liquor began to smell sourish, and was immediately distilled. A pint and a half of the first runnings were alone collected, which redistilled, gave a weak ardent spirit, which from its specific gravity was found by Blagden's Tables, to contain 14 drams by measure of proof spirit.

The whole quantities used, and the product were $8\frac{3}{4}$ lbs. of potatoes, yielding $1\frac{1}{2}$ lbs. starch, which gave $1\frac{1}{4}$ lb. of dry saccharine matter, from which, after fermentation, as much ardent spirit was extracted as would equal 14 drams, by measure, of proof spirit.

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Observations on the three preceding Articles.

M. Kirchoff's curious discovery of the conversion of starch into sugar, by the agency of sulphuric acid, is fully confirmed by these experiments, but the explanation of this singular change is very obscure.—By a late analysis of several kinds of vegetable matter, through the agency of oxymuriate of potash, by Messrs. Gay Lussac and Thenard, these eminent Chemists think that they have established the following facts, viz:

1st. That a vegetable substance is always acid when the oxygen which it contains is in a greater proportion to the hydrogen than that which constitutes water.

2nd. That the vegetable substance is always resinous or oily, or alcoholic, when the oxygen is in a less proportion to the hydrogen, than to constitute water.

3d. That the vegetable substance is analogous to sugar, starch, gum, ligneous fibre, &c. when all the oxygen and hydrogen united would exactly compose water.

If there is any reliance to be placed on these positions, it must follow that sugar, starch, gum, and sugar of milk, may be said to consist only of carbon and water; and on a separate analysis of each, the above Chemists estimate the carbon of su-

gar to be 42.47 per cent; that of gum arabic to be 42.23; that of starch to be 43.55; and that of sugar of milk to be 38.825; all the remaining part of each substance to be oxygen and hydrogen, in the same proportion as would produce water. Therefore, if the agency of sulphuric acid in Mr. Kirchoff's experiment is merely to abstract water, or its constituent parts, from the starch or sugar of milk, and thus to convert them into sugar, it should of course follow that sugar must contain proportionably much more carbon than these. This explanation would answer well enough for sugar of milk, the carbon of which, according to the statement given, is only 38.825 per cent; but the carbon of starch is somewhat *more* than that of sugar, and that of gum arabic is scarcely less, it appears certain, however that some loss of weight is experienced by these substances during their conversion into sugar, and that there is no evidence of any decomposition of the sulphuric acid.

ON THE MOST SUITABLE REMEDIES FOR DISEASES OF SHEEP.

(Continued from page 12.)

Professor Daubenton also remarks, that there is another remedy absolutely necessary for sheep in every country, and in every season—a remedy for the *Itch* and *Scab*, to which they are more liable than to any other disease. He conceives that though none are exempt from it, yet that those which are best fed, and those which are most vigorous are most liable to it. It is a disease which makes continual progress, and the longer it lasts, the more difficult it is to cure, for which a shepherd should be extremely attentive to watch its earliest approaches; and wherever a sheep scratches itself or the wool is displaced, should carefully examine the part by separating the wool, to see if any real symptoms manifest themselves.

The remedy which Mr. Daubenton prefers to all others as most efficacious towards a cure, and least detrimental to the wool is to dress the part affected, after moderately scratching the skin, with an ointment made by melting a pound of suet or fat over the fire, and then mixing with it the fourth of the quantity of oil of turpentine; this cheap and simple method is found to have no bad effect upon the wool, but to soften the skin which has been hardened by the eruption, and to completely cure the disease. From much experience he pronounces this remedy to be far preferable to the infusion of tobacco, oil of Juniper, solution of green vitriol, of alum, of common salt, the flower of sulphur, the gray ointment, or any of the remedies in ordinary use, and adds that it may be rendered more active by increasing the oil of turpentine.

Observations. Notwithstanding these remarks more particularly relate to France, yet the similarity of diseases to which sheep are subject, on both sides of the channel render them interesting to an English reader. Though from the difference of climate between France and England, the *heat* is not likely to prevail here to any extent, still instances may occur, and where they do bleeding is obviously the only effectual remedy, and the mode of performing the operation pointed out by M. Daubenton is equally safe and certainly more efficacious than any method practised in this country. The scab is a disease which occurs so frequently and so universally, and it is at the same time so destructive of the health, and detrimental to the fleece of the animal, that it cannot be too carefully or too anxiously guarded against. The ointment recommended, simple as it is, is an effectual and safe remedy, though not perhaps so speedy as some others; but infusion of tobacco, oil of Juniper, and solution of salt, harden and irritate the skin still more, and are therefore hurtful to the growth of the wool, sulphur gives it a bad smell, which even remains after shearing, and the mercury in the gray ointment, may bring on a salivation, to remove which internal remedies may become necessary. This ointment seems more deserving of general adoption, as a remedy for the scab than the much celebrated preparation of Sir Joseph Banks.

Remarks by the editor of the Observer and Record. The above article is one deserving the attention of every person in the U. S. interested, or engaged in raising sheep.

ON THE BLIGHT IN WHEAT.

(Continued from page 13.)

That class of plants which the botanists call mosses and lichens, are reckoned by this writer, the insects of the vegetable kingdom, destined to prey on weak plants, as insects of the animal kingdom are to prey on weak animals. And in both cases the remedy must be looked for in the natural health and vigour of the object.

He then applies this argument to wheat by considering the nature of the plant and the kind of cultivation which usually renders it productive, or as nature has furnished the wheat plant with a double set of roots so contrived that the first may be deep enough to enable it to stand the severity of the winter, and the second so shallow as to admit the genial influence of the spring, it first shoots down a perpendicular tap root to keep it steady through the winter, and in the spring tillers out a number of coronal roots, each of which has also its own proper root and produces its own ear, though still adhering to the former root, and when this operation is complete, the winter root becomes useless and decays; but if the winter root be imperfect, the side shoots will be so likewise, for which reason a strong solid *foot hold* for the tap root, is necessary for wheat, and the more complete the winter root, the more perfect the crop; in like manner, if the young plants be unequal, so will the ripening of the crop; and it is generally found that blight takes the crop while one part of the ear which is ripe, is wasting for another part which is green.

A thin crop of wheat and a *late ripening* crop are said to be the peculiar prey of the blights, and these are generally produced either by sowing the land with wheat which is unfit for it, or in an improper state of cultivation, or by sowing it in an improper season. In short he gives it as his opinion that any cause which tends to weaken the plant, will predispose it to receive the blight.

Among the most obvious of these are reckoned, 1st. sowing wheat on land that has been so worn out by cropping as to have lost that tenacity and cohesion, which are so necessary to a wheat crop, and which dung without rest, will not restore. 2. Sowing the land in a light loose state, whereby the plants root too near the surface, and are liable to be injured by the frosts and to have the roots laid bare by the wind. 3. Sowing wheat too late in autumn, especially in poor and exposed situations, where the roots have not time to establish themselves before winter comes on, and vegetation is at a stand. As these causes appear to him to have occurred more of late years than in preceding times, he thinks there is much probability in the assertion "the blight on wheat has increased of late years." For it has not been uncommon to sow land with wheat every third, instead of every fourth or fifth year, introducing in the interim a system of crops exactly calculated to make the land light, whereby the crops of wheat, though abundant in straw, have not had strength enough to support them till harvest, but have been laid by the rain, and thereby become a prey to the blight. And it has been more the practice lately to sow wheat after turnips, which has been productive of clean crops, but the wheat has been unavoidably sown a month too late, and being consequently late ripe, has been attacked by the blight. Nor has it been an unfrequent practice to sow wheat after potatoes, which is still worse, except in rich deep land, where the plants will grow through the whole of the winter, and the practice of sowing wheat after clover is held to have been carried to too great an extent, as it encourages the slug and the wire-worm, which destroy and weaken a considerable portion of the wheat crop, and necessarily render it more obnoxious to blight. If then it can be proved (and Mr. Davis asserts that every farmer has observed it,) that *weak* crops of wheat and particularly of *late ripe* crops are peculiarly subject to blight, he thinks it should be the object of the husbandman to sow *only* such land with wheat as is fit for wheat, to get that ready early in summer, that it may be close and firm before sowing, to sow as early as the weather will permit, and such kind of seed as will ripen early, and above all, not to wear out his land by too frequent repetitions of wheat crop, since not the number of acres sown but the number of bushels produced will enrich the farmer, and supply the market.

Observations. These remarks on the cause of the blight in wheat by a man

who joined the best information and the strongest sense to the most extensive experience, are better deserving the notice of the practical farmer, than whole volumes by a mere theorist, whatever may be his rank or acquirements. The advice of Mr. Davis, in the last paragraph can never be attended to without producing corresponding advantages.

PROCESS TO MAKE VARNISHES.

Lack varnishes, or lacquers, consist of different resins in a state of solution, of which the most common are mastich, sandarach, lac, benzoin, copal, amber, and asphaltum. The menstrua are either expressed or essential oil, or alcohol. For a varnish of the first kind the common painters' varnish is to be united, by gently boiling it, with some more mastich or colophony, and then diluted with a little more oil of turpentine. The latter addition promotes both the glossy appearance and drying of the varnish. Of this sort also is the amber varnish. To make this varnish half a pound of amber is kept over a gentle fire in a covered iron pot, in the lid of which there is a small hole, till it is observed to become soft, and to be melted together into one mass. As soon as this is perceived the vessel is taken from the fire and suffered to cool a little, when a pound of good painters varnish is added to it, and the whole suffered to boil up again over the fire, keeping it continually stirring. After this, it is again removed from the fire and when it is become somewhat cool, a pound of oil of turpentine is to be gradually mixed with it. Should the varnish when it is cool, happen to be yet too thick, it may be attenuated with more oil of turpentine. This varnish has always a dark brown color, because the amber is previously half burned in the operation; but if it be required of a bright color, amber powder must be dissolved in transparent painters' varnish, in Papin's Machine, by a gentle fire. As an instance of the second sort of lac varnishes with etherial oils alone, may be adduced the varnish made with the oil of turpentine.

For making this, mastich alone is dissolved in oil of turpentine by a very gentle, digesting heat, in close glass vessels. This is the varnish used for the modern transparencies employed as window-blinds, fire screens, and for other purposes. These are commonly prints, colored on both sides, and afterwards coated with this varnish on those parts that are intended to be transparent. Sometimes fine thin calico, or Irish linen, is used for this purpose, but it requires to be primed with a solution of isinglass before the color is laid on, copal may be dissolved in genuine Chio turpentine by adding it in powder to the turpentine previously melted, and stirring till the whole is fused. Oil of turpentine may then be added to dilute it sufficiently. A varnish of the consistence of thin turpentine, is obtained by the digestion of one part of elastic gum, or caoutchouc, cut into small pieces, in thirty-two parts of naphtha. Previously to its being used however, it must be passed through a linen cloth in order that undissolved parts may be left behind. The third sort of varnishes consist of the spirit varnishes. The most solid resins by themselves produce brittle varnishes; therefore something of a softer substance, must always be mixed with them, whereby this brittleness is diminished.

For this purpose Elemi, Turpentine, or balsam of Capaiva, are employed in proper proportions. For the solution of these bodies the strongest alcohol ought to be used. In conformity to these rules a fine colored varnish may be obtained by dissolving eight ounces of gum Sandarach, and two ounces of Venice turpentine in thirty-two ounces of alcohol by a gentle heat. Five ounces of shell-lac and one of turpentine dissolved in thirty-two ounces of alcohol by a very gentle heat give a harder varnish but of a reddish cast. To these the solution of copal is undoubtedly preferable in many respects. This is effected by triturating an ounce of powdered gum copal, which has been well dried by a gentle heat, with a drachm of camphor, and while these are mixing together, adding by degrees, four ounces of the strongest alcohol without any digestion. Between this and the gold varnish there is only this difference, that some substances that communicate a yellow tinge, are to be added to the latter. Take two ounces of shell-lac, of annatta, and turmeric, of each one ounce, and thirty

grains of fine dragon's blood, and mak ean extract with twenty ounces of alcohol, in a gentle heat. Oil varnishes are commonly mixed immediately with the colors; but lac or lacquer varnishes are laid on by themselves upon a burnished colored ground. When they are intended to be laid upon naked wood, a ground should be first given them of strong size, either alone or with some earthy color, mixed up with it by levigation.

The gold lacquer is simply rubbed over brass, tin, or silver, to give them a gold color. Before a resin is dissolved in a fixed oil it is necessary to render the oil drying. For this purpose, the oil is boiled with metalic oxides, in which operation the mucilage of the oil combines with the metal while the oil itself unites with the oxygen of the oxide.

To accelerate the drying of this varnish it is necessary to add oil of turpentine. The essential varnishes consist of a solution of resin in oil of turpentine. The varnish being applied the essential oil flies off and leaves the resin, this is used only for paintings. When resins are dissolved in alcohol the varnish dries very speedily and is subject to crack; but this fault is corrected by adding a small quantity of turpentine to the mixture, which renders it brighter, and less brittle when dry. The colored resins or gums, such as gamboge, dragon's blood, &c. are used to color varnishes. To give lustre to the varnish after it is laid on, it is rubbed with pounded pummice stone and water, which being dried with a cloth, the work is afterwards rubbed with an oiled rag and tripoli. The surface is last of all cleaned with soft linen cloths, cleared of all greasiness with powder of starch, and rubbed bright with the palm of the hand. The following receipt for a good spirit varnish is given by Tingry: Take strong alcohol thirty-two parts; pure mastich, four; sandarach, three; clear Venice turpentine, three; coarsely ground glass, four; reduce the mastich and the sandarach to fine powder; introduce them with the glass and spirit, into a matrass, which is to be placed in hot water, for one or two hours taking care to stir up the materials from time to time with a glass spatula; then pour in the turpentine, and keep the vessel for half an hour longer in the water. Next day decant off the liquor, and filter it through cotton. It will be perfectly limpid. This varnish is usualy applied to objects of the toilet, as work boxes, card cases, &c. *Essence varnish*, by the same. Take mastich in powder twelve parts; pure turpentine one and a half; camphor in bits, one half; crystal glass ground, five; rectified oil of turpentine, thirty-six. Put the mastich, camphor, glass and oil into a matrass, and dissolve as above described. This varnish is applied to paintings. *Fat varnish.* Take copal, sixteen parts, linseed, or poppy oil, made drying with litharge, eight; oil of turpentine, sixteen, melt the copal in a matrass by exposing it to a moderate heat; pour then upon it the boiling oil; stir the mixture and when the temperature is about 200° Fahr. add the oil of turpentine heated; strain the whole through a linen cloth and keep the varnish in a wide mouth bottle. It becomes very clear in a little while, and is almost colorless when well made. Copal varnish is applied on coaches, also generally on polished iron, brass, copper, and wood—*varnish*, among medalists, is the term used to signify those hues which antique medals have acquired by lying in the earth. The beauty which nature alone is able to impart to medals, and which art has never yet attained the power of counterfeiting, enhances their value.

The colors acquired by certain metals, from having lain a long while in the ground, are various, and some of them exquisitely beautiful. The blue nearly rivals that of turquoise, others have an inimitable vermillion color; others again, a polished shining brown. But that most usually found is a delicate green, which hangs to the finest strokes without effacing them. No metal except brass is susceptible of this. The green rust which gathers on silver, always spoils it, and must be removed with vinegar or lemon juice. Falsifiers of medals have a varnish which they use on their counterfeits, to give them the appearance of being antique; but there are means of discovering these deceptions.—(*See Numismatics*) *Encyclopedia Americana.*

Description of a vapour, fumigation or shower bath.

Adapted at a cheap expense for Public Hospitals, or Private Families.

By George Cumming, M. D.
Trans. Soc. of Arts. Vol. 33.

This Bath is extremely simple, and may be conveniently made of a piece of cooperage, of sufficient dimensions. But nothing can perhaps answer better than a common wine-pipe, which after being well washed, is to be sawn across, about the middle, then to be well scraped and cleaned in the inside, and afterwards placed vertically upon a frame with castors. The upper half (in the top of which an aperture has been previously prepared for the head and neck of the bather,) is to be furnished with cord pullies and counterpoise, so that by connecting it with any beam, roof, or ceiling, it can be raised or depressed, or in other words, the bath can be opened or shut with the greatest facility. Upon the margin of the lower piece of the bath there is a groove, three-fourths of an inch deep, receiving the circumference of the upper half and which is thus formed. A strong iron hoop is first put on, on the outside, and then well driven about half its depth, when a similar one, after being riveted, is driven to the same depth within.—The groove thus formed, is of the first importance, as it not only renders the bath, with the assistance of a little water, steam tight, but also effectually prevents it from undergoing any change of shape. It may also be observed that the above hoops are so hammered or set, as to make the grooves somewhat wider than the staves upon which they are applied, and that the edge of the upper or moveable piece of the Bath, is cut with a cooper's knife so as readily to fall, or slip into it.

The boiler is distant from the Bath about six feet, and the steam pipe is made to enter an inch above the bottom, and to extend itself horizontally to the centre of the same, when with the view of equally diffusing the heat, a piece of coarse linen or calico stretched upon a hoop (with a notch to admit the steam tube,) is placed over it. This may be called the diffuser, and is made of a less diameter than the bottom of the bath, in order that the feet of a strong frame or grating to support the bather, may securely rest upon the bottom of the bath.

Immediately over this grating, a floor of split ash (like a sieve,) is laid, and upon this, a seat is placed which is fastened to the side of the bath, by means of a bracket. This seat serves the bather as a step as he gets in, or comes out of the bath. To accommodate the various sizes of bathers, light frames covered with split ash, in the manner of cane-work, may be placed upon the same seat if required.

The whole of these loose articles may be packed within the bath, when not in use, and placed in proper order, in a few seconds when wanted.

Dr. Cumming concludes his general description of the apparatus by declaring that it is simple, cheap, neat, durable and efficient, and admits of a great variety of applications.

In this opinion we perfectly concur, and think that Dr. Cumming has made an useful present to the public, in contriving this apparatus, which may enable many an invalid to employ the valuable remedy of a vapour bath with comparative ease and cheapness.

An improved machine to enable boot and shoe makers to work without pressure upon the breast or stomach.

By Mr. J. King, Trans. Soc. of Arts.

This machine consists of an oblong frame of wood of two sides, with cross pieces. It may be conveniently fixed in a situation, and at a proper height for working, by screwing down to a window sill by means of two screws, such as are used for bedsteads. These, and an iron bracket extending from the front to the machine, being screwed against the wainscot, support the machine very steadily; or a stand consisting of proper legs, may be used if preferred. The external parts of the machine are covered with leather, so as to become like cushions to support the last, and it is held down by a strap, which has a loop or treadle at the bottom, for the foot. The principal novelty of this invention consists in a lever which is attached by an iron link to a wire,

upon which it moves as a centre, and when that is down in its place, a small point or beak of iron, enters into holes made in an iron plate; and the other end of the lever comes to rest on a stop, which has several holes in it. The end of the lever has also a little iron beak which enters these holes. Thus, when the lever is down, it becomes an immoveable cross-bar of the frame, and the last may be held or wedged in between this, and either side of the frame, and held down by the strap. But to adjust the width of the opening on which the last lies, nothing more is necessary than to lift up the lever, so that the point clears the holes of the plate, then sliding the link along the wire to the intended width, and shutting it down again, the beak or point enters some other hole of the plate, and holds the lever fast in the new position, so as to adapt it to the width of any last, or to hold it in any position at pleasure.

Mr. King observes that at other times the last is held down by the foot strap pressing the lever upon it; that the machine forms an universal vice, supporting and holding the last firmly down upon the cross-bar, in any required position. Two stiff pieces of sole leather are also fixed in the frame, which in certain positions supports the last.

Observations.—If confidence is to be placed in the certificate of a long list of individuals who have used Mr. King's machine, and who state that it is highly conducive to the health of boot and shoemakers, Mr. King will, doubtless, be speedily gratified in witnessing its general adoption by that numerous class of the community; but we fear that the liberality of the society for rewarding individuals for inventions of a similar nature, has not yet led to the general adoption.

IMPROVEMENTS IN MONTGOLFIER'S HYDRAULIC RAM.

These improvements consist in, 1st. widening the body ram in a curved form, which facilitates the entrance of the water as much as possible and thus augments the effect of the machine; 2d. in substituting hollow balls for flap valves; 3d. by the addition of a small sucking valve, which admits at each pulsation a quantity of air into the head of the ram, from whence it is expelled at the following pulsation into the compressing reservoir, which would be filled with water if the air lost by absorption were not renewed by this method; 4th. by so disposing the valve of ascension that between its outer sides and the inside of the head of the ram, there shall be a volume of air which cannot be driven into the reservoir, but which is compressed at each pulsation by the power of the water. In consequence of these improvements, the shutting of the valves make less noise, all the operations take place with more gentleness, the machine is less shaken, less liable to want repairs, and its construction is rendered more simple.

CHINESE CORN.

Mr. Grant Thorburn, of Hallets Cove, N. Y. informs the public in a letter to the Editor of the New York Commercial Advertiser, that he has the aforesaid corn for sale, price 25 cents per ear. He describes the corn as striking off in two, three, and frequently four branches, in appearance like a small tree, and produces an ear at the head of each branch. It grows from 8 to 10 feet high, produces an abundance of fodder, is a large white flint twelve row corn, and ears from 10 to 14 inches long, he counted six hundred and sixty grains on one ear; it was planted on the 10th of May, and had ears fit to boil on the 10th of July; the produce of one stalk was two thousand one hundred and twenty grains, although subject to a severe drought while growing. The *dutton*, planted on the same day, on the same field and receiving the same quantity of manure, cross ploughing and hoeing, did not produce one half of the quantity.—*U. S. Gaz.*

Tomato Pies equal to fine English Gooseberries.

The other day we partook, for the first time, of a Tomato pie, and were so much pleased with the treat that we enquired into the mode of making them. The tomatoes are skinned and sliced, and after being mixed with sugar are prepared in the same manner as other pies.

The Tomato is likely to become one of the most useful plants.—*Phila. Com. H. and Sent.*

From Sir Humphrey Davy's Elements of Agricultural Chemistry.

AGRICULTURAL CHEMISTRY.

Continued from page 3. *

The value and uses of every species of agricultural produce are most correctly estimated and applied when practical knowledge is assisted by principles derived from chemistry. The compounds in vegetables, really nutritive as the food of animals, are very few; farina or the pure matter of starch, gluten, vegetable jelly, and extract. Of these the most nutritive is gluten, which approaches, nearest in its nature to animal matter, and which is the substance that gives to wheat its superiority over other grain.

The next in order as to nourishing power is sugar, then farina; and last of all, gelatinous and extractive matters.

Simple tests of the relative nourishing powers of the different species of food, are the relative quantities of these substances that they afford by analysis; and though taste and appearance must influence the consumption of all articles in years of plenty, yet they are less attended to in times of scarcity, and on such occasions this kind of knowledge may be of the greatest importance.

Sugar and farina, or starch, are very similar in composition, and are capable of being converted into each other by simple chemical processes. In the discussion of their relations, I shall detail to you the results of some recent experiments which will be found possessed of applications both to the economy of vegetation, and to some important processes of manufacture.

All the varieties of substances found in plants, are produced from the sap, and the sap of plants is derived from water or from the fluids in the soil, and it is altered by, or combined with principles derived from the atmosphere. The influence of the soil, of water, and of air, will therefore be the next subject of consideration. Soils in all cases consist of a mixture of different finely divided earthy matters; with animal or vegetable substances in a state of decomposition, and certain saline ingredients. The earthy matters are the true basis of the soil; the other parts, whether natural or artificially introduced, operate in the same manner as manures. Four earths generally abound in soils, the aluminous, the sileceous, the calcareous, and the magnesian. These earths, as I have discovered, consist of highly inflammable metals united to a pure air or oxygen, and they are not as far as we know, decomposed or altered in vegetation.

The great use of the soil is to afford support to the plant, to enable it to fix its roots, and to derive nourishment by its tubes slowly and gradually, from the soluble substances mixed with the earths.

That a particular mixture of earths is connected with fertility, cannot be doubted: and almost all sterile soils are capable of being improved by a modification of their earthy constituent parts. I shall describe the simplest methods as yet discovered of analyzing soils, and of ascertaining the constitution and chemical ingredients which appear to be connected with fertility, and on this subject many of the former difficulties of investigation will be found to be removed by recent enquiries.

The necessity of water to vegetation, and the luxuriancy of the growth of plants connected with the presence of moisture in the southern countries of the old continent, led to the opinion so prevalent in the early schools of philosophy, that water was the great productive element, the substance from which all things were capable of being composed and into which they finally resolved, "water is the noblest," seems to have been an expression of this opinion, adopted by the Greeks from the Egyptians taught by Thales, and revived by the alchemists in late times. Van Helmont in 1610, conceived that he had proved by a decisive experiment that all the products of vegetables were capable of being generated from water. His results were shown to be fallacious by Woodward in 1691, but the true use of water in vegetation was unknown till 1785, when Cavendish made the grand discovery, that it was composed of two elastic fluids or gasses, inflammable gas or hydrogen, and vital gas or oxygen.

Air, like water, was regarded as a pure

* Note—In lines 23 & 24, p. 2, col. 2d, instead of *six and three substances*, read seven are inflammable bodies and two are gasses.

element by most of the ancient philosophers: a few of the chemical enquirers in the sixteenth and seventeenth centuries, formed some happy conjectures respecting its real nature.

Sir Kenelm Digby in 1660, supposed that it contained some saline matter, which was an essential food of plants. Boyle, Hooke, and Mayaw, between 1665 and 1680, stated that a small part of it only was consumed in the respiration of animals, and in the combustion of inflammable bodies; but the true statical analysis of the atmosphere is comparatively a recent labour, achieved towards the end of the last century by Scheele, Priestly, and Lavoisier. These celebrated men showed that its principal elements are two gasses, oxygen and azote, of which the first is essential to flame, and to the life of animals, and that it likewise contains small quantities of aqueous vapour, and of carbonic acid gas; and Lavoisier proved that this last body is itself a compound elastic fluid, consisting of charcoal dissolved in oxygen.

Jethro Tull, in his treatise on Horse-hoeing, published in 1733, advanced the opinion that minute earthy particles supplied the whole nourishment of the vegetable world; that air and water were chiefly useful in producing these particles from the land; and that manures acted in no other way than in ameliorating the texture of the soil, in short that, their agency was mechanical.

This ingenious author of the new system of agriculture, having observed the excellent effects produced in farming by a minute division of the soil, and the pulverization of it by exposure to dew and air was misled by carrying his principle too far. Duhamel, in a work printed in 1754, adopted the opinion of Tull, and stated that by finely dividing the soil any number of crops might be raised in succession from the same land. He attempted also to prove, by direct experiments, that vegetables of every kind were capable of being raised without manure. This celebrated horticulturist lived however sufficiently long to alter his opinion. The results of his later and most refined observations led him to the conclusion, that no single material afforded the food of plants. The general experience of farmers had long before convinced the unprejudiced of the truth of the same opinion, and that manures were absolutely consumed in the process of vegetation. The exhaustion of soils by carrying off corn crops from them, and the effects of feeding cattle on lands, and of preserving their manure, offer familiar illustrations of the principle; and those philosophical enquirers, particularly Hassenfratz and Saussure, have shown by satisfactory experiments, that animal and vegetable matters deposited in soils are absorbed by plants, and become a part of their organized matter. But though neither water, nor air, nor earth, supplies the whole of the food of plants, yet they all operate in the process of vegetation. The soil is the laboratory in which the food is prepared. No manure can be taken up by the roots of plants unless water is present; and water or its elements exist in all the products of vegetation. The germination of seeds does not take place without the presence of air or oxygen gas; and in the sunshine vegetables decompose the carbonic acid gas of the atmosphere, the carbon of which is absorbed and becomes a part of their organized matter, and the oxygen gas, the other constituent, is given off; and in consequence of a variety of agencies, the economy of vegetation is made subservient to the general order of the system of nature.

It is shown by various researches that the constitution of the atmosphere has been always the same since the time that it was first accurately analyzed; and this must in a great measure depend upon the powers of plants to absorb or decompose the putrefying or decaying remains of animals and vegetables, and the gaseous effluvia which they are constantly emiting. Carbonic acid gas is formed in a variety of processes of fermentation and combustion, and the respiration of animals, and as yet no other process is known in nature by which it can be consumed, except vegetation. Animals produce a substance which appears to be a necessary food for vegetables; vegetables evolve a principle necessary to the existence of animals; and these different classes of beings seem to be thus connected together in the exercise of their living functions, and to a certain extent made to

depend upon each other for their existence. Water is raised from the ocean, diffused through the air, and poured down upon the soil, so as to be applied to the purposes of life. The different parts of the atmosphere are mingled together by winds, or changes of temperature, and successively brought in contact with the surface of the earth, so as to exert their fertilizing influence. The modifications of the soil and the application of manures are placed within the power of man as if for the purpose of awakening his industry and calling forth his powers.

The theory of the general operation of the more compound manures may be rendered very obvious by simple chemical principles; but there is still much to be discovered with regard to the best methods of rendering animal and vegetable substances soluble; with respect to the processes of decomposition, how they may be accelerated, or retarded, and the means of producing the greatest effect from the materials employed; these subjects will be attended to in the lecture on manures.

Plants are found by analysis to consist principally of charcoal and aeriform matter. They give out by distillation volatile compounds, the elements of which are pure air, inflammable air, coally matter, and azote, or elastic substance, which forms a great part of the atmosphere, and which is incapable of supporting combustion. These elements they gain either by their leaves from the air, or by their roots from the soil. All manure from organized substances, contain the principles of vegetable matter which during putrefaction are rendered either soluble in water or aeriform— and in these states they are capable of being assimilated to the vegetable organs. No one principle affords the pabulum of vegetable life, it is neither charcoal nor hydrogen, nor azote, nor oxygen, alone; but all of them together in various states and various combinations. Organic substances as soon as they are deprived of vitality, begin to pass through a series of changes which end in their complete destruction, in the entire separation and dissipation of the parts. Animal matters are the soonest destroyed by the operation of air, heat, and light. Vegetable substances yield more slowly but finally obey the same laws.

The periods of application of manures from decomposing animal and vegetable substances depend upon the knowledge of these principles, and I shall be able to produce some new and important facts founded upon them, which I trust will remove all doubt from this part of agricultural theory.

The chemistry of the more simple manures, the manures which act in very small quantities, such as gypsum, alkalies, and various saline substances, has hitherto been exceedingly obscure. It has been generally supposed, that these materials act in the vegetable economy in the same manner as condiments or stimulents in the animal economy, and that they render the common food more nutritive. It seems however a much more probable idea, that they are actually a part of the true food of plants, and that they supply that kind of matter to the vegetable fibre which is analagous to the bony matter in animal structures.

(To be continued.)

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OBSERVER AND RECORD
OF AGRICULTURE, SCIENCE, AND ART.

EDITED BY D. PEIRCE.

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The object of this paper is to concentrate and preserve, in a form suitable for future reference, the most useful and interesting articles on the aforesaid subjects. Each number will contain sixteen octavo pages, printed on good paper, and when a sufficient amount is published to form a volume of convenient size, an alphabetical table of contents will be published and forwarded to subscribers, in order for binding. This number, shows the general plan of the work.

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For the Observer and Record of Agriculture, Science, and Art.

LOCOMOTIVE STEAM ENGINES.

The writer of this has not observed in any of the scientific works, published, the following theory, and as the present time is emphatically named the "*Day of advancement in Steam Power*," the attention of scientific and practical engineers is most respectfully directed to the subject with a request that any position here assumed which may be incorrect, may be so proved, and given to the public through the columns of the *Observer & Record.*

The writer has no object in view beyond that of every other citizen, who feels most anxiously the importance of cheap and rapid communications from one section of country to another, steam when directed in the best manner of which it is capable seems to be the only agent yet known fitted for this purpose.

1. *Required* an application of steam power upon the wheels of a Locomotive that will cause them to ascend upon an inclined plane at the highest grade, or the greatest angle from the horizon, without sliding on the rails.

2. *Required* the difference, (if any) between the maximum inclination from the horizon at which the wheels of a Locomotive will ascend upon a plane when the best application of power is communicated to those wheels from the rectilinear motion of pistons, and connecting rods of steam engines, and the maximum inclination at which wheels may be retained at any required position, upon a plane, when they are prevented from turning by the application of what is usually named a *brake.*

Answer to the first.—The wrist of the crank, if attached to the same wheel that runs upon the rail of the inclined plane, or to the axle of the wheels that run upon the rails should not receive any power, or force from the engne, while it is describing any part of a circle nearer to the rails of the plane than the periphery of the axle which receives the bearing of the load, that is when lines are drawn parallel with the inclined rails, so as to meet the periphery of the axle at the greatest distance from the rails, and where it turns in the boxes, the power should be applied above these lines, but not below them.

The wheels which run upon the rails, then perform the function of levers of the second order, the periphery of each wheel while in contact with a rail is a fulcrum, and the power applied being farther distant from the fulcrum than the body moved, (the axle and load) consequently forms a lever of the second order.

This effect may be produced by forming the axle into a triple crank, each placed at an angle of one hundred and twenty degrees from the other respectively, provided power can be applied from the rectilinear alternating motion of the pistons to the cranks, only while the cranks are above a line parallel with the inclined plane, and at as great a distance from it as the most distant part of the axle which supports the load (as aforesaid,)

Answer to the Second.—If the power from the steam engine be applied to the wheel or axle, above the line aforesaid, in the manner described, or by the aid of an additional wheel placed above with a cog wheel connected with the axle, so as to work into another cog wheel connected with the axle of the wheels that run upon the rails of the inclined plane, the maximum inclination of a plane from the horizon, on which wheels may ascend when sufficient power is applied, and the maximum inclination of a plane upon which wheels may be retained by a *brake* (which prevents them from turning) will be the same,* provided the periphery of each wheel is perfectly cylindrical, and the rails a perfect plane, and both composed of non-elastic substances; because the principle upon which the power is applied to the wheels to prevent them from rolling down upon the plane in one case, and causing them to roll upwards in the other case is the same; the difference being the manner of applying the power, and the quantity, or degree of force applied. The power required to cause the wheels to roll upwards upon the plane will be more than that required to keep them stationary, and the difference will be in proportion to the elasticity of the substance composing the wheels and inclined rails, upon which they run, and, the irregularity of the surface of each that comes in contact with the other.

With ordinary iron wheels and rails, the difference in practice would not, probably be more than one per cent.

For the Observer and Record.

TO PREVENT OR CURE THE RHEUMATISM.

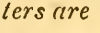
The use of cotton cloth next to the skin, is highly recommended for the cure and prevention of this complaint. The reasons given for the superiority of this over wool or flax, is its superior absorbent power, thereby preserving a more uniform degree of moisture to the skin where the perspiration is irregular. Another question naturally arises, what is the best substance to surround this? wool, fur, silk, flax and cotton, each has advocates, perhaps each may be best in particular situations, for instance wool and fur, may be best in dry cold weather, silk in damp situations, flax where the atmosphere is both dry and warm, and cotton where it is a medium between extreme dryness, moisture, heat and cold.

A proper degree of heat and electricity in the human system appears to constitute so large a portion of what is denominated *health*, that every fact (however trivial it may appear) which shows how to produce or preserve the just proportions, is worthy of consideration.

A. D. V.

The above suggestions are certainly upon a subject of great importance, to which might be added something relative to the color of clothing, for instance whether or not, the heat from the body passes outward to a lower temperature, tending to produce an equilibrium in the same ratio, as the heat from the rays of the sun passes inwards to a lower temperature.—*Communications from experimenters are requested.*

* Friction not estimated.



ON RAISING ORANGES AND LEMONS FROM CUTTINGS.

By A. Hawkins, Esqr. Hort. Trans. vol. 2, part 1.

The writer states that Mr. Luscombe of Combe Royal near Kingsbridge, had discovered a method of raising Orange and Lemon trees from cuttings, by which he had raised eleven plants out of thirteen. The art is to place the cuttings in the mould deep enough to touch the bottom of the pot; they are then to be plunged in a bark, or hot bed and kept. This method has been scarcely known to fail of success in Mr. Luscombes' practice.

ON THE BLIGHT IN PEAR TREES.

To prevent the blight in Pear trees the following method is recommended. When the tree is about ten or twelve feet high, cut off the centre or main branch, a foot or two above the point where the lower branches issue. Some persons attribute the blight to an overcharge of electricity in the main centre branch, and when that is removed sufficiently low an increased number of sprouts issue, each of which conducts a portion of electricity to the earth; through the body of the tree, in the aggregate, more than the main branch would have been capable of doing had it been suffered to remain on the tree.

UPON THE CULTIVATION OF THE PEACH TREE AND PRESERVATION OF IT.

1. *Soil.* Persons engaged in cultivating Peach trees, recommend a soil where sand predominates, and of a medium degree of fertility.

2. *To plant.* Prepare the ground as for corn, plant three or four stones (previously cracked by the frost) at suitable distances asunder; the spaces between the places occupied by the stones may be planted with corn, so that the young trees and the corn may be cultivated at the same time.

3. *To guard against the peach insect or worm,* wrap a leaf of Tobacco in a spiral manner round the young tree or plant when it is only four or five inches high, confine the upper end by a string to the tree an inch or two above the ground, heap up sand against the tobacco so as to press it against the tree as low as the upper roots. Plant two or three stalks of tobacco round each tree. Pursue the same course each succeeding year, so long as the trees remain healthy. If the process here recommended should prove insufficient wash the body and principle branches of the trees with a decoction of tobacco, formed by boiling some tobacco in water and applying some of the liquid to the body from the roots upwards, including the large branches, *or* the liquid may be combined with soft soap, ley of wood ashes, or any substance which will destroy insects and vermin, without injuring vegetables. If all of these fail, search the root and the body, at and near the ground, and remove with the point of a knife, or other suitable instrument such worms as may be discovered, the search should be made about the last of July, and again late in September; on the first of October remove the earth, so as to form a basin round the body of the tree, in this state they are left, until the season of cultivation; the following spring; the ice and water which frequently fill the hole, or basin during the winter, effectually kill the worm, should it have escaped the search, and descended into the roots for winter covering. Excessive bearing should be prevented, by close pruning. Branches to be removed may previously have roots formed on them, by what is called the "*Chinese method*" see the article pg. 14.

Another plan recommended is to pour boiling water, soap suds, or ley, on the body and roots after the last search in autumn, and in the spring to place unleached wood ashes upon the roots, and against the tree, to several inches in height, and over this sharp sand is placed, which is sometimes confined to a uniform height through the summer by a box without top or bottom, which surrounds the tree.

A decoction of aloes, or a coat of tar might be applied to the body, in case all the above methods fail.

4. *For the Yellows.* Bore a hole in the body of the tree, fill it with mercurial ointment, and plug or cork it up. *Another,* bore a hole in the north side of the tree, fill it with spirits of turpentine and cork it up. *Another,* wash the body of the tree with strong brine, after the worms are removed, repeat the operation frequently through the spring and summer; tie a small bag of salt round each tree. This last method is recommended to guard *all trees* from the attacks of insects.

Hogs should be allowed to run in a peach orchard, to eat the imperfect fruit, and search for depredators. Diseased trees should be drawn up by a strong team, and converted into fuel.

(*To be continued.*)

THE CHINESE MULBERRY TREE, (MORUS MULTICAULIS) HOW TO PRESEVE IN WINTER.

Frequent enquiries have been made for information, as to the best manner of preserving the Chinese Mulberry tree (*Morus Multicaulis,*) through the winter, a few words therefore, upon the subject may be of service to such readers of the *Observer & Record,* as may not be acquainted with the process. Each of the following modes has its advocates, viz: 1. Place a box in a cellar, spread a layer of sand in the bottom an inch or two thick, fill one end to the top of the box, and extend the filling toward the middle, descending at an angle of two or three degrees, a distance equal to the length of a tree, lay a course of trees upon this, with the roots at the lowest part of the inclined plane, and the tops at the highest part of it, fill in sand so as to cover the roots, then lay

another course of trees, with the roots as near as possible to the former, but not over them, and the tops pointing in the same direction as those of the former course, cover the roots in like manner as those of the former, and continue in the same manner, to fill the box; the roots being surrounded by sand one or two inches in thickness, and all the trees pointing up wards at an angle of two or three degrees in one direction, or nearly so.

The trees may remain in this situation until the temperature of the atmosphere is so low, as to endanger the tops; a course of sand is then put upon the tops, covering them completely to the depth of an inch or two; in this situation they may remain till immediately before planting in the spring—*2d method* is to place them in a vertical position, within a box upon a course of sand an inch or two thick, and then fill the spaces between the roots with sand, and let them remain in this position, till immediately before planting them, the following spring—*3d plan*, cover the trees in a garden or other convenient place, with common earth, (vegetable mould) to the depth of two or three inches, the trees being placed in the same relative position with each other, as those described in the first mentioned plan.

Where it is desirable to adopt the first plan, and room sufficient cannot be had in a cellar, or other suitable building, the following plan is recommended as a substitute, first place plank with one edge of each on the ground, so as to form four vertical sides, which for convenience, we may name a box, (with no plank in the bottom, the surface of earth forms the bottom) the plank are held or confined in a vertical position by stakes driven into the ground; place sand in the bottom, and the trees upon it, and proceed exactly as in the first plan before described, raise the sand two or three inches higher in the middle from one end of the box to the other, than it is at the sides, form a roof over this with plank, which are to be confined to each other at the upper ends, and to the box by nails, the lower ends should project a few inches beyond the plank (or sides of the box) so as to conduct the water clear of them; heap up earth round the box against it to the height of a few inches; let the trees remain in this situation till immediately before planting them in the spring. In trimming off the side branches, it is recommended to leave one eye between the trunk and the place where the branch is separated.

BEET ROOT, RUTA BAGA AND HAND DRILL TO PLANT SEED.

The editor has frequently been asked, for information respecting the cultivation of the aforesaid plants, he is therefore induced to offer the following remarks, accompanied by a request, that if any of the readers should know of a superior process, that the same may be made public.

1. *To prepare the ground*, Plough land that has been occupied with corn the preceding year, into ridges, from eighteen inches to two feet asunder.

Spread manure of any kind in the furrow between the respective ridges.

Turn the ridges on the manure with a plough, so as to form ridges over the manure, the seed are then planted and covered on those ridges by a machine of the following construction which is both simple and effective, and can be put in operation at a trifling expense.

Imagine an ordinary wheel barrow without any boards in front, or between the side pieces (usually named a bottom) attach a *pulley* to the shaft or axle of the wheel; this *pulley* may have several grooves formed round the periphery to admit an *endless band* to convey motion to the *revolving seed box*, hereafter described; the grooves are made of different diameters, in order to increase or diminish the velocity of the revolving seed box, compared with the velocity of the wheel; and to effect this with the aid of one endless rope or band, the groves on the shaft of the seed box, increase in the same direction that those on the shaft diminish in diameter; this arrangement allows the rope to be shifted to any two grooves opposite to each other, and be of a uniform tightness in each situation.

The seed box is composed of a *shaft* which turn in the standards, and to this shaft a *pulley* is attached to admit an *endless rope* or *band*, to convey motion from the wheel, as already described—and *two hollow frustums* of *cones*, composed of sheet tin, soldered together at the large

ends, so as to form one piece, the middle of which may be five or six inches in diameter, and the hole or opening at each small end, the same diameter, as that of the shaft, to which it is confined, so that the shaft, *sheet tin vessel,* and *pulley,* all turn together.

The sheet tin vessel has holes made round the periphery at its largest diameter, for the seed to pass out, when each hole respectively is at the lowest position while revolving; the dimensions of each hole is sufficient for one large seed, or two small ones, to pass at the same time, the seed drop into a tube large at the upper end and small at the lower end which conducts the seed into the track, or hollow formed by the wheel immediately behind it, and are covered by a roller, which turns with a gudgeon at each end, in the respective feet of the wheel-barrow, near their lower ends. The distance of the holes in the sheet tin vessel asunder, may be estimated at a medium between the extremes, at which plants are required to grow.

The extremes will of course be found, by placing the endless band first at one extreme end of each pulley, and then shifting it to the other extreme end of each pulley, and moving the wheel forward, while in each of these positions.

There is another hole or opening made into the *sheet tin vessel* of about half an inch diameter, to pass the seed into it, which may afterwards be closed with a cork or plug.

The above description is deemed sufficient, to enable any one to understand how to construct a machine entirely new, or to attach the parts required to an *old invention* common upon almost every farm.

DESCRIPTION OF A BUTTER POT,

To prevent butter from becoming rancid in warm weather, or in hot climates.

This is nothing more than a common butter pot, but is covered with an earthen cover, made of that porous kind of earthenware, which will permit water to pass through it, and in the form of a dish, so that this being filled with water, the water percolates down the sides, and produces a coolness by its constant evaporation.

AN IMPROVED CONSTRUCTION OF A HORSE SHOE.

It is remarked that the hoof of a horse, has a constant tendency to increase in circumference, and that when this natural propensity is counteracted by the operation of a firm ring of iron nailed all round, the least powerful part yields to the pressure, which then falls upon the tender mechanism of the frog, excites a degree of inflammation, and ends in contraction; to remedy this it is proposed to use a shoe jointed about the middle of each side, having a sunk hole near the point of the heel, large enough to admit the end of a screw-bar. A screw bar is then to be made in two or three parts, similar to the machine in daily use for preserving the shape of hats, which is to be put into the shoe, whenever the horse is not at work, and then screwed by means of a double winch, so as to keep the heels of the shoe moderately extended, and this bar may be entirely removed, when the horse is wanted for his labours, and be again replaced when he returns to the stable. And as much has been said about the mischief arising from shoes remaining too long upon the foot, the writer observes, that it matters not how long a jointed shoe remains, as the joints admit of the natural augmentation of circumference.

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Observations. We are inclined to give the preference to this, over every mode formerly suggested; for preventing the contraction of the foot of the horse; an object deemed of much importance by the Professor of the veterinary art. And it appears to us that the double jointed shoe alone, even without the bar, is a valuable discovery, inasmuch as while the shoe remains firmly fixed to the foot it admits of all the expansion at the heel, which is so essential for preserving the frog, or internal part of the foot from inflammation, which invariably ends in contraction, or closing of the clefts of the heels. One of the most prevalent, and at the same time most pernicious diseases, arises from bad shoeing which contracts the foot, but this could not happen if the double jointed shoe was used.—*Retrospect.*

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Remarks by the Editor Observer and Record. That part of the above article

relating to the length of time which a shoe may remain upon the foot when constructed in the manner here recommended, appears erroneous, for the growth of the foot forward, would in time become inconveniently long, and the shoe being drawn forward thereby, would leave the frog too much exposed, therefore the shoe would still require moving; yet less frequently than where it is constructed without joints. The other parts of the article seem correct, in theory at least, and is one of the cases which can be easily tested by practice.

RULES FOR ASCERTAINING THE AGE OF HORSES, BY INSPECTING OF THEIR TEETH.

By F. G. (Farmers Magazine, No. 54.)

The rules given in the narrative are compressed into the following recapitulation:—*At from* 2½ *to* 3 *years old*, a horse sheds in both rows the two centre teeth and is then said to be a three year old. *At from* 3½ *to* 4 *years*, he loses other four teeth, one on each side of those he lost the preceding year, both in the upper and under-jaw, having the four outside, or corner teeth remaining; he is now called a four year old. *At from* 4½ *to* 5 *years*, the four corner foal teeth are cast, and then he passes for a five year old; at full five years the flesh disappears and the corner teeth become complete shells, hollow within, and the tusks have pierced the gum, and their points may be felt with the finger. *At from* 5½ *to* 6 *years*, the tusks become of a moderate size, sharp, the inside fluted, and the edge next the gatherers thin, he is now called six years old, which is the most valuable age. *At from* 6 *to* 8 *years*, all the gatherers are full having only a brown speck on the top, the corner teeth have become much thicker, and the tusks longer, but as the speck remains with many horses for several years after, a person who is not a judge, will be told that the horse is not more than six years old. *At* 8 *to* 10 *years and upwards;* at eight the bean being generally worn out from the teeth of the under-jaw, the upper jaw may be examined; at nine the speck of the centre; at nine and a half, that of the middle; and at ten, that of the corner teeth is effaced, then the horse is said to be *aged*, and to have lost all mark. The age may no longer be distinctly known from the teeth, but a probable conjecture may be formed from the length of the tusks.

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Observations. Since there is no part of the farmers stock more expensive, nor any in which he is more subjected to imposition, than horses, we trust we shall stand excused by the more intelligent part of the agricultural public, for noticing this paper, in order to convey the information it contains to the young and more inexperienced reader, who will the easier understand the subject, from its being elucidated systematically.—*Retrospect.*

ON PLANTING AND REARING THORN HEDGES.

By Wm. Aiton, Farmers Magazine, No. 54.

Thorn hedges are represented to be of all other fences, the cheapest, most beautiful, most durable, and most valuable yet known, and that no other ought to be formed, where these can be made to grow; and that it is not the richness of the soil, but its quality, for retaining moisture, and the manner in which the dykes are formed, and kept, that govern the growth of these hedges. The whole art of raising white thorn into fence, is said to lie in placing them within the reach of a due supply of moisture, the benefit of the sun and weather, and in keeping them from being overgrown with weeds; the luxuriance of their growth depending on their obtaining more moisture than is required for the generality of trees and shrubs, and the stuntedness of hedges, in nine cases out of ten, proceeding from the want of a due supply of moisture. Whenever a thorn fence is attempted to be raised on a dry or a sandy soil, the trench should be opened on the lower side, and the dyke reared on the rising ground, that when rains fall, the moisture may run to the root of the thorns; while if the trench be formed on the higher ground, it would intercept and carry off the water; and whenever a thorn hedge is planted on a dry sandy soil, the thorns ought to be placed low in the dyke; and great pains taken to keep them free from weeds. When thorns are planted in a dyke formed of sterile moss, they are found to grow as well for two or three years, as if planted in rich mould, but

whenever the moss is divested of moisture, they become stunted and soon die, unless means are taken to supply that necessary nourishment.

In order to make a fence at once sufficient to turn cattle, the author directs that a trench five or six feet wide, and three or four feet deep, be dug, and not only the earth taken from it, but a considerable quantity of turf dug up on the other side, and the whole formed into a dyke several feet high, tapering narrow at the top; and the thorns, have a sufficient degree of moisture, for a long time after they are put in, but as the dyke is raised high, the water will not run to the roots, unless there be a trench at the back part, which should be kept open five, or six years, and sometimes this proves ineffectual. It is recommended therefore to make but a moderate trench in front of the dyke, and not to raise the top of the dyke too high, to exclude the sun from the roots of the thorns; and though this may require additional fencing to guard it at first, yet it will become much the more secure fence in the course of years.

The notion of thorns or any other plant being killed when their roots reach the cold sub-soil, is treated as a mere conceit; since nature has taught plants where to strike their roots in search of the most nutricious food, and if every plant died when its roots reached the sterile sub-soil, none would be found alive after a few years. But it is not in clay soils says Mr. Aiton, or where the sub-soil is a cold clay, that thorns die soonest: but that happens much more frequently in dry sandy, or gravelly soil, or in dry rocky parts, where there is no cold soil of clay within reach of the roots; and the failures in growth which are supposed to proceed from the roots reaching a cold sub-soil, proceed nine times out of ten from want of moisture.

It is also noticed that hedges are seldom dressed in a proper shape, being either permitted to rise like trees, and their bushy tops to overshadow and kill the smaller branches near the roots, or else having the lower branches lopped off, in order to straighten the hedge, while the tops are allowed to remain. To prevent this, it is directed that the hedge after it rises three or four feet high, be kept thin at top in form of a wedge and the lateral twigs allowed to spread out near the ground, to the breadth of eighteen inches or two feet, and the hedge tapered on both sides. And when this is done, the heat, light dews, and rains fall upon the parts of the hedge equally, and the thorns grow as close at the root as at the top.

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Observations. These remarks may appear trivial to some of our readers, but many thorn hedges have failed for want of proper attention to the planting and rearing them. And it is an important part of agriculture, to obtain fences at once fully adequate for the separation of cattle, and affording shelter from storms.—*Retrospect.*

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Remarks of the Editor Observer and Record.

If the white thorn require more moisture than other plants, or if all kinds of plants employed in forming *live fences* require more than what falls in rain immediately around them, (and I have no reason to doubt it) a question arises what is the best *general* method to furnish a supply necessary for the hedge at all times. It is suggested that a trench be excavated two feet wide, and two feet deep, and that one half of this trench be filled with the upper half of earth that has been removed in forming it, (where this is a grass sod, let it be reversed) the operation may be performed in the following manner; first dig the earth from the trench for any convenient distance, say three feet, and throw it upon the bank; then dig the upper half of the next three feet; and throw it into the bottom of the part first formed, with the top reversed, which will bury such seeds and grass as may be at the surface so deep as to prevent them in some degree from growing and thereby injuring the young hedge, in this way proceed in preparing the ground the whole distance for the intended hedge; the lower half of earth removed from the trench, may be deposited where most convenient, so as not to interfere with future cultivation. The young plants from the nursery are to be planted in a row at the middle of the trench, and cultivated with a hoe. The land upon each side of the hedge while in cultivation during the time

the hedge is advancing towards maturity, may be turned by the plough from the hedge to the distance of fifteen or twenty feet, or to any required distance to bring enough water to the hedge, by its descent in that direction. The surface of earth for the distance of a foot on each side of the hedge may be raised five or six inches during that time, by adding a little vegetable mould each year. The land here is supposed to be perfectly level; where it is otherwise, the water may be collected from a considerable distance, and retained about the hedge by an embankment or dyke parallel with the hedge and in other directions as the declivity of the ground may require.

SILK MANUFACTURE.

(Continued from p. 19.)

The ends thus joined into two or three threads, are passed into the holes of three iron rods in the fore part of the reel, then upon the bobbins or pulleys, and at last, are drawn out to the reel itself, and there fastened, each to an end of an arm or branch of the reel. Thus disposed, the winder, giving motion to the reel by turning the handle, guides the threads, substitutes new ones, when any of them break, or any of the balls are wound out; strengthens them where necessary, by adding others, and takes away the balls wound out, or that having been pierced, are full of water.

In this manner, two persons will spin and reel three pounds of silk in a day, which is done with greater despatch than is made by the spinning wheel or distaff. Indeed, all silks cannot be spun and reeled after this manner; either because the balls have been perforated by the silk-worms themselves, or because they are double, or too weak to bear the water, or because they are coarse, &c.—Of all these together they make a particular kind of silk, called floretta; which being carded, or even spun on the distaff, or the wheel, in the condition it comes from the ball, makes a tolerable silk. As to the balls, after opening them with scissors and taking out the insects, (which are of some use for the feeding of poultry,) they are steeped three or four days in troughs, the water of which is changed every day to prevent putrefaction. When they are well softened by this scouring, and cleared of that gummy matter, the worm had lined the inside with, and which renders it impenetrable to the water, and even to air itself, they boil them half an hour in a ley of ashes, very clear and well strained; and after washing them out in river or running water, and drying them in the sun, they card and spin them on the wheel &c., and thus make another kind of floretta, somewhat inferior to the former.

As to the spinning and reeling of raw silks off the balls, such as they are brought from Italy and the Levant the first is chiefly performed on the spinning wheel, and the latter either on hand reels, or on reels mounted on machines which serve to reel several skeins at the same time. As to the milling, they use a mill composed of several pieces, which may mill two or three hundred bobbins at once, and make them into as many skeins. For dying of silk, see p. 19.

DEFINITION OF TERMS.

Beginning with the letter A.

Acetic Acid, Differs from acetous acid, by having a larger proportion of oxygen.

Acetate of Potash. This salt occurs native in the sap and some other vegetable juices.

Acetous Acid, is obtained from vinegar by distillation.

Acetum Rosatum. Vinegar of roses, is produced by rose-buds infused in vinegar five or six weeks, the roses are then pressed out, and the vinegar preserved, it is used in cases of head-ache.

Acetum Prophylacticum, Is a preparation of acetic acid, camphor, flower of lavender, &c. It is called also the *Vinegar of the four thieves,* who during the plague at Marseilles, plundered the sick, the dying, and the dead, and escaped unhurt by the use of this preparation.

Acids, Possess the following properties (among others.) They change the blue colours of vegtables to red. The vegetable blues employed for this purpose are generally tincture of litmus, and syrup of violets or radishes, which have obtained the name of reagents or tests. If these colours have been previously converted into green by alkalies, the acids restore them again.

Acidifiable base or *radical,* Is any sub-

stance whether simple or compound, that is capable of uniting without decomposition, with such a quantity of oxygen, as to become possessed of acid properties. Almost all the acids agree with each other in containing oxygen, but they differ in their radicals; of course the acidifiable base or radical determines the species of acid.

Sulphur combined with oxygen, forms sulphuric or vitriolic acid.

Almost all substances will combine with oxygen, but they are not all acidifiable bases. That the process of acidification may take place, a large proportion of oxygen is necessary, otherwise the result is only an oxyde.

Æther or Ether, An extremely volatile spirit, made by distilling alcohol with an acid, and then precipitating the acid gas with an alkali. The properties of the æther obtained are supposed to vary a little according to the acid employed; accordingly every particular kind is distinguished by the acid employed in its preparation.

Thus the æther obtained by means of sulphuric acid, is called *sulphuric æther;* that by means of nitrous acid, *nitrous æther.*

Agglutinants, A class of strengthening medicines, of a glutinous or viscous nature; which, by readily adhering to the solids, contribute greatly to repair their loss. They may be divided in two kinds;

1st. Good nourishing food, especially jellies, whether of hartshorn, veal, mutton, &c. &c.

2nd. Medicines, properly so called.

Albumen, The white of eggs, and a substance found at the roots of various vegetables, also in wheat, and the farinaceous seeds, and in most of the green and succulent plants and jelly, is known by the name of *Albumen.* It is supposed that when albumen is converted into jelly, acid is evolved, and oxygen combined with the jelly during the process,—that is, the oxygen supplies the place of the acid.

Alburnum, The soft white substance, found in trees between the liber, or inner bark, and the true wood, and which in process of time, is converted into that substance.

Alkali, The term alkali, is applied to all bodies which possess the following properties. 1. A caustic taste. 2. The property of being volatilized by heat. 3. Of being capable of combining with acids. 4. Of being soluble in water, even when combined with carbonic acid. and 5. Capable of converting vegetable blues into green.

Alkaline Earths, Are those earths which agree with the alkali in the property of solubility in water to a certain extent, of changing blue and red vegetable colours to green; of absorbing carbonic acid; and of possessing those acrid qualities that distinguish the alkalies.

Magnesia, lime, barytes, and strontian, are deemed alkaline earths, but the former is very imperfectly so, being scarcely more soluble in water than silex. Barytes and strontian approach nearer to an alkali, than lime, in being largely soluble in water.

Alum, A neutral salt, the base of which is alumina, argil or clay, combined with sulphuric acid. Potash or ammonia, are also supposed to be ingredients in the composition forming a triple salt.

Alumina, Is the argilaceous part of common clay, that is, pure argil or clay, free from impurities. It is smooth and unctious to the touch, when pure diffusible in water, and adhering to the tongue. Its specific gravity is 200°, or double that of water. Its bulk is diminished by great heat, and its hardness so increased, as to strike fire with steel. It forms a difficult combination with acids. With the sulphuric, it makes sulphate of alumina; but its crystallization is difficult, both with the nitric and muriatic. It has a powerful attraction for lime. The most intense heat is not able to melt it alone, but it is easily fusible when lime or an alkali is added to it. By its mixture with water and silex, it acquires great solidity.

Anemometer, Among mechanical philosophers, an instrument contrived for measuring the strength of the wind.

Antiseptics, Among physicians, a denomination given to all substances that resist putrefaction.

The following table exhibits a comparative view of the antiseptic virtue of salts, the common sea salt being reckoned equal to unity.

Sea Salt. 1. Sal. Gemmæ, 1. Tartar

Vitriol, 2. Spirit of minder., 2. Tartar solub., 2. Sal. diuret., 2. Sal. ammoniac, 3. Saline mixture, 3. Nitre 4. Salt of hartshorn, 4. Salt of wormwood, 4. Borax, 12. Salt of amber, 20. Alum, 30.

Besides these there are various substances which possess in a high degree, *anticeptic* properties, among them camphor ranks very high.

Aqua Regia, A combination of nitric and muriatic acids.

In the new nomenclature, it is called nitro-muriatic acid; it is called aqua regia, as the only acid formerly known to dissolve gold.

Aqua Secunda, Aqua-fortis diluted with water, and employed in the arts.

Atom, In Philosophy, a particle of matter so minute as to admit of no division.

REMARKS ON THE PRESERVATION OF TIMBER.

The following methods are reccomended for the purpose:

1st. To girdle the tree by cutting away a ring of the alburnum, in the early part of summer, thus putting a stop to the further ascent of the sap, and then to suffer it to stand until the leaves should have expended, by their growth or transpiration, all the fluid which could be extracted by them previously to the death of the tree. The wood would thus, probably be found in the driest state, to which any treatment could reduce it in the living state.

2nd, Strip the tree of its bark in the spring, and fell it in the succeeding autumn.

3d, Consists in immersing the green timber in clear water for about two weeks, after which it is taken out and seasoned in the usual manner. A great part of the sap, together with the soluble and fermentable matter, is said to be dissolved or removed by this process. Running water is more effectual, than that which is stagnant. It is necessary that the timber should be sunk, so as to be completely under the water, since nothing is more destructive to wood than partial immersion.

4th, The sap to be extracted by an air pump.

5th, The but-end of the trees to be placed in water, with the branches and leaves on them, the water will displace the sap; seasoning afterwards removes the water.

6th, Pyro-ligneous acid, tar, bitumen, and other resinous substances; or lime in powder, or mixed with water, or other fluid; common salt, (muriate of soda,) deprived of its bitter deliquescent salts, (which substance is said to cause dampness in sea vessels;) nitre, alum, and some of the metallic salts, such as sulphates of iron, copper, and zinc. Wood, boiled in a solution of the former of these metals, and afterwards kept some days in a warm place to dry, is said to be impervious to moisture. Oxide of iron combined with an antiseptic fluid, and forced into the spongioles of the wood; or a fluid of this character, may be combined with any antiseptic finely pulverized solid substance, and forced in the same manner by hydarulic or other pressure, into the spongioles of the wood. Corrosive sublimate is also recommended.

(See article page 6, on this subject.)

ON A METHOD OF DRAWING EXTREMELY FINE WIRES.

By W. H. Wollaston, M. O. F. R. S.

Artists who use silver wire in large quantities, sometimes begin with a rod 3 inches in diameter, and ultimately obtain wires of no more than $\frac{1}{600}$ of an inch in thickness. If in any stage of this process a hole be drilled longitudinally through the silver rod, having its diameter one-tenth of that of the rod, and if a wire of pure gold be inserted so as to fill the hole, it is evident that by continuing to draw the rod, the gold within it will be reduced in diameter, exactly in the same proportion as the silver; so that if both be thus drawn out together till the diameter of the silver is $\frac{1}{5000}$ of an inch, then that of the gold will be only $\frac{1}{30000}$, and of such a wire, five hundred and fifty feet will weigh no more than one grain. Now, if such silvered gold wire be steeped for a few minutes in warm nitrous acid, the silver alone will be dissolved, and the gold will be left untouched. In this way the author succeeded in making gold wire of very great tenuity, but he experienced great difficulty in drilling the hole in the silver rod and inserting the gold. He therefore made the experiment of substituting platina for gold wire, as its infu-

sibility would then allow the silver to be poured round it in a fluid state, without injuring the texture of the platina.

A cylindrical mould of the third of an inch in diameter was made; in the centre of which, wa sfixed a platina wire $\frac{1}{100}$ of an inch in diameter, and the intervening space was filled with melted silver. When this rod was drawn to $\frac{1}{30}$ the platina which it contained in its centre was reduced to $\frac{1}{1000}$, and by a successive reduction, and application of nitrous acid to dissolve away the external coat of silver, platina wires of $\frac{1}{4000}$, and $\frac{1}{3010}$ were obtained which are very useful for applying to eye pieces of astronomical instruments, and are as fine as can be required for such purposes, since in a thirty inch telescope, $\frac{1}{4500}$ of an inch subtends only the second of a degree.

The most convenient method of managing the removal of the silver from these delicate wires, is to bend a portion into the shape of the letter U, with small hooks at its upper extremities, by which it may be suspended and immersed in the nitrous acid, and the silver will then be dissolved away from all the part between the hooks, leaving the hooks themselves as a means of conveying and attaching the wire whenever wanted. The platina wire is sufficiently visible to the naked eye, when the diameter does not exceed $\frac{1}{3000}$ of an inch, but when much less it eludes the sight, and the slightest breath of air would carry it away, if it were not retained by the ends that still retain the silver. It is of consequence to have the platina in as dense and solid a state as possible before it is drawn out, and for this purpose, Dr. W. first brings a considerable globule of it into perfect fusion, under the flame of a spirit lamp, impelled by a blow-pipe fed with oxygen gas, (which was first suggested by Dr. Marcet,) after which, the globule is hammered out, and wire-drawn, before it is coated with silver. Dr. W. has succeeded in obtaining small portions of platina wire, which by calculation, could not exceed $\frac{1}{30000}$ part of an inch in diameter, but at $\frac{1}{8000}$ of an inch, though quite invisible to the naked eye, it would support $1\frac{1}{2}$ of a grain before breaking.—*Retrospect.*

ON THE BAROMETER.

By Richard Walker, Esqr. Phil. Mag. No. 172.

The Barometer when *stationary*, and having a *concave surface*, at the top, is almost an infallible indication of *rain* at the place of observation, or in its vicinity, especially if the barometer be at, or below changeable. The barometer when stationary, and with a *convex surface* of the mercury at the top, is a strong indication of *fair weather*, at the place of observation, or in its vicinity; especially if the barometer be at or above *changeable*. In the first instance, Mr. Walker accounts for the circumstance, by the natural spring or elasticity of the air, being suspended, or diminished, (the density of the atmosphere remaining the same,) by the intervention of vapour collecting into a mass, and in the latter instance, to the dispersion of the interposed vapour, by which the natural elasticity of air is restored.

For the same reason it is he presumes, that during a steady fall of rain, the barometer is commonly *stationary*, with a concave surface at the top, and as soon as the weather begins to clear up, the top of the mercury in the barometer assume a convex surface. The quick ascent of smoke, vapour, &c. into the atmosphere, indicates fair weather; and the slow ascent, and particularly the descent of them indicates rain. The former in consequence of an influx of denser, or heavier air, into the lower stratum of the atmosphere, commonly proceeding from the north and east points. And the latter, in consequence of an influx of rarer, or lighter air, into the lower stratum of the atmosphere, proceeding commonly from the south and west points.

Upon the whole, there is more wet weather, while the barometer is above *changeable*, than there is dry, while the barometer is below *changeable*. Hence it follows, that the former state of the barometer is not so strong an indication of fair weather, as the latter is of rainy weather.—*Retrospect.*

ON THE PRESERVATION OF ZOOLOGICAL SPECIMENS.

By M. M. Peron & Le Sueur, Jour. de Phys. Oct. 1810.

Glass upon the whole combines more

advantages than any other substance; the vessels of which for the larger specimens may be of the capacity of two gallons, of a rectangular shape, approaching to cubical, and more elongated for fishes and reptiles; these should be made of green glass as cheaper and more tough; the smaller vials of the capacity of a few ounces, should be of white glass.

Method of closing the Vessels.—Sound corks and a lute composed in the following manner: Take common resin and yellow bees wax, equal weights, and melt them together, then add successive portions of colcothar (levigated red oxide of Iron,) till the composition, on dropping a little of it on a plate of glass, has acquired a sufficiency of hardness, then boil the mixture for a quarter of an hour and temper it by the addition of common oil of turpentine. Having thus prepared the cement, proceed to close the vessel by selecting a proper cork, wiping it dry, and dipping it in the melted cement, drive in the cork thus prepared while the cement is still soft, and pour a sufficient quantity of the same cement over the cork to close completely every orifice; tie down the cork by a cross ligature in the same manner as bottles of cider are wired, and cover the whole with a piece of cotton or linen cloth well soaked in boiling pitch; this for the larger vessels. For the vials, after the cork is put in, invert the vial and dip to the neck in the melted cement three or four times, till the cork is covered with a coating of a sufficient thickness. Camphorated alcoholic liquor of strength merely sufficient to preserve the specimens from putrefaction, is preferred to all other substances. The intestines of all animals, and the external mucus of fishes and reptiles are to be removed, and the specimens suspended in the liquor by elastic rings or pieces of cork. The cavities previously occupied by the stomach and intestines, is to be filled with *strong* camphorated spirits.

From Sir Humphrey Davy's Elements of Agricultural Chemistry.

AGRICULTURAL CHEMISTRY.

Continued from page 32.

The operation of gypsum, it is well known, is extremely capricious in this country, and no certain data have hitherto been offered for its application.

There is, however, good ground for supposing that the subject will be fully elucidated by chemical enquiry.

Those plants which seem most benefitted by its application, are plants which always afford it on analysis. Clover, and most of the artificial grasses, contain it; but it exists in very minute quantity only in barley, wheat and turnips. Many peat ashes which are sold at a considerable price consist in a great part of gypsum, with a little iron, and the first seems to be their most active ingredient. I have examined several of the soils to which these ashes are successfully applied, and I have found in them no sensible quantity of gypsum. In general, cultivated soils contain sufficient of this substance for the use of grasses; in such cases its application cannot be advantageous. For plants only require a certain quantity of manure; an excess may be detrimental and cannot be useful.

The theory of the operation of alkaline substances, is one of the parts of the chemistry of agriculture, most simple and distinct. They are found in all plants, and therefore may be regarded as amongst their essential ingredients. From their powers of combination likewise, they may be useful in introducing various principles into the sap of vegetables which may be subservient to their nourishment.

The fixed alkalies which were formerly regarded as elementary bodies, it has been my good fortune to decompose. They consist of pure air, united to highly inflammable metalic substances; but there is no reason to suppose that they are reduced into their elements in any of the processes of vegetation.

In this part of the course, I shall dwell at considerable length on the important subject of lime, and I shall be able to offer some novel views.

Slacked lime was used by the Romans for manuring the soil in which fruit trees grew. This we are informed by Pliny. Marle had been employed by the Britons and the Gauls from the earliest times as a top dressing for land. But the precise period in which burned lime first came into general use in the cultivation of land, is, I believe, unknown. The origin of the application from the early practices is

sufficiently obvious; a substance which had been used with success in gardening, must have soon been tried in farming; and in countries where marle was not to be found, calcined limestone would be naturally employed as a substitute.

The elder writers on agriculture had no correct notions of the nature of lime, limestone, and marle, or of their effects; and this was the necessary consequence of the imperfection of the chemistry of the age. Calcarious matter was considered by the alchymists as a peculiar earth, which in the fire became combined with inflammable acid; and Evelyn and Hartlib, and still later, Lisle, in their works on husbandry, have characterized it merely as a hot manure of use in cold lands. It is to Dr. Black of Edinburg that our first distinct rudiments of knowledge on the subject are owing.

About the year 1755, this celebrated professor proved, by the most decisive experiments, that lime stone and all its modifications, marbles, chalks, and marles, consist principally of a peculiar earth united to an aerial acid: that the acid is given out in burning, occasioning a loss of more than 40 per cent, and that the lime in consequence becomes caustic.

These important facts immediately applied with equal certainty to the explanation of the uses of lime, both as a cement and as a manure. As a cement, lime applied in its caustic state acquires its hardness and durability, by absorbing the aerial (or as it has been since called, carbonic) acid, which always exists in small quantities in the atmosphere, it becomes as it were again limestone. Chalks, calcareous marles, or powdered limestones, act merely by forming an useful earthy ingredient of the soil, and their efficacy is proportioned to the deficiency of calcareous matter, which in larger or smaller quantities seems to be an essential ingredient of all fertile soils; necessary perhaps to their proper texture, and as an ingredient in the organs of plants. Burnt lime, in its first effect, acts as a decomposing agent upon animal or vegetable matter, and seems to bring it into a state on which it becomes more rapidly a vegetable nourishment; gradually, however, the lime is neutralized by carbonic acid, and converted into a substance analagous to chalk; but in this case it more perfectly mixes with the other ingredients of the soil, is more generally diffused and finely divided, and it is probably more useful to land than any calcareous substance in its natural state. The most considerable fact made known with regard to limestone within the last few years, is owing to Mr. Tennant. It had been long known that a particular species of limestone found in different parts of the North of England, when applied in its burnt and slaked state to land in considerable quantities, occasioned sterility, or considerably injured the crops for many years. Mr. Tennant in 1800, by a chemical examination of this species of limestone, ascertained, that it differed from common limestones by containing magnesian earth; and by several experiments he proved that this earth was prejudicial to vegetation, when applied in large quantities in its caustic state. Under common circumstances, the lime from the magnesian limestone is, however, used in moderate quantities upon fertile soils in Leicestershire, Derbyshire, and Yorkshire, with good effect; and it may be applied in greater quantities to soils containing very large proportions of vegetable matter. Magnesia, when combined with carbonic acid gas, seems not to be prejudicial to vegetation, and in soils rich in manure, it is speedily supplied with this principle from the decomposition of the manure. After the nature and operation of manures have been discussed, the next, and last subject for our consideration, will be some of the operations of husbandry capable of elucidation by chemical principles. The chemical theory of fallowing is very simple. Fallowing affords no new source of riches to the soil. It merely tends to produce an accumulation of decomposing matter, which in the common course of crops, would be employed as it is formed, and it is scarcely possible to imagine a single instance of a cultivated soil, which can be supposed to remain fallow for a year with advantage to the farmer. The only cases where this practice is beneficial seems to be in the destruction of weeds, and for cleansing foul soils. The chemical theory of paring and burning, I shall fully discuss in this part of the course.

It is obvious that in all cases it must destroy a certain quantity of vegetable

matter, and must be principally useful in cases in which there is an excess of this matter in soils. Burning, likewise renders clays less coherent, and in this way greatly improves their texture, and causes them to be less permeable to water. The instances in which it must be obviously prejudicial, are those of sandy, dry, siliceous soils, containing little animal or vegetable matter. Here it only can be destructive, for it decomposes that on which the soil depends for its productiveness.

The advantages of irrigation, though so lately a subject of much attention, were well known to the ancients; and more than two centuries ago the practice was recommended to the farmers of our country by Lord Bacon. "Meadow watering," according to the statements of this illustrious personage, (given in his Natural History, in the article Vegetation,) acts not only by supplying useful moisture to the grass; but likewise the water carries nourishment dissolved in it, and defends the roots from the effects of cold. No general principles can be laid down respecting the comparative merit of the different systems of cultivation, and the different systems of crops adopted in different districts, unless the chemical nature of the soil, and the physical circumstances to which it is exposed are fully known. Stiff coherent soils are those most benefitted by minute division and areation, and in the drill system of husbandry, these effects are produced to the greatest extent; but still the labor and expense connected with its application in certain districts, may not be compensated for by the advantages produced. Moist climates are best fitted for raising the artificial grasses, oats, and broad leaved crops; stiff, aluminous soils, in general, are most adapted for wheat crops, and calcareous soils produce excellent sain-foin and clover. Nothing is more wanting in agriculture, than experiments in which all the circumstances are minutely and scientifically detailed. This art will advance with rapidity in proportion as it becomes exact in its methods. As in physical researches all the causes should be considered; a difference in the results may be produced, even by the fall of a half an inch of rain more or less in the course of a season, or a few degrees of temperature, or even by a slight difference in the sub-soil, or in the inclination of the land. Information collected after views of distinct enquiry, would necessarily be more accurate, and more capable of being connected with the general principles of science; and a few histories of the results of truly philosophical experiments in agricultural chemistry, would be of more value in enlightening and benefiting the farmer, than the greatest possible accumulation of imperfect trials, conducted merely in the empirical spirit. It is no unusual occurrence for persons who argue in favour of practice and experience, to condemn generally all attempts to improve agriculture by philosophical enquiries and chemical methods. That much vague speculation may be found in the works of those who have lightly taken up agricultural chemistry, it is impossible to deny. It is not uncommon to find a number of changes rung upon a string of technical terms, such as oxygen, hydrogen, carbon, and azote, as if the science depended upon words, rather than things.

But this is in fact an argument for the necessity of the establishment of just principles of chemistry on the subject.

Whoever reasons upon agriculture, is obliged to recur to this science. He feels that it is scarcely possible to advance a step without it; and if he is satisfied with insufficient views, it is not because he prefers them to accurate knowledge, but generally because they are more current. If a person journeying in the night wishes to avoid being led astray by the ignus-fatuus, the most secure method is to carry a lamp in his own hand.

It has been said, and undoubtedly with great truth, that a philosophical chemist would most probably make a very unprofitable business of farming; and this certainly would be the case if he were merely a philosophical chemist; and unless he had served his apprenticeship to the practice of the art, as well as to the theory. But there is reason to believe that he would be a more successful agriculturalist than a person equally uninitiated in farming, but ignorant of chemistry altogether; his science as far as it went, would be useful to him. But chemistry is not the only kind of knowledge required, it forms a small part of the philosophical basis of agriculture; but it is an important part, and when

ever applied in a proper manner, must produce advantages. In proportion as science advances, all the principles become less complicated, and consequently more useful. And it is then that their application is most advantageously made to the arts. The common labourer can never be enlightened by the general doctrines of philosophy, but he will not refuse to adopt any practice, of the utility of which he is fully convinced, because it has been founded upon these principles.

The mariner can trust to the compass, though he may be wholly unacquainted with the discoveries of Gilbert on Magnetism, or the refined principles of that science developed by the genius of Æpinus. The dyer will use his bleaching liquor, even though he is ignorant not only of the constitution, but even of the name of the substance on which its powers depend. The great purpose of chemical investigation in agriculture, ought undoubtedly to be the discovery of improved methods of cultivation. But to this end, general scientific principles and practical knowledge are alike necessary. The germs of discovery are often found in rational speculations; and industry is never so efficacious as when assisted by science.

It is from the higher classes of the community, from the proprietors of land; those who are fitted by their education to form enlightened plans, and by their fortunes to carry such plans into execution; it is from these that the principles of improvement must flow to the labouring classes of the community; and in all cases the benefit is mutual; for the interest of the tenantry must be always likewise the interest of the proprietors of the soil. The attention of the labourer will be more minute, and he will exert himself more for improvement when he is certain he cannot deceive his employer, and has a conviction of the extent of his knowledge. Ignorance in the possessor of an estate of the manner in which it ought to be treated, often leads either to inattention or injudicious practices in the tenant or the bailiff.

There is no idea more unfounded than that a great devotion of time, and minute knowledge of general chemistry is necessary for pursuing experiments on the nature of soils or the properties of manures. Nothing can be more easy than to discover whether a soil effervesces, or changes colour by the action of an acid, or whether it burns when heated; or what weight it looses by heat: and yet these simple indications may be of great importance in a system of cultivation. The expense connected with chemical enquiries is extremely trifling; a small closet is sufficient for containing all the materials required. The most important experiments may be made by means of a small portable apparatus; a few vials, a few acids, a lamp and a crucible are all that are necessary, as I shall endeavor to prove to you, in the course of these lectures.

It undoubtedly happens in agricultural chemical experiments conducted after the most refined theoretical views, that there are many instances of failure, for one of success; and this is inevitable from the capricious and uncertain nature of the causes that operate, and from the impossibility of calculating on all the circumstances that may interfere; but this is far from proving the inutility of such trials; one happy result which can generally improve the methods of cultivation is worth the labour of a whole life; and an unsuccessful experiment well observed, must establish some truth, or tend to remove some prejudice.

Even considered merely as a philosophical science, this department of knowledge is highly worthy of cultivation. For what can be more delightful than to trace the forms of living beings and their adaptations and peculiar purposes; to examine the progress of inorganic matter in its different processes of change, till it attain its ultimate and highest destination; its subserviency to the purposes of man.

Many of the sciences are ardently pursued, and considered as proper objects of study for all refined minds, merely on account of the intellectual pleasure they afford; merely because they enlarge our views of nature, and enable us to think more correctly with respect to the beings and objects surrounding us. How much more then is this department of enquiry worthy of attention; in which the pleasure resulting from the love of truth and of knowledge is as great as in any other

branch of philosophy, and in which it is likewise connected with much greater practical benefits and advantages.

Discoveries made in the cultivation of the earth, are not merely for the time and country in which they are developed, but they may be considered as extending to future ages, and as ultimately tending to benefit the whole human race; as affording subsistence for generations yet to come; as multiplying life, and not only multiplying life, but likewise providing for its enjoyment.

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Of the general powers of Matter which influence Vegetation. Of gravitation, of Cohesion, of Chemical Attraction, of Heat, of Light, of Electricity, ponderable Substances, Elements of Matter, particularly those found in Vegetables, Laws of their Combinations and Arrangements.

The great operations of the farmer are directed towards the production or improvement of certain classes of vegetables; they are either mechanical or chemical, and are, consequently, dependent upon the laws which govern common matter. Plants themselves are, to a certain extent, submitted to these laws, and it is necessary to study their effects both in considering the phenomena of vegetation, and the cultivation of the vegetable kingdom.

One of the most important properties belonging to matter is *gravitation,* or the power by which masses of matter are attracted towards each other. It is in consequence of gravitation that bodies thrown into the atmosphere fall to the surface of the earth, and that the different parts of the globe are preserved in their proper positions. Gravity is exerted in proportion to the quantity of matter. Hence all bodies placed above the surface of the earth fall to it in right lines, which if produced would pass through its centre; and a body falling near a high mountain, is a little bent out of the perpendicular direction by the attraction of the mountain, as has been shown by the experiments of Dr. Maskelyne on Schehallien.

Gravitation has a very important influence on the growth of plants; and it is rendered probable by the experiments of Mr. Knight, that they owe the peculiar direction of their roots and branches almost entirely to this force.

(To be continued.)

PROCESS RECOMMENDED TO FORM WHITE-WASH.

One gallon of lime-water is strained through a cloth or hair sieve, to which add one pound of brown sugar and three or four table spoons-full of salt—more salt is required in *dry* than in *wet* weather; and perhaps different degrees of moisture in the atmosphere, and different substances to be operated on by the white-wash, may require the relative proportion of lime-water and sugar different from the above statement: experience will be the best guide in mixing the ingredients.

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OBSERVER AND RECORD
OF AGRICULTURE, SCIENCE, AND ART.

EDITED BY D. PEIRCE.

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The object of this paper is to concentrate and preserve, in a form suitable for future reference, the most useful and interesting articles on the aforesaid subjects. Each number will contain sixteen octavo pages, printed on good paper, and when a sufficient amount is published to form a volume of convenient size, an alphabetical table of contents will be published and forwarded to subscribers, in order for binding. This number, shows the general plan of the work.

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A CONCISE VIEW OF THE THEORY RESPECTING VEGETATION.

Lately advanced in the Philosophical Transactions illustrated in the culture of the Melon.

By T. A. KNIGHT, F. R. S. Transactions of the Horticultural Society, Vol. 1. pg. 5

"A seed," says Mr. Knight, "exclusive of its seed coats, consists of one or more cotyledons, a plumule or bud, and the caudex or stem of the future plant, which has generally, though erroneously been called its radicle.

It is asserted, that in these organs, but principally in the cotyledons, is deposited as much of the concrete sap of the parent plant, as is sufficient to feed its offspring till that has attached itself to the soil and become capable of absorbing and assimilating new matter. The plumule is stated to differ from the buds of the parent plant in possessing a new and independant life, and thence in assuming in its subsequent growth different habits from those of the parent plant; the organizable matter, derived from the parent probably existing in the cotyledons, and like the alburnum of trees, undergoing considerable apparent changes, before it becomes the true circulating fluid of the plant. In the process of germination, the vital fluid is thought to be drawn from the cotyledons into the caudex of the plumule or bud through vessels which correspond with the bark of the future tree. From the point of the caudex springs the first root, which if uninterrupted by any opposing body, descends in a straight line toward the centre of the earth provided the seed has been permitted to vegetate at rest. The first root being put forth, the caudex elongates in a diametrically opposite direction and raises the cotyledons out of the soil in many kinds of plants, which then becomes seminal leaves, and furnish nutriment, and if these are destroyed, the plant perishes. The bark of the root now beginning to execute its office of depositing albernous, or woody matter; the sap, which had hitherto only descended through the vessels of the bark, begins to ascend through the albernum, and the plumule in consequence elongates, its leaves enlarge and unfold, and a set of vessels which did not exist in the root are brought into action. The power of each proper leaf to generate sap is held to be in the compound ratio of its width, its thickness, and the exposure of its upper surface to light in proper temperature; and as the growth of the plant proceeds, the number and width of the mature leaves increase in proportion to the young leaves to be formed, and this accumulation continues during a succession of weeks, months, or years, according to the natural habits and duration of the plant; and the sap thus generated is deposited in the bulb of the tulip, in the tuber of the potato, in the fibrous roots of grasses, and in the alburnum of trees during the winter, and is dispersed through their foliage and bark, during the spring and summer; and as soon as the plant has attained its age of puberty, a portion of its sap is expended in the production of blossoms and fruit; and the

fruit, or seed vessels appear to be generated wholly by the prepared sap of the plant, and its chief office to be that of adapting the fluids, which ascend into it to afford proper nutriment to the seeds it contains."

After this statement of the principles of his theory, Mr. Knight proceeds to offer some observations on the culture of the *melon* a species of fruit, which very rarely acquires any great degree of perfection in our climate, but is generally so defective both in richness and flavour, that it ill repays the trouble and expense of its culture. The writer however thought he saw sufficient cause for the want of flavour in the fruit, in the want of sufficient foliage, and an appeal to experiment has confirmed his opinion.

The leaves of the melon, he observes, like those of every other plant, naturally so arrange themselves, as to present their upper surfaces to the light with the greatest advantage and make efforts to regain their position whenever they are changed; but the extended branches of the melon, particularly under glass being slender and feeble, its leaves broad and heavy, and its leaf stalks long, when the leaves are from any cause removed from their position, they seldom regain it, and in consequence a large portion of the foliage become diseased and sickly, and consequently out of office, before the fruit acquires maturity. To remedy this defect, at greater distances than usual putting a single plant under each glass of six feet long, by four feet wide, the beds were formed of rich mould, and were covered as usual with brick tiles over which the branches were so conducted as to present the greatest possible width of foliage to the light, and were securely fixed down by small hooked pegs between the tiles to prevent their being disturbed from their first position. But it being still found that the leaves sustained injury from the weight of the water falling from the watering pot, it was then poured upon the tiles, without at all touching them, and the foliage remained erect and healthy; the fruit also grew with extraordinary rapidity, ripened in an unusually short time, and acquired a degree of perfection not previously seen.

It is recommended to prevent the further production of foliage, by pinching off the lateral shoots, as soon as a sufficient of fruit on each plant is set; but no part of the full grown leaves should ever be destroyed before the fruit is gathered, unless they injure each other by being too much crowded, for each leaf, however distant from the fruit, and though upon a separate branch, still contributes to its support.

The only variety of melon cultivated by the writer is one imported from *Salonica* by Mr. J. Hawkins, and not generally known: its form is nearly spherical, without any depression upon the surface, and its colour approaching to that of gold, and its flesh perfectly white; it acquires a greater state of maturity than any other variety, and continues to improve in flavour and richness, till it shows signs of incipient decay, and the flavour such, that few would think it improved by sugar; the weight of a good melon of this variety is about seven pounds.

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Observations.—The success which has attended the application of the principles of Mr. Knight's theory of the physiology of vegetables to the culture of the melon, may be considered as a strong confirmation of his pre-conceived opinions; and it appears to us to be so coincident with nature and reason, that we have no hesitation in believing that the same principles might be applied with equal advantage in the cultivation of other plants.—*Retrospect.*

Patent of Mr. Thomas Willis Cooper of Old Street London, Mill-Wright, for apparatus to be fixed on the naves of wheels, and beds of axletrees of carriages, to prevent accidents. Dated March, 1811, Repository of Arts, No. 115.

Mr. Coopers' apparatus is intended to prevent the wheels of carriages from separating from them, if the axle should break or the linch pins drop out. It is formed by a jointed hoop, which incloses the back part of the nave, while it is connected with the bed of the axle by strong straps of iron, so that the nave turns round freely within it; a grooved hoop is fastened round the nave, further in than the plate where the jointed hoop lies, which prevents the wheel drawing off. The use of the joint is to admit of the wheel being

taken off, when necessary, by opening the hoop to let the nave pass.

When the jointed hoop is fast in its place, if the axle breaks, the nave is sustained by the iron straps which support the jointed hoop, and this grooved hoop projecting from the nave, forming an obstacle all round which cannot pass the jointed hoop, the nave is retained in its place, and revolves within the jointed hoop so as to support the carriage; and by the same means the nave is prevented from passing outwards, if the linch-pins should drop out.

A second method of effecting the same purpose consists in making the box of the wheel project beyond the back of the nave, where it is surrounded with two flanches; between which a jointed hoop connected, as the one before mentioned, with the bed of the axle, is made to lie, which in like manner secures the wheel from coming off in case of accidents. Covers are fastened to the jointed hoops to secure the grooves between the flanches from dirt.

A third method for the same design is effected by attaching to the back of the nave a hoop with a flanch to it projecting towards its centre, which is placed so as to inclose within it another hoop attached to the axle of its bed.

The patentee adds, that these contrivances have been proved on a heavy loaded stage coach furnished with them, which went several miles without linch-pins or nutts, without inconvenience; and again went several miles more after the axle was broken off purposely.

Observations.—The many serious accidents which happen from wheels coming off render contrivances of the above description of much importance, stage coach owners would find it to their interest to adopt them.—*Retrospect.*

ON THE ANALYSIS OF VEGETABLE AND ANIMAL MATTER.

By M. Gay Lussac and Thenard, Ann. de Chim. Volume 74.

In order to obtain precise ideas on the ultimate component parts of vegetable and animal matter, it appeared to the authors of this paper, of essential importance to invent some satisfactory method of combining the subjects of their analysis with oxygen, so as to convert them, (with the exception, of course, of the earths and metallic oxydes,) into water, carbonic acid, and nitrogen. In order to effect this, the substance under examination was reduced to a state of the utmost possible division, and mixed with such a proportion of hyper-oxymuriate of potash, as was capable of effecting its entire decomposition, it was then subjected to combustion in a proper apparatus, and the mixed gas hence resulting, was analysed in the usual manner.

In this way, analyses have been performed with the most scrupulous accuracy, of the following substances, viz: oxalic, tartaric, mucous, citric, and acetic acids; resin of turpentine, copal, wax, and olive oil; sugar, gum, starch, sugar of milk; the chrystallizable part of manna, and beech and oak woods.

From their labours they have deduced the following very important general principles.—

1. Whenever a vegetable substance affords oxygen and hydrogen; and the ratio of the former to the latter, is greater than the proportion required for the formation of water; such substance is an acid. The strength of the acid is also in proportion to the excess of oxygen.—

Thus 100 parts of oxalic acid are composed of,

Carbon,	26, 566
Oxygen,	70, 689
Hydrogen,	2, 745

The quantity of oxygen requisite for the saturation of the whole of the hydrogen, is 20, 127. There remains therefore, an excess of oxygen to the amount of 50.562.

100 parts of acetic acid, on the other hand, are composed of,

Carbon,	50, 224
Oxygen,	44, 147
Hydrogen,	5, 629

The hydrogen requires for saturation, 41, 282, of oxygen. There remains therefore, of this latter, in excess, 2, 865.

The two substances, the analysis of which are here recited, occupy the extremities of the series of vegetable acids, the one being in the highest, and the other in the lowest state of oxygenation. Hence is explained the fact of so large a proportion of nitric acid being required for the conversion of sugar, of gum, &c., into oxalic acid; and hence also, we see clearly

how it happens that so great a variety of animal and vegetable substances pass into acetic acid; a circumstance wholly inexplicable, when this acid was considered as the most highly oxygenated of any of the vegetable acids.

2. All vegetable substances that afford oxygen and hydrogen in such proportions that the latter is in excess, belong to the class of resins, oils, or alcohols.

Thus 100 parts of common resin are composed of,

Carbon,	75, 944
Hydrogen and Oxygen, in the proportion requisite to form water,	15, 156
Hydrogen in excess,	8, 900
	100, 000

100 parts of olive oil are composed of,

Carbon,	77, 213
Hydrogen and Oxygen, in the proportion requisite to form water,	10, 712
Hydrogen in excess,	12, 075
	100, 000

All vegetable substances that afford oxygen and hydrogen in such proportion that the one completely saturates the other belong to the class, neither of acids, nor resins, but are analogous to sugar, gum, starch, or woody fibre.

Thus 100 parts of crystallized sugar, consist of,

Carbon,	40, 074
Oxygen,	52, 101
Hydrogen,	7. 105
	99, 910*

*Here appears to be an error of ninety-hundredths of one.

100 parts of beech-wood consist of,

Carbon,	51, 192
Oxygen,	42, 951
Hydrogen,	5, 857
	100, 000

In both which cases, the oxygen and hydrogen are to each other in the exact proportions requisite to form water.

The only animal substances hitherto examined by Gay Lussac, and Thenard, are fibrin, albumen, gelatine, and caseous matter. In all these, the hydrogen, if considered only with regard to the oxygen, is considerably in excess; but if this excess of hydrogen be compared with the nitrogen, which is one of the constituents of the above substances, the proportions of the two latter will be found to approach nearly to those deduced from the analysis of ammonia.

Observations. The experiments recited in this paper, are of considerable importance, and will, no doubt, if pursued lead to curious and interesting results; but the authors appear to generalize too hastily. It may be objected to their theory with regard to vegetable substances, that it assumes the composition of water to be about 88 of oxygen, to 12 of hydrogen; whereas the general concurrence of the ablest Chemists, has fixed it about 75 of oxygen, to 15 of hydrogen.—*Retrospect.*

ON A MODE OF TRAINING VINES.

By Joseph Hayward, of Wilton,

Transactions of the Horticultural Society. Vol, 1, Part 4.

Mr. Hayward remarks that it is necessary to keep three main objects in view, in training the vine; first to cover the space allotted to it with fruit branches, leaving room for both ripening the fruit, and the branches that are to bear the fruit the succeeding year; secondly, to take off the top of each branch, bearing fruit, the third joint above the uppermost bunch, except such branches as are destined to bear fruit the next year, which latter must be duly exposed, and, by no means topped, for if the sap be checked in these, many of their buds will burst the same season, and the fruit for next year be destroyed; thirdly, to take off all collaterals as they arise, and any shoots which turn out unproductive of fruit, that the whole strength of the tree may be properly applied.

He then directs that a stock be properly planted so as to produce three shoots of sufficient strength and age for bearing, the middle one to be topped for fruit, and the extreme ones to be trained for young wood, and so on year after year in succession; and the most effectual mode of accomplishing this, is illustrated by two plates.

Observations. — The principles laid down by Mr. Hayward in this paper, are the best axioms we have met with for the pruning and training of vines.—*Retrospect.*

ON POTATOES.

BY THOMAS ANDREW KNIGHT, ESQR.

Transactions of Horticultural society, Vol. 1, part 4.

From experiments which have been made on the potato, it is inferred, that when a plant affords either seeds or blossoms, a diminution of tubers, or an increased expenditure of the richness of the soil, must necessarily take place; and Mr. Knight is satisfied from his own practice, that the crop is increased by destroying the fruit-stalks, and immatured blossoms, as soon as they appear, and he had thought that very considerable advantages would arise if varieties of a sufficiently luxuriant growth, and large produce for general culture, could be formed, which would never produce blossoms; and such, he has the gratification to find, may be readily obtained. And by shifting his varieties, so as to make them ripen earlier in each succeeding year, he has no doubt of having completely established a potato, which will produce tubers without either fruit or blossom.—*Retrospect.*

Observations. — By mowing off the tops of potatoes, so as to prevent the stem and blossoms from attaining maturity, is recommended.

MR. SCHMALCALDER'S PATENT FOR CERTAIN IMPROVEMENTS IN MATHEMATICAL INSTRUMENTS.

March 1812, Rep. Arts. 129.

On the edge of the mariner's compass, theodolite, or other instrument for measuring angles of azimuth, Mr. S. places a three-sided prism; this produces a single reflection, and enables the observer to read the divisions on the card, at the same time, by raising his eye partly above the angular edge of the prism, he sees the subject of observation by direct vision. In this manner the line of collimation becomes the index to the card divisions, and the azimuth or bearing may be taken and read off at one observation.

By the application of a four sided pyramid, on the same principle, to a plumb-line, spirit-level, or the divisions of a theodolite, or other instrument, Mr. S. is enabled to see the object by direct vision; the position of the plumb-line, etc., by means of one reflecting or inclined surface, and to read off the divisions by the other reflecting surface.

The adaptation of these prismatic reflectors to the telescope, Hadley's sextant, and similar instruments, enables an observer to obtain the angles of azimuth, and altitude, without the usual necessity of assistants. Where a magnifying power is required, Mr. S. produces it, by making certain surfaces of the prism convex.

ON A METHOD OF FREEZING AT A DISTANCE.

BY WILLIAM HYDE WOLLASTON, M. D.

Sec. R. S. Phil. Trans. for 1813.

If an attempt were made to freeze water by mere evaporation in the vacuum of an air pump, (Dr. W. observes,) the receiver must be of large dimensions in proportion to the quantity of water employed, otherwise its capacity would set too confined a limit to the quantity of vapour that will rise, and consequently to the degree of cold produced. According to the commonly received estimates as to the respective quantities of heat in ice, water, and steam, 32 grains of water at 62° must lose about 5 grains by evaporation, in order to convert the remainder into ice, (making no allowance for the accession of heat from the surrounding bodies,) and as water expands to 1800 times its former bulk when it assumes the gaseous state, these 5 grains require a dry vacuum of $5 + 1800 = 9000$ grains of water.

To avoid the necessity of so large a vacuum, Mr. Leslie has most ingeniously employed an extensive surface of some substance that strongly absorbs and condenses the vapour of water, (sulphuric acid in preference to any other,) which, by extracting from the receiver the aqueous vapour as fast as formed, keeps up a vacuum within it, and thus allows the congelation of a large quantity of water in a moderate space. Dr. W. has employed another way of applying the same principle of preserving a vacuum round the water to be frozen in the little apparatus here described. This is no other than the common glass toy called the *pulse glass*, and consists of a bulb of glass blown at each end of a piece of a glass tube, and bent at right angles to the tube.

One of the bulbs is half-filled with water, and the other hermetically sealed at the moment that the whole is kept fill-

ed with steam by heating over a lamp a considerable time, till all the air is expelled, so that when the glass is cooled, one bulb remains half-full of water, and the other bulb, and the intevening tube are perfectly empty of air.

Now, if the empty bulb is immersed in a mixture of salt and snow, the aqueous vapour proceeding from the water in the other bulb is congealed as fast as it is produced, and in a few minutes the water is frozen solid. The distance between the two bulbs may be very considerable without impairing the effect. Dr. W. has given this little instrument the name of *Cryophorus, or Frost Bearer.*

A PLAN OF A FRUIT ROOM, WITH SOME ACCOUNT OF IT.

BY JOHN MAHER.—Horticultural Transactions, Vol. 2, part 1.

This fruit room consists of a nest of drawers occupying one side of it from the floor to the ceiling; the drawers are numbered, so that the fruit contained in each may be registered in a book, and its progressive delivery for the table or kitchen, accurately noted. The lower drawers have close bottoms, and are called sweating drawers, the fruit being put into them as soon as gathered. In ten days or a fortnight, as the apples and pears come forward they are sorted, and the other drawers are prepared to receive them, by covering the bottom of each with very clean wheat straw, thoroughly dried and ventilated, the bottom of these drawers is made of trellis-work. The room is directed to have slides both in the door and window to admit a circulation of air in fine weather; but in damp and rains, the rooms should be closely shut.

ON THE TRANSPLANTATION OF BLOSSOM-BUDS.

BY T. A. KNIGHT, ESQR.—Horticultural Transactions, Vol. 2, part 1.

The experiment of transposing buds from the branches of one plant, to the scions growing from the root of another, was first practised on roses, in 1810, in the month of August; and the success with which this was attended, led to a number of similar experiments upon the pear and peach tree.

An old unproductive pear tree on a north-west wall, was pruned so close as to occasion the protrusion of many strong succulent shoots, and into these were inserted blossom-buds of the St. Germain, and long green pears; some of these vegetated and afforded leaves the same year, but others, not till the following year, but those buds succeeded best, which were inserted into the bases of the abortive branches of blossoms of the preceding year. Similar experiments were made upon the seedling peach trees under glass, with equal success, and the buds of the peach tree were afterwards found to set perfectly in the open air.

ON THE PROPER STOCK FOR THE MOOR-PARK APRICOT.

BY T. A. KNIGHT, ESQR.—Horticultural Transactions, Vol. 2. part 1.

In some experiments with a view of ascertaining the advantages, or disadvantages of stocks of different species in the culture of the peach, the nectarine, and the apricot, made by Mr. Knight, the following circumstance occurred. A single plant of the *Moor-Park* Apricot obtained sixteen or seventeen years before, by grafting upon an apricot stock, retains a smooth and polished surface, and the old tree presents a perfect degree of health and vigour; while the other Moor-Park Apricots in the garden, like those in most others, become in a few years diseased and debilitated, and exhibit in spaces near the head of the stock, lifeless alburnum, beneath a rough bark. So different was the appearance of the Moor-Park, or the Apricot stock from all the other trees of the same kind in the garden, that its specific identity was at first view, doubted by some gardeners.

ON THE GOOD EFFECTS OF WATERING THE FROZEN BRANCHES OF PEACH AND NECTARINE TREES VERY EARLY IN THE MORNING.

By G. H. NOEHDEN Hort. Trans. Vol. 2. part 1.

This method was resorted to in the garden of James Stuart Wortley, Esqr. near Sheffield, in order to counteract the effects of spring frosts. The garden lies very high above the level of the sea, and is consequently without the advantage of a sheltered situation, but the local position is not otherwise unfavourable, as it slopes

a little to the eastward on the side of a high hill. Though much of the produce of this superior garden is attributed to the attentive pruning, yet Mr. Wortley was equally fortunate in the preservation of his peaches and nectarines in 1810 and 1811, when that kind of fruit was entirely destroyed by the frost in neighbouring gardens. The gardener applied cold water at the blooming and setting of the fruit in the following manner: if upon visiting the trees before the sun is up in the morning, after a frosty night; he finds that there is any appearance of frost in the bloom or young fruit, he waters the bloom or young fruit thoroughly with cold water, from the garden engine, and even if the blossoms and young fruit are discolored this operation recovers them provided it be done before the sun comes upon them, and he has sometimes occasion to water particular parts of the trees more than once in the same morning, before he can get entirely rid of the effects of the frost. This method was first discovered by an accident, watering cabbage plants among some rows of kidney beans, early in a frosty morning, part of the water was spilled on the beans, and these beans were found immediately to recover from the effect of the frost; the extent of wall on which the fruit was in this manner successfully preserved was 172 yards.

ON THE EARLY PUBERTY OF THE PEACH TREE.

By T. A. KNIGHT, Esqr. Hort. Trans. Vol 2. part 1.

Mr. Knight subjected peach seeds to an artificial heat in February, and the plants appeared above the soil early in March and were kept under glass during the whole summer and autumn, but without any artificial heat after the end of May. As many lateral shoots were suffered to remain upon the plant, as could present their foliage to the light, and these were shortened while very young to the 4th or 5th leaf, and the buds in the axillae of these leaves were destroyed as soon as they became visible, so that none of the sap generated by these leaves might be uselessly expended; the pots were filled with green turf of a rich meadow which had been overflowed, and were thrice changed during the summer and new portions of the living turf, added at the same time. The summer proving cold and cloudy all hope of success was relinquished for that year, and artificial heat in autumn was not applied; yet late in the autumn three of the seven plants unexpectedly formed blossom buds, and these buds presented so vigorous and healthy a character, as to leave no doubt of their being capable of producing fruit.

Observations.—This experiment shows how much may be effected by judicious training which enables the gardener to accomplish many objects in a shorter space of time than would be otherwise required. The bearing of the peach tree may be always actuated by shortening the branches.

Directions for covering the soil in Hot Beds and Pineries, and on the proper time for sowing small seeds, by Mr. Henderson, Bredlen Castle.

Memoirs of Caledonian Hort. Society, Vol. 1, part 2.

The advantages resulting from covering the beds of hot houses and pineries with fine drifted river or sea sand, three inches deep are stated to be extirpating the *Slater,* or wood louse, the nature of the sand preventing this insect from concealing itself from the rays of the sun; keeping down the steam in dung hot beds, and affording to the fruit as warm and dry a bed as tiles or slates. This covering also retains the moisture in the beds longer than any other, and is itself sooner dry, and always gives the house a clean and neat appearance, and will be found a great preventive of that alarming evil the mildew. The remainder of the paper relates to the most proper time for sowing the smaller seeds, of both flowers and shrubs; which is recommended to be done at such times as the insects that feed upon them, do not produce their young from the eggs crysalides of the former year.

Attention to this circumstance is thought of more importance to securing a crop, than any particular mode of culture whatever.

Observations.—The direction for covering the beds in hot houses with fine sand is among the most valuable improvements in garden management of the present day. And as different insects are hatched at different periods, it will be advantageous to prevent any seed from vegetating at the

precise time its enemy is prepared to destroy it.

METHOD OF PRESERVING APPLES AND PEARS.

The fruit is to be gathered when it begins to drop spontaneously; and in plucking it, the rule to be observed is to take what appears ripest in the hand and raise it level with the foot stalk, and if it parts from the tree, to lay it carefully into the basket, otherwise let it remain. In the fruitery the fruit is to be laid in heaps, and covered with clean cloths, and mats, in order to its sweating, which is generally effected in three or four days. They may remain in the sweat three or four days more, and are then to be wiped separately, with clean cloths. Some glazed earthen jars with covers are to be provided, and some pure pit sand, which has been well dried on a flue. A layer of sand an inch thick, is to be put at the bottom of the jar and then a layer of sand and fruit alternately, till it be full; the jars are to be closed, and kept in a dry cold place, but free from frost. When fruit is wanted a jar may be unpacked, and that part which is ripe may be sent to the fruit room, and the remainder repacked as before. By this mode, some fruit will be preserved till June, or July.

To destroy Wasps.—Make a roll of damped gunpowder on the end of a small stick, light this under their nests when on a bush or tree, or into the entrance, when in the ground, this stupifies them, they can while in this state, be mixed up with the ground which is made in a state of mortar by adding a sufficient quantity of water, which completely destroys them.

Green Flies can be destroyed by watering trees infested by them with water, in which lime (a peck of lime to a hogshead of water,) has been previously mixed for twenty-four hours, the water is drawn off, and a pound of common soda added to the water before applying it to the trees.

It is said they can be destroyed by enticing them into bottles by means of jam, or jelly.

Observations.—The soda might possibly destroy the leaves as well as the flies.

Coloured Vinegar, Wine, and many other liquors may be rendered transparent by animal charcoal, a litre (1¾ Ale pints) of liquor to 45 grammes (eleven drams, thirty five grains Troy) of charcoal; mix without heat for two or three days, stirring them frequently, then filtrate.

The animal charcoal is prepared by filling a crucible with the most solid compact oxbones, and luting on a cover with a small hole drilled through. Heat is applied, at first moderate, as long as any inflammable vapour issues through the hole, and then pretty briskly for a short time. When the crucible is cold the charcoal is reduced to fine powder and kept for use. Ivory black is said to answer equally well.

PROCESS TO MAKE INDELIBLE INK.

From the Journal of the Franklin Institute.

No. 1. For writing with quill pens.

Indian Ink, dissolved in water acidulated with hydrocloric* acid of commerce, and marking 1½° Baume's areometer.

No. 2. For writing with metalic pens.

Indian Ink dissolved in water rendered alkaline by caustic soda, and making 1° on Baumes' areometer.

No. 3. For printing the indelible designs and patterns.

Common printing ink, whitened with a sufficient quantity of sulphate of barytes, either artificial or natural, which has been ground in water for a considerable time. *Mag. Pop. Science.*

As Baume's areometer is but little used in this country, it may be useful to state that if water be taken at 1000 sp. gr.

1° on this instrument is		1007 sp. gr.
1½	do	1010 "
2	do	1014 "

For the acidulated solution. To a pint of water, add about three tea spoonfulls of muriatic acid.

For the alkalized solution. To the same quantity of water add 100 grains of pure caustic soda, of the kind prepared for chemical purposes.

About 40 grains of Indian ink may be dissolved in a pint of the solution. This will make an Ink sufficiently black for ordinary writing, but it is evident it may very easily be made darker or lighter at pleasure.

* Muriatic acid, about sp. gr. 1 28, so called by the French Chemists.

The Indian Ink should be of the best quality, care should be taken that it be uniformly good throughout the stick.

An inferior kind, hard, gritty, and possessed of little colouring power, is sometimes imposed upon the purchaser, by the deceptive practice of attaching a little bit of good ink at each end of the stick. A good mode of examination, is to break the stick in two; this defeats the above trick, and exposes the fracture; that of good ink is brilliant, angular and clean; the bad, dull and earthy.

ELECTRICITY.

Extract from a treatise upon Electricity by J. A. De Luc, Esqr., F. R. S Phil. Journ. No. 126.

1. The *electric fluid*, resides on all terestrial bodies, every particle air included; being retained upom them by a mutual attraction which however, differs in degree, according to the bodies; some attract the *electric fluid* when it comes in contact with them; but then it adheres strongly to the parts which receive it, moving very slowly along the surface of these bodies, which are therefore *non-conducters*: others receive it at more or less distance, and it is propagated more or less rapidly along their surfaces. Glass though absolutely *impenetrable* to the *electric matter* permits the *electric fluid* (i. e. the electric matter united with *vector*) to move with a sensible progress along its surface.

2. Friction excited between two bodies has no other effect than that of disturbing the natural *equilibrium* of the *electric fluid* which tends always to produce among all bodies, according to its *actual* (but local in a certain extent) quantity on them, and in the *ambient air*. If both the bodies which exercise *friction* on each other are good *conducters*, this disturbance, the equilibrium being constantly restored, is not perceived; but if one has more disposition than the other to attract the *electric fluid* thus agitated, with the faculty of transmitting it to its remote parts, when they are separated, either suddenly, or in general before the *equilibrium* of the fluid can be restored between them—one is found *positive* as having acquired a proportional quantity of *electric fluid* greater than the *ambient air*, and the other *negative*, as having lost that quantity: both being supposed to have previously possessed the same electric state as the *ambient* air.

3. The general effect, therefore, of *friction* between two bodies is, that one never becomes *positive* without the other being made *negative* (*or vice-versa.*)

This evident proof, that all *electric phenomena* which we are hitherto able to produce at will, namely, by *friction*, proceed from the disturbance of the *equilibrium* of only *one fluid*, will be afforded by the experiments which I shall here relate with another remark. The surest mode of following the course of the electric fluid, when in motion is by means of *electroscopes*; and that made of gold leaf being judged the most proper for this purpose; but as this would be torn in pieces by the smallest machine in common use, it became necessary for this ingenious philosopher, to invent an apparatus for himself.

The following brief description answers to the result of his ingenuity. The apparatus consists of a wooden base, supporting two upright wooden pillars fitted at their upper extremities to receive different spindles, which are separately inserted, and each turned by a winch handle. The prime conductor is composed of a brass tube, stopped at each end, supported by a *glass* pillar, covered with insulating varnish and fixed in the base.

One end of the conductor communicates with the spindles by means of a very thin slip of whale-bone covered with gilt paper, fixed to a piece of brass that screws into the conductor, so as to admit of being adjusted to the proper bearing on the spindle: this adjustment must be acquired by experiment. The other extremity communicates with a gold leaf electroscope.

The rubbers are of different kinds, but all fixed to the apparatus in the same manner: they principally consist of a very elastic brass lamina, and only differ in that end which presses on the spindle. The different kinds of rubbers must press against the spindles with different degrees of force, and always yield readily to the inequalities on the surfaces of the spindles.

For these purposes, the rubbers are fixed horizontally into a proper pillar, and part of the pressure occasioned by the ac-

tion of one or two additional brass springs, pressing on the main spring.

Another gold leaf electroscope is connected with the brass piece, into which the rubbers are fixed. Many trials were made before the machine was brought to a sufficiently small power. The following are the dimensions when it nearly succeeded, though still too strong; the spindle is a solid glass cylinder very little more than one fourth of an inch in diameter, and covered with sealing-wax at both ends, for the purpose of insulating about three fourths of an inch in length in the middle where the friction is produced. The rubber is simply a brass spring, bent at one end to fit the upper part of the cylinder. Small as this machine is, it was found necessary to move it very slowly, to prevent too great a motion of the electroscopes.

Mr. De Luc next states his experiments with considerable precision and minuteness. In the first the cylinder was glass, and the rubber brass; and it appeared that the former received electric fluid from the latter by means of the friction, and communicated it through the prime conductor to one of the electroscopes, which diverged positively, while the other diverged negatively. In the second experiment the communication between the rubber and the prime conductor, was restored by means of a wire, and the motion of both electroscopes immediately ceased. In the third experiment, both the rubber and the cylinder were glass, and the latter obtained electric fluid from the former.

Experiment fourth was made with glass and sealing-wax; 5th, with glass and Indian-rubber; 6th, with brass and sealing-wax; 7th, with Indian-rubber and sealing-wax; and the 8th, with some of the beads, of the size and color of a cherry, worn by Indian women, mounted instead of a cylinder, and acted upon successively by rubbers of brass and sealing-wax. From all these experiments the author draws the following conclusions.

"Such are the constant phenomena observed at the fountain head of all the *electric effects* which it is in our power to produce, and they depend on *friction*, respecting which various systems have been fabricated. Now from the whole tenor of these experiments, it may be laid down as a fundamental truth, in terrestrial physics, that friction has no other influence in *electric* phenomena, than that of disturbing the *equilibrium* of the *electric fluid* in such a manner, that one body, by *acquiring* a certain portion of it above what it had before, is rendered *positive*, and that the other is found *negative*, as having lost that quantity.

It is only when its equilibrium is disturbed that it is manifested to us. The *electroscope* is our first test of this disturbance; but if the bodies, either *conductors* themselves, or associated with *conductors*, are of sufficient size, and the electric fluid between them has arrived to a certain degree, it is manifested by a *spark* darting from one to the other, and the equilibrium is restored."

Observations. We cannot altogether adopt the whole of Mr. De Luc's ingenious theories, which appear to us to want the great merit of simplicity: his experiments are interesting, and so far as they are directed to the establishment of a basis for the explanation of elementary facts, they must be considered as highly important; but we do not think that his hypothesis are such as materially facilitate the connection of these facts with each other, which in the investigation of so abstruse a subject, is all that we have at present a right to expect from any hypothesis; for a theory, which shall in all cases correctly represented the intimate nature of the operations concerned, is scarcely to be expected from the utmost exertions of human intellect continued and combined for many ages.

Retrospect.

DEFINITION OF TERMS.

Beginning at the letter B.

Barytes in Mineralogy and Chemistry, an earth, discovered by Sheele in 1774 and may be obtained from ponderous spar, or sulphate of barytes, as it is now called, by the following process, for which we are indebted to Vauquelin. Reduce the mineral to a fine powder, mix it with the eighth part of its weight of charcoal powder; and keep it for some hours red hot in a crucible, and it will be converted into sulphuret of Barytes. Dissolve the sulphuret in water, and pour nitric acid into

the solution, and the sulphur will be precipitated. The solution, which consists of nitic acid combined with barytes, is to be filtered and evaporated slowly till it crystallizes. Put the crystal into a crucible, and expose it to a strong heat; the nitric acid is driven off, and the barytes remains in its purity.

Another method pointed out by Dr. Hope. Decompose the sulphate of barytes, by heating it strongly along with charcoal powder. The product is to be treated with water to dissolve every thing that is soluble, and the liquid being filtered, is to be mixed with a solution of carbonate of soda. A white powder falls. Wash this powder; make it up into balls with charcoal, and heat it strongly in a crucible. When these balls are treated with boiling water a portion of barytes is dissolved, which crystallises as the water cools. It is a grayish white porous body, which may very easily be reduced to powder. It has a harsh and more caustic taste than lime, and when taken into the stomach proves a most violent poison.

Belles-Lettres, a word absurdly introduced from the French. The French writers themselves have no determinate idea affixed to this phrase; some applying it to polite literature only, and some extending it to the whole scope of human learning, even to the mathematics.

Beta, a genus of the pentandria digynia class and order of plants; and in the natural method ranking under the 12th order, holoraceae. The calyx has five leaves; there is no corolla; the seeds are kidney shaped, and situated within the base of the calyx. There are four species, viz: 1st, Beta cicla the root of scarcity. The Beta hortensis, or common white beet, is a variety of this; 2d, the Beta maritima, the sea beet: 3d, Beta apatula, a native of Madeira; 4th, Beta vulgaris, the red beet with a pyramidal root, has large thick succulent leaves, which are for the most part of a dark green or purple color, the roots are large and of a deep red, the larger these roots grow, the more tender they are, and the deeper the color, the more they are esteemed; the varieties of this species are the common red beet, the turnip rooted beet, and the green leaved red beet. On many parts of the continent of Europe, the beet root has been used for the purpose of extracting sugar from it, (see pages 5, 6, 20, 36, which relate to beets and sugar). According to Achard, the quantity of beet in Prussia that will yield one pound of sugar is twenty pounds; one hundred pounds of raw sugar give fifty five of refined, and twenty five pounds of molasses. It is computed by the same gentleman, who has employed much time in the pursuit, that a German square mile of land, that is, sixteen square miles English, properly cultivated, would produce white beet sufficient to furnish the whole Prussian dominions with sugar.

Bice or *Bise*, among painters, a blue colour prepared from the Lapis Armenus.

Bice bears the best body of all bright blues used in common work, as house painting, &c. but it is the palest in color. It works indifferently well, but inclines a little to sandy, and therefore requires good grinding. Next to ultramarine, which is too dear to be used in common work it lies best near the eye of all other blues.

Boiling or *ebullition*, in Physics, the agitation of a fluid body, arising from the application of fire, &c. The following table shows the boiling point of several liquids.

Bodies.	*Boiling point.*
Ether,	98° Fahr.
Amonia,	140 "
Alcohol,	176 "
Water,	212 "
Muriat of lime,	230 "
Nitric Acid,	248 "
Sulphuric Acid,	590 "
Phosphorus,	554 "
Oil of Turpentine.	560 "
Sulphur,	570 "
Linseed oil,	600 "
Mercury,	660 "

The boiling point however is found to depend upon the degree of pressure to which the liquid is exposed. In a vacuum, all liquids are said to boil at 145 degrees lower than in the open air under a pressure of 30 inches of mercury; therefore water would boil in vacuo, at 67 degrees, and alcohol at 34 degrees. In Papin's digester, the temperature of water may be raised to 300 degrees, or even 400 degrees without ebullition; but the instant that this great pressure is removed, the boiling commences with prodigious violence.

Bronzing, the art of varnishing wood, plaster, Ivory, &c. so as to give them the color of bronze. There are two sorts of composition used for this purpose, the red and the yellow.

The latter is made of the finest copper dust and to the former is added, a small quantity of red oehre. well pulverized, both are applied with varnish, and the work is dried over a chafing dish as soon as bronzed.

Brunonian *system*. The system of medicine discovered by the late Dr. Brown and explained at large in his elements of medicine. *Brunonian system, account of.* The human body particularly the system of solids it consists of, it is a form of living matter, whose characteristics are sensation and motion. The capability of being affected by external powers, is termed *excitability;* the agents stimuli, or exciting powers; the result *excitement.* Without this property, excitability, the body would be dead inert matter, by this property it becomes living matter; by this property, called into action by the exciting powers, it becomes a living system.

While the *stimuli* acts on the excitability with a sufficient degree of power, then is the pleasant sensation of health; when they raise the excitement above this point, or depress it below it, disease takes place; when the stimuli cease to act, or the system to feel their power, death ensues.

Excitability is a property of living matter, peculiar and inherent, but it is a property which Dr. Brown did not pretend to explain.

He left it as Sir Isaac Newton did his attraction as a property not to be investigated. Of this energy or power there is assigned to every living system, at the commencement of life, a certain quantity or proportion; but its quantity differs in each, and in the same body it is found to change; for the excitability, according to circumstances, may be 'abundant, increased, accumulated, superfluous, exhausted consumed', &c. The *stimuli* or exciting powers are of two classes, external and internal. The external stimuli are heat, light, sound, air, and motion; food, drink, medicines, and whatever else is taken into the body, not excepting poisons and contagions. The internal are the functions of the body, the blood, the secretions, muscular exertions, and finally the powers of the mind; as sensation, passion, and thought. *Excitement* is life; the natural movements of the machine, and the functions resulting from these, as sensation, reflection, and voluntary motion, as they immediately flow from the exciting powers, are vigorous when they are strong, languid when they are weak, and cease when they are taken away entirely. Thus our body is continually moved by external agents, and life is a *forced state*, our weak frame has an unceasing tendency to dissolution, which is opposed only by the incessant application of *exciting powers*, which are the sources of life, and which being partially or completely withdrawn are immediately followed by disease or death. It is also a principle of this doctrine, that all stimuli by acting on the excitability exhaust it. Thus the stimuli of food, air, motion, passion, and thought, have supported the body through the labours of the day: they have supported the functions by acting on the excitability; in the evening it is exhausted by their continued operation, they have no longer the same power; the functions fail; we sink into rest, and continue in sleep, unaffected by the stimuli, renewing by sleep that excitability which had been exhausted by the labours or the pleasures of the day; we rise with restored excitability; we feel a new power of excitement in every object around us; we are refreshed in the morning, and languid at night, and our whole life is an alternation of motion and rest, of action and sleep, of apathy and pleasure, of wasting our excitability by day in labour or enjoyment, and of recruiting it by night by the abstraction of all stimulant powers.

The same philosophy extends to the duration of life; in childhood excitability is abundant in *quantity* as being little exhausted; but it is low in power, because the tender stamina and accumulated excitability of children can neither suffer, nor support high excitement. Their excitability is so abundant that they are easily supported by weak diet and low exciting powers, and therefore most of their diseases, are diseases of weakness. In youth and manhood, the excitability is yet entire, the stamina are strong, the powerful stimuli are applied, and high passions pre-

vail; these are the periods of vigour, and the era of inflammatory disease. In old age the stamina are worn, the excitability is exhausted, the common stimuli have lost their power, and the system begins to decline; we have weakness of body, imbecility of mind, and asthenic diseases. We may last of all, have recourse to more generous diet, and raise the stimulant powers by substituting wine to water, or brandy to wine; thus perhaps excitement may be awhile supported and life prolonged; but in a few years, these also fail.

This doctrine further teaches that our body is never moved but by exciting powers. None but stimuli affect our system. That there are direct sedatives, in nature is esteemed an unphilosophic, and vulgar error. In stimuli there is a gradation which being relative to the system deceives our senses; for as some stimuli are powerful and others weak, a low stimulus applied after a more powerful one, will stimulate less than the former, will allay the motions which the former had excited, and will therefore be named a sedative.

Take heat as an example of this: cold is but an abstraction of heat, yet it is thought a positive existence; and cold is named a sedative and heat a stimulant power. To detect this deception of sense, plunge the right hand into water at the heat of one hundred and fifty degrees, the left hand into melting snow; withdraw both and plunge them at once into water at 100°, it will prove at once stimulant and sedative; cold or sedative to the right hand, and hot or stimulant to the left; so is fasting an abstraction of the wanted stimulus of food, bleeding of the usual stimulus of blood, and so on. Health is then the due operation of stimuli on a well regulated excitability, producing a moderate excitement, and a pleasant sensation, moving the whole system with a just degree of power, and giving all the functions their due energy and tone. Asthenic disease, disease of debility or of weakness, is the result of stimuli applied in a low degree, or of the system less easily excited; asthenic disease, or disease of strength, is the result of stimuli applied in too great a degree, or of a system too susceptible of excitement. The first is depression of excitement below the healthy state; it produces languid motions, and functions, and requires excitement for its cure. The second is a strong state of the system, wound up to too high a degree of excitement. It is an exuberance of health and strength. It is marked by violent movements, and is cured by extraction of stimuli. Thus are all our maladies either diseases of weakness or of excessive strength; and thus is the foundation of the Brunonian scale, which has for its middle point, health; below that are arranged the diseases of weakness; above it the diseases of excessive strength; and in both divisions of the scale, diseases are so arranged, that the worst forms are set off at the greatest distance from the middle point, to mark them as the widest deviations from the healthy state.

(*To be continued.*)

PROCESS TO PRESERVE BEEF AND PORK.

To the Hams and Shoulders of 1800lbs. of Pork apply one pint of saltpetre finely pulverized and one gallon of molasses—and to any other quantity in the same relative proportions.

The saltpetre and molasses are first mixed together and then rubbed over the hams and shoulders, they are then immediately packed away in barrels or other water-tight vessels, with the skin down.

The next day they are to be covered with a brine that will bear an egg.

In about six weeks or two months smoke them as usual in a smoke house in which air is allowed to circulate, and flies prevented from entering, by a wire or other screen.

If the pickle becomes mouldy put a few handsfull of salt on a board, the upper surface of which is just below the surface of the fluid brine, and if mould appears at any time afterwards in the brine add more salt.—Beef is treated exactly as the pork.

From Sir Humphrey Davy's Elements of Agricultural Chemistry.

AGRICULTURAL CHEMISTRY.

Continued from page 48.

That gentleman fixed some seeds of the garden bean on the circumference of a wheel, which in one instance was placed vertically, and in the other horizontally, and made to revolve, by means of another wheel worked by water, in such a manner,

that the number of the revolutions could be regulated; the beans were supplied with moisture, and were placed under circumstances favorable to germination. The greatest velocity of motion given to the wheel was such that it performed 250 revolutions in a minute. It was found that in all cases the beans grew, and that the direction of the roots and stems was influenced by the motion of the wheel. When the centrifugal force was made superior to the force of gravitation, which was supposed to be done when the vertical wheel performed one hundred and fifty revolutions in a minute, all the radicles, in whatever way they were protruded from the position of the seeds, turned their points outwards from the circumference of the wheel, and in their subsequent growth receded nearly at right angles from its axis; the germens, on the contrary, took the opposite direction, and in a few days their points all met in the centre of the wheel.

When the centrifugal force was made merely to modify the force of gravitation in the horizontal wheel when the greatest velocity of revolution was given, the radicles pointed downwards about ten degrees below, and the germens as many degrees above the horizontal line of the wheels motion; and the deviation from the perpendicular was less in proportion as the motion was less rapid.

These facts afford a rational solution of this curious problem, respecting which different philosophers have given such different opinions; some referring it to the nature of the sap, as De la Hire, others, as Darwin, to the living powers of the plant, and the stimulus of air upon the leaves, and of moisture upon the roots. The effect is now shown to be connected with mechanical causes; and there seems no other power in nature to which it can with propriety be referred but gravity, which acts universally, and which must tend to dispose the parts to take a uniform direction.

If plants in general owe their perpendicular direction to gravity, it is evident that the number of plants upon a given part of the earth's circumference, cannot be increased by making the surface irregular, as some persons have supposed. Nor can more stalks rise on a hill than on a spot equal to its base; for the slight effect of the attraction of the hill, would be only to make the plants deviate a very little from the perpendicular. Where horizontal layers are pushed forth, as in certain grasses, particularly such as the fiorin, lately brought into notice by Dr. Richardson; more food may, however, be produced upon an irregular surface; but the principle seems to apply strictly to corn crops.

The direction of the radicles and germens is such that both are supplied with food, and acted upon by those external agents which are necessary for their development and growth. The roots come in contact with the fluids in the ground; the leaves are exposed to light and air; and the same grand law which preserves the planets in their orbits, is thus essential to the functions of vegetable life.

When two pieces of polished glass are pressed together they adhere to each other, and it requires some force to separate them. This is said to depend upon the *attraction of cohesion.* The same attraction gives the globular form to drops of water, and enables fluids to rise in capillary tubes; and hence it is sometimes called *capillary attraction.* This attraction like gravitation seems common to all matter, and may be a modification of the same general force; like gravitation, it is of great importance in vegetation. It preserves the forms of aggregation of the parts of plants, and seems to be a principal cause of the absorption of fluids by their roots.

If some pure magnesia, the calcined magnesia of druggists be thrown into distilled vinegar it gradually diss ves.—

This is said to be owing to *chemical attraction*, the power by which different species of matter tend to unite into one compound. Various kinds of matter unite with different degrees of force: thus sulphuric acid and magnesia unite with more readiness than distilled vinegar and magnesia; and if sulphuric acid be poured into a mixture of vinegar and magnesia, in which the acid properties of the vinegar have been destroyed by the magnesia the vinegar will be set free, and the sulphuric acid will take its place. This chemical attraction is likewise called *chemical affinity.* It is active in most of the phenomena of vegetation. The sap consists of a number of ingredients, dis-

solved in water by chemical attraction ; and it appears to be in consequence of the operation of this power, that certain principles derived from sap are united to the vegetable organs. By the laws of chemical attraction, different products of vegetation are changed, and assume new forms; the food of plants is prepared in the soil ; vegetable and animal remains are changed by the action of air and water and made fluid or aeriform ; rocks are broken down and converted into soils : and soils are more finely divided and fitted as receptacles for the roots of plants.

The different powers of attraction tend to preserve the arrangements of matter, or to unite them in new forms If there were no opposing powers, there would soon be a state of perfect quiescence in nature, a kind of eternal sleep in the physical world. Gravitation is continually counteracted by mechanical agencies, by projectile motion on the centrifugal force; and their joint agencies occasion the motion of the heavenly bodies. Cohesion and chemical attraction are opposed by the *repulsive energy of heat*, and, the harmonious cycle of terrestrial changes is produced by their mutual operations.

Heat is capable of being communicated from one body to other bodies ; and its common effect is to expand them, to enlarge them in all their dimensions. This is easily exemplified. A solid cylinder of metal after being heated will not pass through a ring barely sufficient to receive it when cold. When water is heated in a globe of glass having a long slender neck, it rises in the neck and if heat be applied in air confined in such a vessel inverted above water, it makes its escape from the vessel and passes through the water. Thermometors are instruments for measuring degrees of heat by the expansion of fluids in narrow tubes. Mercury is generally used, of which 100,000 parts at the freezing point of water become 101,835 parts at the boiling point, and on Fahrenheit's scale these parts are divided into hundred and eighty degrees.

Solids, by a certain increase of heat, become fluids, and fluids gasses, or elastic fluids. Thus ice is converted by heat into water, and by still more heat it becomes steam: and heat disappears, or, as it is called, is rendered *latent* during the conversion of solids into fluids, or fluids into gasses, and reappears or becomes sensible when gasses become fluids, or fluids solids: hence cold is produced during evaporation, and heat by the condensation of steam.

There are a few exceptions to the law of expansion of bodies by heat, which seem to depend either upon some change in their chemical constitution, or on their becoming crystallized. Clay contracts by heat, which seems to be owing to its giving off water. Cast iron and antimony, when melted, crystallize in cooling and expand. Ice is much lighter than water. Water expands a little even before it freezes, and it is of the greatest density at about 41° or 42°, the freezing point being 32° ; and this circumstance is of considerable importance in the general economy of nature. The influence of the changes of seasons and of the position of the sun on the phenomena of vegetation, demonstrates the effects of heat on the functions of plants. The matter absorbed from the soil must be in a fluid state to pass into their roots, and when the surface is frozen they can derive no nourishment from it.

The activity of chemical changes likewise is increased by a certain increase of temperature, and even the rapidity of the ascent of fluids by capillary attraction.

This last fact is easily shown by placing in each of two wine glasses a similar hollow stalk of grass, so bent as to discharge any fluid in the glasses slowly by capillary attraction ; if hot water be in one glass, and cold in the other, the hot water will be discharged much more rapidly than the cold water.

The fermentation and decomposition of animal and vegetable substances require a certain degree of heat, which is consequently necessary for the preparation of the food of plants ; and as evaporation is more rapid in proportion as the temperature is higher, the superfluous parts of the sap are the most readily carried off at the time its ascent is quickest.

Two opinions are current respecting the nature of heat. By some philosophers it is conceived to be a peculiar subtile fluid, of which the particles repel each other, but have a strong attraction for the particles of other matter. By others it is considered as a motion or vibration of the particles of matter, which is supposed to

differ in velocity in different cases, and thus to produce the different degrees of temperature. Whatever decision be ultimately made respecting these opinions, it is certain that there is matter moving in the space between us and the heavenly bodies capable of communicating heat; the motions of which are rectilineal: thus the solar rays produce heat in acting on the surface of the earth. The beautiful experiments of Dr. Herschel have shewn that there are *rays* transmitted from the sun which do not illuminate; and which yet produce *more heat* than the *visible rays*; and Mr. Ritter and Dr. Wollaston have shown that there are *other invisible* rays distinguished by their *chemical* effects.

The different influence of the different solar rays on vegetation have not yet been studied; but it is certain that the rays exercise an influence independent of the heat they produce. Thus plants kept in the dark in a hot-house grow luxuriantly, but they never gain their natural colours; their leaves are white or pale, and their juices watery and peculiarly saccharine.

When a piece of sealing-wax is rubbed by a woolen cloth, it gains the power of attracting light bodies, such as feathers or ashes. In this state it is said to be *electrical*; and if a metallic cylinder, placed upon a rod of glass, is brought in contact with the sealing wax, it likewise gains the momentary power of attracting light bodies, so that electricity like heat is communicable. When two light bodies receive the same electrical influence, or are electrified by the same body, they repel each other. *To be Continued.*

Chinese Mulberry Italian (or white) Mulberry, silk-worm and silk.

As the relative value of these trees to supply food for the silk worm is at present a contested point; it is suggested that persons who have the power to make the following experiments, will do so the following season, and publish the result for the benefit of others.

1st. Feed them separately, one parcel of worms entirely upon one kind of leaves, and another parcel entirely upon the other kind, and note the relative health of the worm also the quality and quantity of silk produced from the same number of worms.

2nd. Feed two other parcels, one of them the first half of the season upon one kind of leaves, and the other half upon the other kind of leaves.

3d. Reverse the time of feeding the other parcel, with each respective kind of leaves

4th. Place an equal quantity of each kind of leaves, together with another parcel of worms, during the season, and observe which kind is preferred, and the relative value and quantity of silk, and health of the worms in each parcel, including the whole stated above.

5th. Make an estimate of the relative labour and expense, of gathering the different kinds of leaves to produce a given quantity of silk.

The experiments might probably be extended, so as to furnish other valuable information.—*Ed. Ob. & Rec.*

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OF AGRICULTURE, SCIENCE, AND ART.

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The object of this paper is to concentrate and preserve, in a form suitable for future reference, the most useful and interesting articles on the aforesaid subjects. Each number will contain sixteen octavo pages, printed on good paper, and when a sufficient amount is published to form a volume of convenient size, an alphabetical table of contents will be published and forwarded to subscribers, in order for binding. This number, shows the general plan of the work.

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BRUNONIAN SYSTEM.

Continued from page 61, *of No.* 4.

To illustrate still farther the nature of these two forms of disease we must observe their respective causes. Sthenia or excessive strength, is simply the effect of many or powerful stimuli acting on the system. Asthenia is the immediate effect of withdrawing these; but asthenia is not so simple as its opposite state for debility varies in its nature according to its various causes,—1st By abstraction of exciting powers is produced a species of debility named *direct.*—2nd By long or violent application of strong exciting powers, the excitability is exhausted; both the excitement and the strength fail; this species of debility is named *indirect.*—3rd When the exciting powers are withdrawn, and the direct debility produced, it is at the same time combined with a new species. By merely withdrawing the stimuli, such weakness would be produced as should be temporary only, and might be done away by restoring the usual exciting powers; but where the stimuli are withdrawn, excitability is accumulated, and when it is accumulated to an undue degree, it cannot bear the usual stimuli, and will not give out the healthy degree of excitement. Thus, direct debility caused by the absence of exciting power, is attended with accumulation of excitability. In direct debility, caused by superabundant stimuli is attended with exhausted excitability. The former is most easily cured, as we have but to apply stimuli and raise the excitement; the latter is cured with difficulty; for the excitability, being in some degree exhausted, the system is less susceptible, and has less excitability to operate upon for the restoration of health. The abstraction of stimuli is the immediate cause of weakness; high excitement is a state of the system which the excitability cannot long endure without being exhausted, so that stimuli themselves produce ultimate weakness. Since, therefore, high excitement is temporary only, and has but one cause while weakness is a permanent state, and has many causes, the diseases of debility must in a very great proportion exceed in number the diseases of excessive strength; and diseases of excessive strength must ultimately end there.

If ninety seven of a hundred diseases arise from weakness the conclusion must be of the first importance in practice. Hence it is a general principle in the system, that though there are many individual diseases, there are but two states of the system, and two general methods of cure; and though it admits the difference between local and general diseases. yet it does not allow that a local sthenic disease can exist for any time along with a general asthenic diathesis or *vise versa.* For the cure of all those diseases which stand above the point of health nothing more is required than withdrawing the stimuli of food, drink, heat, &c. or by evacuation as bleeding, vomiting, purging, &c. For all these diseases which stand below the

point of health, we use the natural stimuli of diet, beef tea, wine, heat, &c. or the less natural stimuli of the pharmacopœia, the chief of which are opium, ether, volatile alkali, musk, camphor, brandy, and other spirits. The cause of the one form of disease is the cure of the other, in the one we raise the excitement till it arrives at the point of health; in the other we depress it to the same point; having effected this by the powers of medicine, we keep it there by attention to regimen; and the great object in the Brunonian practice is to hit the point of health, neither to stop short of this object nor to pass beyond it; for by either imprudence we may do much harm. By profusion of stimuli we may convert a disease of weakness into disease of inflammation; by too severe an abstraction of stimuli we may run into the opposite excess, converting into disease of weakness what was originally a disease of violent inflammation.

The use of stimuli in asthenic disease is to be regulated by the cause and state of disease. In all diseases of indirect weakness, where excitability has been exhausted, the strength must be raised by the immediate application of the most powerful stimuli, which are to be slowly reduced in quantity or strength, till moderate or ordinary stimuli suffice for supporting the excitement of health. In all cases of direct weakness, where excitability is accumulated, the immediate application of powerful stimuli would destroy. Weak stimuli must first be used, the superabundant excitability must be gradually wasted, and the doses very slowly increased till we rise to the point of health.

Dr. Brown's frequent prescriptions of wine, spirits, and opium, to his patients in asthenic diseases, with his repeated recommendations of these stimuli in his lectures and writings, raised a very general prejudice against his system and practice, among those who knew nothing of either but from vague report. They alleged that though he might cure the disease of his patients, he would infallibly corrupt their morals, by habituating them to such dangerous medicines. From these charges Dr. Beddoes vindicates the doctrine, in the following words "The Brunonian system has been frequently charged with intemperance; the objection is serious, but the view already given of its principles shows it to be groundless. No writer has insisted so much upon the dependence of life upon external causes, or so strongly stated the inevitable consequences of excess; and there are no means of promoting morality upon which we can rely, except knowledge of the true relations between man and other beings or bodies. For by this knowledge we are directly led to shun what is hurtful, and pursue what is salutary."

And what stronger motive of temperance can philosophy itself inculcate than the Brunonian doctrine does, when it teaches, that every act of intemperance and excess tends to exhaust the very principle of life.

Remarks upon salt or hard water, and a process recommended to prepare the same for washing.

The reason why hard or sea-water, is not so good a menstruum for washing as rain or river-water is, depends on certain earthy salts in the former, which are capable of curdling or decomposing soap, in consequence of which, the acid of the salt combines with the alkali of the soap, while the earthy base of the salt combines with the oil of the soap, making an insoluble compound, not only not possessed of any detersive quality but absolutely detrimental, by its tendency to adhere to the surface of cloth, and thus protect it from the action of such portion of the soap as may remain undecomposed.

But all soluble earthy salts are readily decomposed by carbonated or semi-caustic alkali, and therefore the most obvious way of bringing hard or sea-water into a state fit for washing, is by the addition of an alkali, till the liquid is slightly sub-alkaline, to effect which, there will be required from 700 to 800 grains of pot-ash, or pearl-ash for each gallon of the strongest sea-water, such as that within the tropics.

Now as the strongest sea-water requires for the decomposition of its earthy salts, at least 700 grains per gallon, of pearl-ash; as pearl-ash contains at least sixty per cent of pure alkali, the required effect may be produced at the trifling cost of an ounce and a half of pearl-ash, and the same quantity of fuller's earth for each gallon of water.

In all probability the best method of washing with seawater would be to get a cask of any size that may be most convenient, fitted with two cocks, one at the bottom, and the other at one-third of the entire height from the top; to fill the cask nearly with sea-water, and to render it slightly subalkaline by the addition of a solution of any cheap alkali. By standing for twelve hours the earth thrown down by the alkali will have subsided, so that one-third of the water may be drawn off clear by the upper cock. The washing should be begun by the turbid water contained in the lower part of the barrel, mixed with a convenient portion of fullers earth, and finished with the clear water and common soap.—*Retrospect*

NEW AND EXPEDITIOUS MODE OF BUDDING.

BY T. A. KNIGHT, ESQR. F. R. S.—Horticultural Transactions, Vol. 1. part 4.

Mr. Knight having noticed that while the luxuriant shoots of the peach and nectarine trees were generally barren, the lateral shoots of the same season, were often productive of fruit, thought that such might as readily be afforded by the inserted buds of another variety, under appropriate management. Accordingly in June, 1808, as the luxuriant shoots of the peach trees, were grown sufficiently firm to permit the operation, he inserted buds of other varieties into them, employing two distinct ligatures to hold the buds in their places, the lower of which was taken off as soon as the buds had attached themselves, but the other was suffered to remain, in consequence of which, the ascent of the sap was much obstructed. The inserted buds began to vegetate strongly in July, and when they had afforded shoots about four inches long, the remaining ligatures were taken off to permit the sap to pass on; and the young shoots were nailed to the wall; the wood ripened well, and afforded blossoms in the succeeding spring, and there was no doubt but that fruit would have succeeded, had not the trees been removed.

Observations.—This is a very vaulable mode of rendering productive the wild and luxuriant branches of peaches and nectaines, which have hitherto generally foiled all the art of the gardiner.—*Retros.*

ON THE PRESERVATION OF TURNIPS, AND THE BEST METHOD OF FEEDING HORSES WITH HAY.

By W. N. of Norfolk, Va.--Agricultural Mag.-No 54.

The operation recommended for the preservation of turnips, is as follows—"Having drawn the turnips, on each side of a furrow of sufficient width to admit a plough and a pair of horses, gather about and place the turnips previously drawn in the new furrows, as close as they will stand, turn the earth of the next furrow upon them, and thus continue till the ridge on each side is drawn off."

To introduce economy in the consumption of hay by horses, the writer recommends to banish the rack from the stable entirely, and to cut all the hay into chaff, which, he asserts, will be a saving of one-third of hay.—*Retrospect.*

DESCRIPTION OF A THRASHING MACHINE MADE FOR H. P. LEE, ESQ.

Transactions of the Society of Arts, Vol. 28.

The machine is fixed in framing, and is turned by cog wheels from the great horse wheel in the same manner as the ordinary thrashing-mills. The cog wheel turns a small pinion fixed on an axis, to which it gives a very rapid revolution, and on the axis of this pinion four beaters are fixed and strongly framed together, each at a right angle from the other, and they revolve with the axis, within a segment or drum, formed of iron plates grooved or ribbed, placed over the machine, and parallel to the axis.

The corn is admitted in the usual way between feeding rollers, and as the beaters revolve rapidly, they strike the heads of the corn upwards with such a jerk, as to beat out all the corn from those ears which they meet fairly, and if any escape they are drawn in together with the straw, and rubbed round by the beaters against the inside of the ribbed drum or cylinder, which is equal to about two-thirds of the whole circumference so as to open the ears and let out the corn, in whatever position the ears may come from the feeder.

Below is grating, through which the corn and chaff fall, and down which the straw slides to the floor. The ribbed cylinder is fixed to curbs of wood, adjusted by screws in such a manner as to be placed

at any distance from the beaters, according to the kind of corn required to be thrashed.

It is stated that many farmers and gentlemen who have seen the machine and its operations, give it a decided preference to every other thrashing-mill, for the simplicity of its construction, for the clearness of its thrashing, and for the quantity of corn thrashed by it in proportion to the power applied; and these opinions are confirmed by such certificates as have pro cured for Mr. Lee, the Gold Medal, as a premium from the Society.

Observations.—As far as we can draw our conclusions from the paper, and accompanying plate, this machine merits all the encouragement it has obtained. Its principal superiority seems to consist in its thrashing all kinds of grain, whereas the common thrashing mills have a grated segment placed *below* the beating drum, allow all ears which are introduced sideways to fall through without being thrashed, and those with an edged cylinder over the drum, entirely destroy the straw. It would have been more satisfactory to have learned the state in which the straw is left by this machine, but we conceive it is not more injured than by the flail. Mr. Lee thinks the straw is not so much broken as by other machines, but he does not say whether it remains fit for thatching.

The variations in the workmanship from the *common* machine are so trivial, that any manufacturer who can make the one, may easily make the other.—*Retrospect.*

PROCESS RECOMMENDED FOR THE CURE OF DISEASED FEET OF SHEEP.–BY RICHARD WORTHINGTON, ESQ.–SOUTH END.

Communications to the Board of Agriculture. Volume 7, Part 1.

Clean the feet perfectly with soap and water, then scrape with a knife, and occasionally cut off the foul and putrid portion of the foot, whether of the interior softer part, or of the hoof; after this, the bloody surfaces are scoured with a mixture muriated antimony, tincture of benzoin, and tincture of myrrh, equal parts of each, and a little muriated antimony alone, is to be applied with a hair-pencil to the more ragged and diseased parts. They should he kept on dry ground or other substance, for an hour or two after each dressing.

It is asserted that the practice here described, will always put a stop to the progress of the disease.—*Retrospect.*

Remarks.— Caustic (unslaked,) lime pulverized, and spread upon a barn (or other) floor, and the sheep compelled to stand or move upon it for an hour or two, is a course highly recommended for the cure of the above disease.

Horned cattle with diseased feet, are cured by placing lime on each side of bars, (or other convenient situation,) so that they may tread upon it as they pass to and fro. The lime is afterwards used for manure.—*Ed. Obs. & Rec.*

ON THE ACACIA TREE, —BY THE REV. JAMES WILLIS, OF SOPLEY, NEAR RINGWOOD.

Communications to the Board of Agriculture. vol 7. pt. 1.

Its rapidity of growth is stated to be equal to the poplar or willow tribes, while at the same time it possesses the durability and closeness of texture of the yew and the box, the beauty of its feathering and closeness of the grain, fitting the better parts for ornamental furniture, while the coarser parts are equal to oak for out-door and farming purposes. The species of acacia recommended, is called the three-horned acacia, *(gleditsia polysperma.)* and is common in most parts of North America, where it is known by the name of the *Honey-Locust.—Retrospect*

Remarks.—In addition to the above, the following are some of the uses that may be made of this tree. 1st–That it be substituted for posts, in making fences; the ends of the rails inserted to the depth of an inch or two in the tree, when it has grown to the size of six or eight inches in diameter. The tops may be cut off at suitable intervals, and converted into rails and fuel. 2nd–That it be used for the construction of *live fences*, (or hedges.) The saccharine envelope which surrounds the seed, is said to contain a large quantity of nutritive matter, useful as food for cattle.—*Ed. Obs. & Rec.*

FROM REGISTER OF ARTS AND SCIENCES.

Alcohol in Pyroligneous Acid.—A manufacturer of salts at Moscow says that in rectifying wood vinegar, he collected about a third of brandy.—*Reg. Arts and Sciences.*

Method of preserving animal substances.—A solution of muriate of soda, or common salt a *little below saturation* will preserve animal substances for an indefinite period at all the temperatures of our atmosphere.—*same.*

Improvements in axletrees.—The improvement consists in making the lower part (say from one third to a half) of the axle a segment of the same diameter as the opening in the nave of the wheel, and the upper portion of the axle a segment of a circle, say half an inch less in diameter than the lower; the shoulder or offset connecting these two portions may be made to descend at an angle of about one degree which will permit the oil or other lubricating substance to descend and furnish a constant supply to the rubbing surfaces, both of the wheels and axles and avoid the *increased resistance* which is observed when a fresh supply of oil or other substance is applied in quantity beyond that required merely to render the surfaces smooth, and which is supposed to arise from its acting as a wedge at the very acute angle between the wheel and axle when the latter is made in the form of a regular concentric circle.—*same.*

Process to form Egyptian Azure.—Sir Humphrey Davy has discovered that this beautiful pigment which has preserved its brilliancy of tint for more than seventeen hundred years, may be easily and cheaply made,—fifteen parts of the carbonate of soda, with twenty of powdered opaque flints, and three of copper filings, when strongly heated togather for two hours will produce a substance, which, when powdered, will be of a fine deep sky blue, and closely resemble the Egyptian Azure in tint.—*same.*

A cheap mode of manufacturing a barometer.—Take a common phial bottle and cut off the rim and part of the neck. This may be done by a piece of a string, or rather whip cord, twisted round it and pulled strongly by two persons in a sawing position, one of them holds the bottle firmly in one hand; heated in a few minutes by the friction of the string, and then dipped suddenly in cold water, the bottle will be decapitated more easily than by any other means.

Let the phial now be filled with clear water and applying the finger to its mouth turn it quickly upside down, on removing the finger it will be found that only a few drops escape. Without cork or stopper of any kind, the water will be retained within the bottle by the pressure of the external air, the weight of air without the phial being so much greater than the small quantity within it. Now let a bit of tape be tied round the middle of the bottle, to which the two ends of the string may be attached so as to form a loop to hang on a nail: let it be thus suspended in a vertical position, with the mouth open, downwards, and this is the Barometer.

When the weather is fair, and inclined to be so the water will be level with the section of the neck or rather elevated above it, and forming a *concave* surface. When disposed to be wet a drop will appear at the mouth, which will enlarge till it falls, and then another drop, while the humidity of the atmosphere continues.

If the bottle be held before the fire the water will also drop from it. When the rim is on the bottle the water will not remain in it.

It is supposed that the reason of the water dropping when placed near the fire is the rarification of the air making the atmospheric pressure to be less on the water; and perhaps the expansion of the water and air* in the phial and in case of the rim being left on, the attraction between the water and the edge of the glass is sufficient to counteract the pressure of the atmosphere on the water in the phial, which being by that means out of the neck, has no longer any thing to prevent its dropping.—*same.*

Black produced by the mixture of colourless liquids.—One of the most interesting phenomena in the operation of chemistry, occurs in the decomposition of the sulphate of iron by the gallic acid.—Into a wine glass, containing the infusion of galls, pour a solution of the sulphate of Iron. The gallic acid, from, its superior elective affinity to the iron, detaches it

*This air is carbonic acid gas; and when water is deprived of it by boiling or by being placed under the exhausted receiver of an air pump it loses its briskness, and is rendered flat and unpalatable.

from its former combination with the sulphuric acid, and in a short time, these two fluids, previously colorless, become intensely black. To make this black fluid into Ink, nothing but a little gum is required to retard the precipitation of the feculae.—*same.*

On Preparation of Borax for the blow-pipe.—Take one ounce of borax, coarsely pounded, put it into a clean crucible, and cover it loosely, put the whole into a furnace, and watch it till it ceases to swell, then augment the heat, and when the whole fuses quietly, take it out, and pour it into a wedgewood-ware or metallic mortar, and when cold, reduce it to an impalpable powder, in which state it is to be used.—*same.*

Composition of the Bronze of the Ancients.—The proportion consists of 88 parts of copper and 12 of tin, and this admixture of the metals has been employed by nations very remote from each other.—*same.*

Method of cleaning Brass Ornaments.—Brass Ornaments that have not been gilt or lacquered may be cleaned, and a very brilliant color given to them by washing them with alum boiled in strong ley, in the proportion of an ounce to a pint, and afterwards rubbing them with fine tripoli.—*same*

Burning Glass.—Sir Isaac Newton presented a burning glass to the Royal Society, which consisted of seven concave glasses, so placed that all their focé join in one physical point. This instrument vitrifies brick or tile in one second, and melts gold in half a minute.

Method to prevent the escape of gas from barrels and other vessels.—This is effected by placing a piece of air-tight substance around the bung so as to prevent the air from passing through the pores of the wood or between the bung and the vessel.—*same.*

Preservation of Cabbages.—The cabbage is cut so as to leave about two inches or more of the stem attached to it; after which the pith is scooped out to about the depth of an inch, care being taken not to wound or bruise the rind in the operation. The cabbages are then suspended by means of a cord, tied round that portion of the stem next the cabbage.

That portion of the stem from which the pith is taken being uppermost, is regularly filled with water every morning.—*same.*

Tainted Meat may be perfectly recovered by first rubbing it with charcoal powder and then boiling it in water with small pieces of charcoal.

Rancid Oil may also be rendered sweet by it.

Stagnant Water boiled with charcoal will be found to possess the properties of spring water.

It may also be used medicinally to advantage in cases of *Putrefaction, Gangrene, Putred fevers &c.*, in which case it should be used freshly made or put in close vessels immediately after being prepared to be used as occasion may require, it is considered a powerful anteseptic.—*same.*

DEFINITION OF TERMS.

Beginning with the letter C.

Calcination.—In Chemistry such a management of bodies by fire as renders them reducible to a caix or cinder.

As most metals were reducible to this form the term calces of metals was long appropriated to them; but in science the term is supplanted by the characteristic appellation of oxide, which expresses the peculiar change that occurs in calcining metallic bodies by the absorption of oxygen. Calcination and oxidation are not strictly synonymous, even when applied to metals, since the true sense of the former implies the agency of fire, but the metals may be oxydated by the action of the acid, as well as that by heat and air.

Caloric.—A word used to denote that substance by which the phenomena of heat are produced.

When caloric elevates bodies above the temperature of the surrounding medium, it is known by the name of sensible heat, and which may be measured by a common thermometer, or Wedgwood's pyrometer.

The absolute heat (or whole quantity of caloric existing in a body) may be ascertained by the calorimeter of La Place.

Calyx—Among botanists, a general term expressing the cup of a flower, or that part of a plant which surround and supports the other parts of the flower.

Camphoric Acid—Is the result of the change produced on camphor by distilling nitric acid several times from it. It crystallizes in parallelopipeds, is efflorescent, soluble in water and volatile in a strong heat.

Caoutchouc—(Gum Elastic or Indian rubber) is the produce of several trees in South America and the East Indies. It is partly soluble in volatile oils and entirely so in Naphtha, melted spermaceti and in nitric ether.

Capillary Tubes.—In Physics little pipes, whose canals are extremely narrow. The principle which causes water or other fluid substance to ascend in those tubes as in a sponge, or the interstices of linen cloth and many other substances is called *capillary attraction.*

Capsule—Among botanists, a species of pericarpium or seed vessels, *Caput Mortum* in Chemistry, that thick dry matter which remains after distillation of any thing but of minerals especially.

Carbon—Or the radical of carbonic acid, has not, unless the diamond is admitted as such, been yet obtained in a separate state. It is infusible and indissoluble by caloric and is hence esteemed the most refractory substance in nature. Its specific gravity is about 3.5.

When the diamond is burnt in oxygen by the solar rays carbonic acid is produced without residue. One part of diamond absorbing four of oxygen and producing fire or carbonic acid.

In proportion as substances contain pure combustible matter will, in fact, be the difficulty of their combustion, their first degrees of oxygenation proceeding slowly. Thus plumbago, and anthracolite, Kilkenny coal, the brilliant charcoal of certain vegetables will not burn except at a very high temperature.

The diamond is therefore considered as pure carbon, plumbago, carbon oxygenized in the first degree.

Charcoal—An oxyde of the second degree, obtained from various substances in the animal, vegetable, and mineral kingdoms, generally by volatilizing their other constituent parts.

When obtained in a state of purity it resists the strongest heat in closed vessels.

It decomposes sulphuric acid from its affinity with oxygen exceeding that of sulphur. It decomposes nitric acid with great rapidity; and if the charcoal is first powdered, and the acid strong and allowed to run down the side of the vessel, to mix with the charcoal, it burns with rapidity, with a beautiful flame, throwing up the powder so as to resemble a beautiful fire-work.

With nitrate of pot-ash it detonates in a hot crucible, leaving a fixed alkali behind. It is dissolved by the alkalies, and by the sulphurets of alkali, both in the dry and moist way. It does not unite with metals but restores their oxydes to a metallic state.

Charcoal possesses the power of absorbing several gasses which thus condensed retain their properties and even exert them in some instances more powerfully. It decomposes water at the common temperature, carbonic acid and carbonated hydrogen being separated. If burnt in contact with common air its acidifiable base attracts oxygen, and this peculiar acid is formed, which, with a certain proportion of caloric, assumes a gasseous form. If burnt in oxygen gas, its peculiar acid is plentifully formed, the charcoal burning with considerable increased rapidity and if the lighter charcoal made from bark is used a very brilliant effect is produced from the numerous vivid coruscating sparks.

Carbonates—Are neutral salts composed of the carbonic acid and certain bases, thus carbonate of ammonia, or mild volatile alkali consists of carbonic acid and pure or caustic ammonia, owing to the weakness of this acid, the characters of their bases are generally, most predominant.

The carbonates are not acted on by light or oxygen or nitrogen; nor do they deliquesce with the moisture of the atmosphere.

All the other acids have a greater attraction for the earthy and alkaline bases than carbonic.

Carmine—A powder of a very beautiful red color, bordering on purple, and used by painters in minature though but rarely because of its great price.

The mode of preparing this color is kept from the public. It is said to be extracted from cochineal by means of water wherein chovan and autour have been infused; some add rocou but this gives it too much of the opal cast.

Others make carmine of Brazil wood, fernembouc, and leaf gold beaten in a mortar, and steeped in white wine vinegar; the scum arising from this mixture, upon boiling when dried, makes carmine; but this kind is vastly inferior to the former. There is another carmine, made of Brazil wood and fernembouc, by a different preparation.

Carton or Cartoon—In painting, a design drawn on strong paper to be afterwards calked through, and transferred on the fresh plaster of a wall to be painted in fresco. Carton is also used for a design colored for working in Mosaic, Tapestry &c.

Case Hardening—A method of preparing iron or steel so as to render its outer surface hard, and capable of resisting any edge tool. The following is Mr. Perkin's method. The article is exposed to a red heat for three hours in a cast iron box, surrounded with a powder made of equal parts of burned bones and the cinders of burned animal matter, such as old leather, and then plunging it slowly while hot into cold water (previously boiled to deprive it of air) to the depth of three or four feet, and leaving it there till cold; by which means it acquires hardness without danger of springing or cracking.

It may afterwards be tempered by heating it in oil heated to 460 degrees in melting lead or in a thick mass of cast iron—till the required hardness is obtained which is shown by the color on a part previously polished with an oil stone.

Casting—Among sculptors, implies the taking of casts and impressions of figures, busts, medals, &c.

Medals of isinglass may be formed in the following manner; dissolve isinglass in water over the fire, then with a hair pencil, lay the melted isinglass over the medal; and when you have covered it properly let it dry. When it is hard, raise the isinglass up with the point of a penknife, and it will fly off like horn, having a sharp impression of the medal.

The isinglass may be made of any color by mixing the color with it; or you may breathe on the concave side, and lay gold leaf on it, which by shining through will make it appear like a gold medal. But if you wish to imitate a copper medal, mix a little carmine with the isinglass, and lay gold leaf on as before.

Catenaria—The name of a curve line formed by a rope hanging freely from two points of suspension whether the points be horizontal or not.

A rope suspended from two points, in horizontal positions from each other will form a curve, which reversed is a form recommended for the arch of a bridge, where each part is intended to support an equal weight; but where a greater weight is intended to rest upon one part than another, the proper curve may be produced by suspending at each respective part of the rope, a body of the same relative as that to be supported by the arch directly over it when the curve is reversed.

Cement—Any glutinous substance capable of uniting and keeping things together by cohesion. The following are some of the best compositions used for the purpose of cementing together various articles.—

Jewelers Cement—For setting precious stones when pieces are broken off by accident. The fragments are heated and a small piece of gum mastich is applied between them, and the parts forced together until a portion of the redundant melted gum is forced out.

Turkey Cement, for joining metals, glass, &c.—Dissolve mastich in a quantity of spirits of wine that will render it liquid; in another vessel dissolve as much isinglass, (which has previously been soaked in water till it is swollen and soft,) in brandy or rum, as will make two ounces by measure of strong glue, and add two small bits of gum galbanum, or ammoniacum which must be rubbed or ground till they are dissolved, then mix the whole with a sufficient heat, keep it in a phial stopped, and when it is to be used set it in hot water.

Centrifugal force—that force by which all bodies that move round any other body in a curve endeavour to fly off from the axis of their motion in a tangent to the periphery of the curve, and that in every point of it.

Centripetal force—That force by which a body is every where impelled, or any way tends toward some point as a centre, such are gravity, or that force whereby bodies tend toward the centre of the earth. Magnetical attraction whereby the load stone draws iron, and that force whatever it be, whereby the planets are continually drawn back from right lined motions and made to move in curves.

Ceruse or Ceruss—White lead, a sort of calx of lead made by exposing plates of that metal to vapor of vinegar.

Charcoal—According to modern chemistry is an oxide of carbon; but as a portion of carburetted hydrogen is obtained after it ceases to yield carbonic acid at a strong heat; it is thought to contain hydrogen also, and is therefore concluded to be a triple compound composed of carbon, hydrogen and oxygen.

Chemistry—Is that branch of science, the object of which is to ascertain the simple substances or elements of bodies, the properties of these and their action on each other.

Chord—In geometry is a right line drawn from one extremity of an arch of a circle to the other.

Chrysalis or Aurelia—In natural history a state of rest and seeming insensibility, which butterflies, moths, and several other kinds of insects must pass through before they arrive at their winged or most perfect state.

Chyle—In animal economy, a milkey fluid secreted from the elements by means of digestion.

Clay—Is a mixture of alumina and silica in various proportions; besides these clay often contains carbonate of lime, of magnesia, barytes, oxyde of iron, &c. specific gravity is from 1.8 to 2.68. A specimen of potters clay from Dreux analyzed by Vauquelin contained

43.5 Silica.
33.2 Alumina.
3.5 Lime.
1.0 Iron.
18.0 Water.

99.2

Indurated clay does not diffuse itself in water but falls to powder. Discovers but little ductility, colors, gray, yellowish, bluish, greenish, reddish, brownish.

Cochineal—This article is esteemed a great cordial, sudorific, alexipharmic, and febrifuge, and much used by dyers and painters, the high crimson color it affords being scarcely equalled by any thing, and making according to their different management of it all the degrees and kinds of red.

Cohesion—The force called cohesion is inherent in the particles of all bodies, except caloric and light, for all bodies except these constantly exist in masses composed of an indefinite number of particles united together.

Combustion—In every case of combustion oxygen combines with the burning body.

When a combustible body is raised to a certain temperature, it begins to combine with the oxygen of the atmosphere, and this oxygen during its combination, lets go the caloric and light with which it is combined while in the gaseous state. Hence their appearance during every combustion. Hence also the change which the combustible undergoes in consequence of combustion.

Concentric — In mathematcs something that has the same centre with another, it stands in opposition to excentric.

Cone—In Geometry, a solid figure having a circle for its base, and its top terminated in point or vertex.

Conic Sections–Are curved lines formed by the intersections of a cone and a plane; *some of the uses of which are as follows.* Any body projected from the surface of the earth describes a parabola, to which the direction wherein it is projected is a tangent and the distance of the directrix is equal to the height from which a body must fall to acquire the velocity with which it is projected: hence the properties of the parabola are the foundation of gunnery. A thorough understanding of conic sections is considered of great importance in learning the mathematics.

Convex—Is a name given to the exterior surface of gibbous or globular bodies, in opposition to the hollow inner surface of such bodies which are called concave. Thus we say, convex lens, mirror, superfices, &c.

Copal—A substance of great importance as a varnish obtained from the rhais copalinum, a tree in North America, specific gravity of copal varies from 1.045 to

1.139. It is soluble in alkalies and nitric acid but not in alcohol nor in oil of turpentine without peculiar management.

Correction—In printing, the pointing out or discovering the faults in a printed sheet, in order to be amended by the compositor before it be printed off.

The corrections are placed on the margin of every page, against the line in which the faults are found and there are different characters used to express different corrections; thus—a mark for dele, to intimate that something, as a point, letter, word &c., dashed in that line is to taken out. If any thing is to be inserted, the place is to be marked ^ and the thing to be inserted, added in the margin. When there are two or more corrections in the same line then they are all separated in the margin by little bars, thus | . If a space is omitted its place is marked with a caret, and in the margin thus ‡‡. When a letter is inverted, it is expressed in the margin. When the thing is to be transposed it is directed thus,

Extraordinary scarce ever fail of | attainments.

scarce ever fail of exciting envy, and in the margin is added *tr.* If italic characters are to be changed for Roman or vice versa, a line is drawn thus —— under the letters and Rom. or Ital. is written in the margin. If a space, or an m or n quadrat stick up and print black it is marked in the margin with a dash thus | . If a word, sentence, or paragraph is entirely omitted, the place is marked with a caret, and in the margin is put the word *out.* If the letters of a word stand too far asunder, a line is drawn under them and in the margin is put a crooked line or hook thus ⌣. There are many other marks used in correcting as *cap.* for capital *l. c.* for lower case &c.

Corrosion—In a general sense, the action of gnawing away by degress, the continuity of the parts of bodies. Acids corrode most natural bodies.

Crataegus—Wild service-tree, hawthorn &c. There are 23 species all of the tree and shrub kind, hardy and deciduous, those most valuable are the following: 1 The oxycanthia, hawthorn or white thorn grows naturally all over Europe. 2 The azarolus or parsely leaved thorn is a native of Italy and south of France. 3 The aria, called the white-beam tree, is a native of the most cold countries of Europe. 4 The terminalis, wild service, or maple-leaved service, is a native of England, Germany, Switzerland and Burgundy. 5 The coccinea, or great American hawthorn is a native of Virginia and Canada. 6 The crus galli, or cockspur-thorn, is a native of Virginia and Canada. 7.The tomentosa woolly-leaved hawthorn, grows to about seven or eight feet high. 8 The viridis, or green-leaved Virginia hawthorn, has the stem and branches together destitute of thorns. The respective species are all propagated by sowing the seeds.

Crayon—A name for all colored stones earths, or other minerals used in designing or painting in pastel.

Cube—A regular or solid body, consisting of six equal sides or faces, which are squares.

It is also called a hexahedron, because of its six sides and is the second of the five platonic or regular bodies.

Cycloid—The cycloid is a curve of such importance, that the honor of its invention has been much contested among mathematicians.

It is a curve generated by the motion of any point in the periphery of a circle, whilst the periphery itself revolves on a right line, till that point which touched the line at the beginning of the motion be brought to touch it again. These are some of the chief properties of the common cycloid. 1 The whole base or right line is equal to the periphery of the generating circle. 2 The semicycloid is double the diameter of the generating circle and the whole cycloid four times the diameter of the generating circle. 3. The area between the cycloid and the right line will be three times the area of the generating circle. 4 The cycloid is the line of quickest descent of a body descending by the force of its own gravity from one point to another in this cure. 5 A body falls through any arc of an inverted cycloid, whether it be great or small in the same time. Hence, if a pendulum be made to vibrate in the arc of a cycloid, all the vibrations will be performed in the same time

Cylinder—In geometry a solid body supposed to be generated by the rotation of a parallelogram. The section of every cylinder by a plane oblique to its base is an ellipsis.

The periphery of a cylinder, multiplied by half the radius will give the contents.

AGRICULTURAL CHEMISTRY.

(Continued from p. 64.)

And when one of them is acted on by sealing-wax, and the other by glass that has been rubbed by woolen, they attract each other; hence it is said, that bodies similarly electrified repel each other, and bodies dissimilarly electrified attract each other: and the electricity of glass is called vitrious or positive electricity, and that of sealing-wax resinous or negative electricity.

When of two bodies made to rub each other one is found positively electrified, the other is always found negatively electrified, and, as in the common electrical machine, these states are capable of being communicated to metals placed upon rods or pillars of glass.

Electricity is produced likewise by the contact of bodies; thus a piece of zinc and of silver give a slight electrical shock when they are made to touch each other, and to touch the tongue: and when a number of plates of copper and zinc, one hundred for instance, are arranged in a pile with cloths moistened in salt and water, in the order of zinc, copper, moistened cloth, zinc, copper, cloth, and so on, they form an electrical battery which will give strong shocks and sparks, and which is possessed of remarkable chemical powers. The luminous phenomena produced by common electricity are well known. It would be improper to dwell upon them in this place. They are the most impressive effects occasioned by this agent, and they offer illustrations of lightning and thunder.

Electrical changes are constantly taking place in nature, on the surface of the earth and in the atmosphere; but as yet the effects of this power in vegetation have not been correctly estimated. It has been shown by experiments made by means of the voltaic battery (the instrument composed of zinc, copper and water) that compound bodies in general are capable of being decomposed by electrical powers, and it is probable, that the various electrical phenomena occuring in our system, must influence both the germination of seeds and the growth of plants. I found that corn sprouted much more rapidly in water positively electrified by the voltaic instrument than water negatively electrified; and experiments made upon the atmosphere show that clouds are usually negative; and as when a cloud is in one state of electricity the surface of the earth beneath is brought into the opposite state, it is probable that in common cases the surface of the earth is positive.

Different opinions are entertained amongst scientific men respecting the nature of electricity; by some the phenomena are conceived to depend upon a single subtile fluid in excess in bodies said to be positively electrified, in deficiency in the bodies said to be negatively electrified. A second class suppose the effects to be produced by two different fluids, called by them the vitrious fluid and the resinous fluid, and others regard them as affections or motions of matter, or an exhibition of attractive powers, similar to those which produce chemical combination and decomposition; but usually exerting their action on masses.

The different powers that have been thus generally described, continually act upon common matter so as to change its form and produce arrangements fitted for the purposes of life. Bodies are either simple or compound. A body is said to be simple when it is capable of being resolved into any other forms of matter. Thus gold, and silver, though they may be melted by heat or dissolved in corrosive menstrua, yet are recovered unchanged in their properties, and they are said to be simple bodies.

A body is considered as compound, when two or more distinct substances are capable of being produced from it; thus marble is a compound body for by a strong heat it is converted into lime, and an elastic fluid is disengaged in the process; and the proof of our knowledge of the true composition of a body is, that it is capable of being reproduced by the same substances as those into which it had been decomposed; thus by exposing lime for a long while to the elastic fluid, disengaged during its calcination, it becomes converted into a substance similar to powdered marble. The term element has the same meaning as simple or undecompounded body; but it is applied merely with reference to the present state of chemical knowledge. It is probable that as yet we are not acquainted with any of

the true elements of matter; many substances formerly supposed to be simple, have been lately decompounded, and the chemical arrangements of bodies must be considered as a mere expression of facts, the results of accurate statical experiments.

Vegetable substances in general are of a very compound nature, and consist of a great number of elements, most of which belong likewise to the other kingdoms of nature, and are found in various forms.

Their more complicated arrangements are best understood after their simpler forms of combination have been examined.

The number of bodies which I consider as at present undecomposed, are as was stated in the introductory lecture, two gasses that support combustion—seven inflammable bodies, and thirty eight metals.

In most of the inorganic compounds, the nature of which is well known, into which these elements enter, they are combined in definite proportions; so that if the elements be represented by numbers, the proportions in which they combine are expressed either by those numbers, or by some simple multiples of them.

I shall mention, in a few words, the characteristic properties of the most important simple, substances, and the numbers representing the proportions in which they combine in those cases, where they have been accurately ascertained.

1. *Oxygen* forms about one-fifth of the air of our atmosphere. It is an elastic fluid, at all known temperatures. Its specific gravity is to that of air as 10967 to 10,000. It supports combustion with much more vividness than common air; so that if a small steel wire, or a watch spring, having a bit of inflamed wood attached to it, be introduced into a bottle filled with the gas, it burns with great splendour. It is respirable.

It is very slightly soluble in water. The number representing the proportion in which it combines is fifteen. It may be made by heating a mixture of the mineral called manganese, and subphuric acid together, in a proper vessel, or by heating strongly red lead, or red precipitate of mercury.

2. *Chlorine*, or oxymuriatic gas, is like oxygen, a permanent elastic fluid. Its colour is yellowish green, its smell is very disagreeable; it is not respirable; it supports the combustion of all the common inflammable bodies except charcoal; its specific gravity is to that of air as 24677 to 1000; it is soluble in about half its volume of water, and its solution in water destroys vegetable colours: Many of the metals (such as arsenic or copper) take fire spontaneously when introduced into a jar or bottle filled with gas. Chlorine may be procured by heating together a mixture of spirits of salt or muriatic acid and manganese. The number representing the proportion in which the gas enters into combination is sixty-seven.

3. *Hydrogene*, or inflammable air, is the lightest known substance; its specific gravity is to that of air as 732 to 10,000. It burns by the action of an inflamed taper when in contact with the atmosphere. The proportion in which it combines is represented by unity, or 1. It is procured by the action of diluted oil of vitriol or hydro-sulphuric acid on filings of zinc or iron. It is the substance employed for filling air balloons.

4. *Azote* is a gaseous substance not capable of being condensed by any known degree of cold: its specific gravity is to that of common air as 9,516 to 10,000. It does not enter into combustion under common circumstances, but may be made to unite with oxygen by the agency of electrical fire. It forms nearly four fifths of the air of the atmosphere and may be procured by burning phosphorus in a confined portion of air. The number representing the proportion in which it combines is 26.

5. *Carbon* is considered as the pure matter of charcoal, and it may be produced, by passing spirits of wine through a tube heated red. It has not yet been fused; but rises in vapour at an intense heat. Its specific gravity cannot be easily ascertained; but that of the diamond, which cannot chemically be distinguished from pure carbon is to that of water as 3500 to 1000. Charcoal has the remarkable property of absorbing several times its volume of different elastic fluids which are capable of being expelled from it by heat.—The number representing it is 11.4.

6. *Sulphur* is the pure substance so well known by that name; its specific gravity is to that of water as 1990 to 1000.

It fuses at about 220 Fahrenheit; and at between 500° and 600° takes fire, if in contact with the air, and burns with a pale blue flame. In this process it dissolves in the oxygen of the air, and produces a peculiar acid elastic fluid. The number representing it is thirty.

7. *Phosphorus* is a solid of a pale red colour, of specific gravity 1770. It fuses at 90° and boils at 550°. It is luminous in the air at common temperatures, and burns with great violence at 150°; so that it must be handled with great caution. The number representing it is 20. It is procured by digesting together bone ashes and oil of vitriol and strongly heating the fluid substance so produced with powdered charcoal.

8. *Boron* is a solid, of a dark olive colour, infusible at any known temperature. It is a substance very lately discovered, and procured from boracic acid. It burns with brilliant sparks when heated in oxygen, but not in chlorine. Its specific gravity, and the number representing it, are not yet accurately known.

Platinum is one of the noble metals, of rather a duller white than silver, and the heaviest body in nature, its specific gravity being 21,500. It is not acted upon by any acid menstrua except such as contain chlorine. It requires an intense degree of heat for its fusion.

The properties of *Gold* are well known. Its specific gravity is 19,277. It bears the same relation to acid menstrua as Platinum, it is one of the characteristics of both these bodies, that they are very difficultly acted upon by sulphur.

11. *Silver* is of specific gravity 10,400, it burns more readily than Platinum or Gold, which require the intense heat of electricity. It readily unites to sulphur. The number representing it is 205.

12. *Mercury* is the only known metal fluid at the common temperature of the atmosphere, it boils at 66°, and freezes at 39° below 0. Its specific gravity is 13, 560°. The number representing it is 380.

13. *Copper* is of the specific gravity 8, 890. It burns when strongly heated with red flame, tinged with green. The number representing it is 120.

14. *Cobalt* is of specific gravity 7,700. Its point of fusion is very high, nearly equal to that of Iron. In its calcined or oxidated state, it is employed for giving a blue colour to glass.

15. *Nickel* is of a white colour, its specific gravity is 8,820. This metal and cobalt agree with Iron, in being attractable by the magnet. The number representing Nickel is 111.

16. *Iron* is of specific gravity 7,700. Its other properties are well known. The number representing it is 103.

17. *Tin* is of specific grav. 7,291, it is a very fusible metal, and burns when ignited in the air, the number representing the proportions in which it combines is 110.

18. *Zinc* is one of the most combustible of the common metals. Its specific gravity is about 7,210. It is a brittle metal under common circumstances, but when heated may be hammered or rolled into thin leaves, and after this operation, is malleable. The number representing it is 66.

19. *Lead* is of specific gravity 11,352, it fuses at a temperature rather higher than tin. The number representing it is 398.

20. *Bismuth* is a brittle metal, of specific gravity 9,822. It is nearly as fusible as tin, when cooled slowly it crystallizes in cubes. The number representing it is 135.

21. *Antimony* is a metal capable of being volatalized by a strong red heat. Its specific gravity is 6,800. It burns when ignited, with a faint white light. The number representing it is 170.

22. *Arsenic* is of a bluish white colour, of specific gravity 8,310, it may be procured by heating the powder of common white arsenic of the shop, strongly in a florence flask with oil. The metal rises in vapour, and condenses in the neck of the flask, the number representing it is 90.

23. *Manganesum* may be procured from the mineral called Manganese, by intensely igniting it in a forge, mixed with charcoal powder. It is a metal very difficult of fusion, and very combustible, its specific gravity is 6,850. The number representing it is 177.

24. *Potassium* is the lightest known metal, being only of specific gravity 850. It fuses at about 150° and rises in vapour at a heat a little below redness It is a highly combustible substance, takes fire when thrown upon water, burns with great brilliancy, and the product of its combustion dissolves in water. The number representing it is 75. It may be made

by passing fused caustic vegetable alkali, (the pure alkali of the druggists,) through iron turnings, strongly ignited in a gun barrel, or by the electrization of pot-ash by a strong voltaic battery.

25. *Sodium* may be made in a similar manner to potassium. Soda or the mineral alkali being substituted for the vegetable alkali. It is of specific gravity 940. It is very combustible. When thrown upon water, it swims on its surface, hisses violently, and dissolves, but does not inflame. The number representing it is 88.

26. *Barium* has as yet been procured only by electrical powers and in very minute quantities, so that its properties have not been accurately examined. The number representing it appears to be 130.

Strontium the 27, *Calcium* the 28, *Magnesium* the 29, *Silicum* the 30, *Aluminum* the 31, *Zirconum* the 32, *Glacinum* the 33, and *Ittrium* the 34, of the undecompounded bodies, like barium, have either not been procured absolutely pure or only in such minute quantities that their properties are little known; they are formed either by electrical powers, or by the agency of potassium, from the different earths whose names they bear, with the change of the termination in *um;* and the numbers representing them are believed to be 90 Strontium, 40 Calcium, 38 Magnesium, 31 Silicum, 33 Aluminum, 70 Zirconum, 39 Glacinum, 111 Ittrium.

Of the remaining thirteen simple bodies, twelve are metals, most of which, like those just mentioned, can only be procured with great difficulty; and the substances in general from which they are procured are very rare in nature. They are *Palladium, Rhodium, Osmium, Iridium, Colubium, Chromium, Molybdenum, Cerium, Tellurium, Tungstenum, Titanium, Uranium.* The forty-seventh body has not as yet been produced in a state sufficiently pure to admit of a minute examination. It is the principle which gives character to the acid called fluoric acid, and may be named *Fluon,* and is probably analogous to phosphorous or sulphur. The numbers representing these last thirteen bodies have not yet been determined with sufficient accuracy to render a reference to them of any utility.

The undecompounded substances unite with each other, and the most remarkable compounds are formed by the combination of oxygen and chlorine with inflammable bodies and metals; and these combinations usually take place with much energy, and are associated with fire.

ANTHRACITE COAL USED FOR DRIVING STEAMBOATS AND LOCOMOTIVES.

A writer in the United States Gazette, states that Anthracite Coal is used in the large Steamboat which plies between Portland and Boston, and that very little alteration had been made in the furnace to change it from a wood to a coal burner. The grate had been raised some inches, and a fan-wheel was rigged in front of the fire. The whole was conducted with ease and without any difficulty consequent upon the hardness of the coal. The same writer states, that a single company in the State of Maryland has purchased this year from a Pennsylvania coal company, 8000 tons of Anthracite coal for the use of their steam-engines. This is a subject of great importance to the whole United States, and particularly to Pennsylvania, where so much wealth lies in her coal-fields. There is certainly reason to believe that anthracite coal might be used in any situation where a sufficient degree of rapidity is given to the current of air which supplies the fire, and a proper temperature conveyed to the air; so that when it first comes in contact with the fire, it may be in the best possible condition to cause ignition. This can only be discovered by experiments. The most suitable form for the furnace, and this surrounded by a body which conducts heat slowly, and a rapid supply of air of the most proper temperature, are the objects required.—*W.*

CURE FOR HYDROPHOBIA.

Take two spoonsfull of fresh Chloride of Lime in powder, mixed with half-a-pint of water, with this wash, keep the wound constantly bathed and frequenly renewed. The chlorine gas possesses the power of decomposing this tremendous poison, and renders mild and harmless, that venom against whose resistless attack, the artillery of medical science has been so long directed in vain. It is necessary that this wash should be applied as soon as possible after the infliction of the bite.—*Liverpool Pa.*

For the Observer and Record of Agriculture, Science, and Art.

ON SILK, COCOONS, SILKWORM EGGS AND COCOONERY.

The following information is submitted to the readers of the Observer and Record, with a request that if any of them know of a process superior to either of those named, the same may be published in this paper.

Hatching the Eggs. This is done by exposing a quantity of them to the air about the last of May or the first of June. In about ten or twelve days afterwards, another parcel are to be exposed in like manner, and so on a different parcel each ten or twelve days, till about the last of July or the first of August. By this process a regular succession of crops are obtained, in a manner convenient for the supply of food and attendance.

First process with the Worms. When the worms begin to appear, they are to be placed on tender leaves, and placed on writing paper together with the leaves, and the date of each days hatching noted on the paper, each parcel being kept by themselves.

The Cocoonery. Is composed of vertical posts, two inches square, (of scantling,) upon which slats are nailed to receive horizontal shelves one foot apart, the bottom shelf may be four feet wide, and each ascending one two inches narrower than the one immediately below it, so that worms falling from a shelf may lodge on the next below. Almost any out-building will serve for a cocoonery.

Second process with the Worms. The worms are to be removed from the litter, immediately after the first, second, third and fourth moultings, and also when they are ready to wind their cocoons, they are then placed on shelves.

Preparation for the worms to wind the cocoons. Rye-straw is cut in lengths, one-and-a-half or two inches longer than the distance between the shelves, and tied in bunches of eighteen or twenty in a bunch, from one or two inches from the bottom, these bunches are placed between the shelves in an upright position, with the upper ends spread asunder, the worms wind the cocoons within those bundles of straw, they can afterwards be gathered with the greatest convenience.

Reeling the Silk. It is recommended to reel the silk from the cocoon before it becomes necessary to stifle the chrysalis. For this they will yield more silk, and it is stronger and more nice.—*E. O. R.*

P. S. In addition to the above, the following is recommended. viz: Two light frames are made to slide horizontally above each shelf, one of them, about one inch from the shelf,* and the other about two inches from it, each of the same length and width as the next shelf below them. The spaces between the edges and ends of the frames are occupied by net-work, composed of cotton (or other) yarn, the ends of each frame are supported by slats. The leaves are placed upon the upper nets, which will induce all the worms to ascend, and leave the lower ones unoccupied. The shelves and all the nets next to them, may then be removed, washed and dried, while the worms are feeding, the shelves are returned to their proper places, and the nets reversed, so that the other nets may in turn be cleaned.

* The nets may be placed nearer to the shelves than one or two inches, if necessary.

CREOSOTE IN DEAFNESS.

By J. HARRISON CURTIS.

One of the principal and most common causes of deafness, is a deficiency of the secretion, from a want of action of the ceruminous glands.

Many cases of loss of hearing which have been under my care, even when the disease has been of long standing, have been fairly referable to this cause, and on its removal the deafness has disappeared, of course in a longer or shorter time, according to the duration of the disease, and the severity of the primary cause of the inaction of the glands. When the *meatus auditorius* has been duly cleansed,¶ and the orifices of the ducts have been, as it were, re-opened, by the removal of the diseased secretion by which they were occluded, a moderate stimulant is of essential service in restoring the glands to healthy action, but the cleansing is imperatively necessary, and no remedy will be of use until that operation has been properly performed. I generally employ a preparation consisting of half-a-ounce of ox-gall, mixed with a drachm of tincture

of musk, with it, a piece of cotton is moistened, and inserted into the *meatus* at night, to soften the hardened cerumen, the ear being syringed in the morning with warm water, to which one ounce of soap liniment and a little *eau de cologne*, have been added. I occasionally substitute the solution of pot-ash of the Pharmacopœia, with oil of almonds, for the preparation of ox-gall and castor, with equal advantages in dissolving the cerumen. In effecting this, be particular in the choice of a syringe. When this important object has been obtained, and the regular ducts and glands are in a fit state to be acted on by the stimulant, a solution of creosote in oil of almonds, I am led to believe from experience, will be found to be of great advantage in inducing the ceruminous glands to resume their healthy action. The formula I use, is as follows:—Take of *Creosote*, one drachm; *Oil of Almonds*, four drachms; *Mix*. A little to be inserted into the *meatus*, night and morning, with a camel-hair brush.

I generally commence with a solution of this strength, occasionally gradually increasing the quantity of creosote employed, according to the effects produced. Cases however have occurred, as will be shown, in which this application has not been beneficial, until after the previous employment of blisters, behind the ears, of an ointment made with tartarized antimony, or other derivatives which are required to abate any irritation to which the ear may be subjected. In cases of otorrhœa, where there is any pain or inflammation, its use is contra-indicated. Its application does not cause any pain or smarting sensation, the only sensible effect produced, being but a feeling of agreeable warmth. *Lancet*

¶ Physiologists are of opinion, that there are not any muscular fibres in the meatus by which, under any circumstances, the cerumen is discharged; but it has been conjectured that its expulsion is effected by the motions of the lower jaw during mastication.

EFFECTS OF PRUSSIC ACID COUNTERACTED.

Two Rabbits were selected for experiment, four drops of powerful hydrocyanic acid were then applied to the tongue of each. The effects were instantly apparent, the animals were for some minutes motionless and apparently dead, when Dr. Robinson administered his restorative, viz: cold water poured from an eminence over the occiput and spine, the temperature of the water being previously lowered by nitrate of potash and common salt. The effect was magical, for by this resucitative process, it was remarked that each animal in turn, skipped about the floor, as if in the enjoyment of perfect health and good spirits. We need scarcely remark that such facts as we now record, cannot be too prominently placed before the public.—*Sunderland Paper.*

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OBSERVER AND RECORD
OF AGRICULTURE, SCIENCE, AND ART.

EDITED BY D. PEIRCE.

No. 6.] Philadelphia, Monday, March 4, 1839. [Vol. I.

The object of this paper is to concentrate and preserve, in a form suitable for future reference, the most useful and interesting articles on the aforesaid subjects. Each number will contain sixteen octavo pages, printed on good paper, and when a sufficient amount is published to form a volume of convenient size, an alphabetical table of contents will be published and forwarded to subscribers, in order for binding. This number, shows the general plan of the work.

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MORUS MULTICAULIS AND SILK CULTURE.

It has been said by some persons that the silk made from worms fed on the foliage of the morus multicaulis is superior in quality to that made from others fed on the white mulberry; yet this opinion is not decided—having seen specimens of silk raised from both, as far as quality is concerned we are not prepared to give the preference to either, but the superior size of the leaf of the morus, its great saving of offal, economy of time and labor, in gathering and feeding, must always place it ahead of every other variety of the mulberry; it requires no more time to pull one of its leaves than the other, or any other kind; but as the leaves of the morus multicaulis are much larger than any other kind, then there is a great saving of time in gathering and feeding the worms, and it is said that the worms are better satisfied in feeding upon this kind of leaves than on any other, and remain in a more vigorous state during the time of feeding; the lessening of expense of attendants alone, in one season, will yield a handsome profit. Besides this mulberry can be acclimated to any region, and braves the most rigorous winters in the United States.

Soil and situation.—The White Mulberry.—The nurseries, as well as the large and small mulberry plantations require a sunny exposure, and spots sheltered against strong winds; therefore, declivities, or hill sides, descending towards the east or south-east, and secured by woods or groves are proper; as also, all spots protected by buildings, &c The trees should never be planted in marshy or low ground—1st, because they would be more exposed than in elevated situations to the injurious influence of cold and frosts; and 2dly, because worms fed from leaves gathered from trees in such situations, owing to the superabundance of aqueous matter in them, do not yield silk either as lustrous or tenacious; and 3dly, from the absence of saccharine matter, the worms are not so healthy, nor do they give as much silk. Next to the soil before described, a calcareous sandy clay is to be preferred.

The morus multicaulis partakes more of the character of the shrub than of the tree, and therefore requires less room when planted as standard trees, and more in hedges, in consequence of its propensity to throw up branches from the roots, therefore it is thought by many experienced persons more practicable to raise them by field culture. If the culturist proposes to go at once into the silk business, and to plant out his orchard to feed from, having prepared his ground and fixed upon the distance of his rows and that of his plants, all he has to do is to strike out deep furrows, place his trees at proper distances, and while one person holds the tree in its place let the other shovel the earth around its roots, which must be compressed by the first, so as to give the earth a firm set in the ground; this done, the labor will have been performed. Two inches is a good depth to cover the roots. If you propose to layer your trees you may either do it by layering the whole tree, or you may deprive it of its lateral branches, and layer

each separately; the latter plan is recommended as being decidedly the best, as there is not room for the trees to expand and grow when placed so closely together.

Method of layering where the branches are taken off.—Prepare the ground with neatness, and pulverize it thoroughly by ploughing, harrowing and rolling; strike out the furrows of the prescribed distance, north and south, manure in the drill with good barnyard manure, then take the root with the main stem attached to it, lay it down in the furrow and cover it over about two inches deep. As you cover the root and main stem, press down the earth lightly with the flat part of the hoe, so as to make the soil adhere to both. Be careful to draw into the furrow none but well pulverised mould, so that the leaflet may meet with no obstruction in its ascent to the surface. A little care in this particular at the time of planting, will save trouble and prevent loss. The roots and main stem being thus planted, proceed to lay down the lateral branches in the same way, and cover as before directed.

By Cuttings.—There are three ways of propagating by cuttings, two in open culture, the one by placing the cutting down flat or horizontally in the furrow, the other by giving it a vertical position, at about an angle of forty-five degrees, inclining to the north, the bud facing the south—the last by starting the plants in *hot-beds*. If the cuttings should be planted in open culture, two buds should be used; if in hot-beds, one bud is sufficient.

Care must be taken as the cuttings come up that they be not choaked with grass and weeds, and at the early part of the season the safest plan will be to hand weed until the plant reaches a height when it may be safe to use a hoe. To prevent the growth of grass or weeds, the plough or cultivator may be used.

If it were practicable to water the plants before they get above the ground, in case of a drought, it would be of great service to them.—*Manual.*

From the Pennsylvania Enquirer.

SILK CULTURE.

We invite attention to the following, from the pen of an intelligent correspondent:—

The raising of the silk worm is not only becoming an object of interest throughout the United States, but more especially in our immediate neighbourhood is claiming the serious care of the farmer, the mechanic, and men of practical information on the subject. It is a little remarkable that so profitable a business as this is likely to be, should have been so long neglected by men of enterprise and capital.—At so early a period as 1778, ladies of rank and fortune in London, merely for amusement, were raising the silk worm; and from 244 worms one lady, without the assistance of reels, actually produced one ounce and a half of beautiful silk of three colors, viz: a light buff or gold color, a lovely white and an apple green and this very silk was pronounced by competent judges to be superior to the Italian: and as early as 1785 another young lady received a silver medal for producing 5 lbs. of sewing silk from 30,000 worms. She also measured one cocoon with critical exactness, and found it 404 yards, and weight only 3 grains.

This same lady, in a letter to a friend, says, " I got 4 oz's of silk from 1270 worms, and on an average 350 produce one ounce. I frequently wound the cones out of boiling water, placing them afterwards on dry paper, and always found the moth came to life again at its proper time; heat injures the strength and glossy hue of the silk, and by this process, the silk may be gathered and the moth preserved.

The one I measured had been feeding only one week on mulberry leaves, and the silk a little coarser. I did not find noise to hurt them." The signs of spinning in the worm, is a visible circulation of the blood or glutinous matter down the middle of the back, erecting themselves on thier bellies, a playfulness and wasting of food; when in this state they seek a corner and commence spinning their ball.

The profits arising from silk are immensely advantageous, one-fourth part of the price being adjudged enough to defray the whole expenses. The proper and best food for the silk worm is in my estimation to be procured from the Morus Multicaulis Mulberry alone; it is undoubtedly the most valuable of the species for many reasons. The tree is very vigorous and upright in its growth, the leaves in a rich soil are large and cordiform, but in an arid soil less size, eliptical and without the

heart shaped indentation, and I have often found on measurement their breadth to be ten inches, and their length 12 and over; they are curled or convex on their surface, of a deep glossy green and perfectly beautiful. The characters which distinguish this tree from the other species are, the remarkable property the roots possess of throwing up numerous flexible stalks without forming a principal trunk, the great length these stalks assume in a very short time, the peculiar developement which the tender and soft leaves soon acquire, and the quickness with which they are renewed, and the extraordinary facility with which the stalks and branches strike root, as cuttings, before they have acquired a ligneous consistence, and it is easy to multiply them by thousands from the roots, by layers and cuttings of a single eye.

Cocoons fed on leaves of this tree *only*, are heavier, and the quality of the silk better. A doubt no longer exists, that two crops of silk may be raised in a single season.

Such are the advantages of the Morus Multicaulis over every other Mulberry, and however the wise and intelligent cultivators of New Hope may wish to see it prostrated on a level with the Paper Mulberry, and thus delay the silk culture in America, in order that his flax may take the place of the silk, or however desirous "Truth," is to see "this mad speculation" share the same fate of Merino sheep, I can assure both of these very *enlightened, patriotic, useful, enterprising* Americans, that all their "Truths" which have not the shadow of foundation, can have no effect in prostrating the efforts a mighty people are now making for the prosperity of their commonwealth. Our country is destined not only to be the successful competitor in the silk market, but will ere long, after the country is well stocked with this valuable tree, have her factories on a larger scale, and with machinery less complex than those at Lyons or Naples.

The silk worm consumes vast quantities of leaves. It is said that 210,000 worms, in the first stage, consume 20 lbs. per diem, in the second, 55, in the third, 215, in the fourth 620, fifth, 3820 lbs; making in all 4,731 lbs of leaves, and two persons can attend and feed more than this number, when the cocoonery is near (as it should be) the mulberry orchard. In ten days from spinning, five or six active children are required. And here is another very important consideration, that these very children will here find employment part of the summer in gathering leaves, which must otherwise be spent in idleness, perhaps in crime.

Silk worms are liable to various diseases in their different ages, especially in their fifth, which all agree to be most critical. Such diseases generally are produced from want of room and air, and their food being damp, and want of cleanliness, proper attention and care: the fermentation of litter, dampness, bad air, and three or four thousand on a hurdle, are the most frequent causes of mortality among them. Therefore, in order for their help and benefit, the diseased worms must be thrown away, their position changed, and more care bestowed. Chloride of lime and soda have been used in some places with good effect to purify the air.

Often is the question asked, what species of the worm makes the best silk? but we all know that it is the food of the worm that is to produce the best. If I had been asked the question, my reply would have been, the white mammoth fed on the leaves of Morus Multicaulis: this is a beautiful species of the silk worm; there is nothing revolting in the sight of this pretty little worm, busily engaged in eating; but there is something very interesting in so humble an object, day to day occupied in eating its verdant meal, until the end of its creation is fulfilled, when it disappears from the sight, and presents a ball of beautiful silk; there is nothing disgusting to the most sensitive mind, but all is in perfect unison with the great architect of even the little silk worm.

Often have I watched them with delight from day to day, and who can form a right estimate of the debt he is under to this little worm, when he takes into consideration, that He who clothes the humble wild flower in raiment of his own inimitable perfection, also has endowed the silk worm with the power of being of great benefit to mankind; and while the heart glows with gratitude for the thousand undeserved favours He has been pleased to bestow upon a thankless world in days that

are past, let all of us, who are engaged in this laudable enterprise, return thanks to the Author of this good and perfect gift, even the gift of the silk culture, which is to produce a moral reformation in our country, enabling its juvenile members to acquire habits of industry, which alone can redeem us from turmoils, strife, and domestic broils.

EARLY CORN.

It is suggested to those who are fond of boiled corn, that they cultivate the kind called *Canada Corn*, which is said to yield well in quantity, and ripens sufficiently for boiling in seven weeks from the time of planting.

POTATOES RAISED FROM CUTTINGS.

An English farmer, Mr. Cotsell of Stapleton, near Bristol, has succeeded in raising potatoes from cuttings. We do not know that the attempt has been tried in this country. Reasoning upon the analogy of the potatoe to the dahlia, I was induced, in the spring, to try the experiment on cuttings, and have succeeded admirably; having, from White Apple and Fox's Seedlings, an early potatoe, produced a full crop of good sized potatoes, many of which weighed half a pound. The method was thus:—When the potatoes were about nine inches high, I cut off the tops, about six inches long, planted them in a line about eight inches apart, with a flat dibble, pressing the earth carefully against them, gave them water, and afterwards hoed them as an ordinary crop. I produced in this way 140 pounds the rod.—*Weekly Messenger.*

Silk Manufacture.—The Masillon (Ohio) Gazette of Monday contains a notice of the successful operation of a machine lately invented by a Mr. Dennis of that town, for making sewing silk, direct from the cocoons, at one operation. The Gazette speaks highly of the nicety and ease with which the cocoons were manufactured by this machine into sewing silk of a superior quality. The culturers of the neighbourhood pronounce this machine superior to any thing of the kind now in use. With its aid, it is stated, that sewing silk can be manufactured from cocoons at an expense of fifty cents the pound—the silk being reeled into small skeins of three hundred to the pound, the reeling process being performed by the machine at the same time it twists the silk.

It was the intention of Mr. Dennis to procure a patent for this invention, and also to commence a manufactory of machines to supply the demand that is likely soon to arise for them.—*Weekly Messenger, February 27th*, 1839.

Useful Hints.—To preserve fresh meat, killed early in winter, through cold weather, bury it in snow. The best way is to place alternate layers of meat and snow in a tub or barrel, and keep it in a cool place. The meat should be a little frozen first. Several days warm weather will not affect it; and if it be kept in an ice house, it may not only be preserved through winter, but during the following spring.

Hams cannot be kept with ease or certainty, unless the flat bone near the centre of the inner side, which joins on the other bones of the ham by a ball and socket, be first carefully removed. Where this has been neglected, although every other care has been taken, failures and loss have followed.—The best way to keep winter apples is to barrel them. This perfectly excludes rats and mice, and preserves them in a great measure from the air.

Where corn is fed out to cattle, and other domestic animals, it is much the best, where practicable, to grind it with the cob.

Oats are more beneficial to horses if ground; and hay, if chopped fine.—Dry wood will produce, on a moderate estimate, twice as much heat as the same amount of green wood, and saves much trouble in kindling fires on cold mornings. To prevent its burning away too rapidly, the sticks should be large.

[Recent experiments show that a given quantity of both wood and anthracite coal reduced to small dimensions, will produce more heat than when large. It is recommended, to cause them to be burned as rapidly as possible, so that the heated oxygen of the air will cause the gas from the fuel to be consumed before it leaves the stove, drum, and pipe. The theory is the heated oxygen of the air passing upwards,

through fuel already ignited, will consume the gas arising from fresh fuel, provided the strata of ignited fuel be not too thick, and the supply of fresh coal be in proper proportion. The proportion of ignited anthracite and the fresh supply may be in the relative proportion as two to one—thus two inches in thickness of ignited coal (each piece not to exceed half an inch diameter upon the grate of a stove,) and one inch of fresh coal of the same dimensions, is said to answer as well.—*Ed. Ob. & Rec.*]

To suppose that green wood will cause more heat than dry is absurd.

To remove ice from door steps, throw on salt, it will cause the ice to crack, and become loose, when it may be easily removed.

Salt should be regularly fed to cattle both in winter and summer. They will never eat too much, if it is placed continually before them, where they can obtain it at all times. The best way to feed them with it, except when snow is on the ground, is to employ salt troughs for the purpose, which are made most conveniently by making a deep cavity in the convex side of a short thick piece of slab, or a chip from scoring timber, to be kept filled with salt, and placed flat upon the ground. They are very cheap, and will not easily upset. In winter, when the ground is covered with snow, salt should be supplied by brining the fodder.

Use spirits of turpentine to remove grease spots from clothes. It dissolves the grease, and then soap the more easily removes it. Grease may be removed from undyed woollen by a solution of pearl ash. Lime spots on woollen cloths may be completely removed by strong vinegar. The vinegar effectually neutralizes the lime, but does not generally effect the colour of the cloth. Dark cloth, the colour of which has been completely destroyed in spots six inches square, has thus had its original colour perfectly restored. The whiteness of ivory handled knives may be restored by rubbing them with fine sand-paper or emery.

The oftener carpets are shaken the longer they last; as the particles of dirt and sand which collect upon them grind the threads. Sweeping them also wears them.—*Genessee Farmer.*

CEMENTS.

A Cement for broken China, Glass, &c.—Take quick lime and white of eggs, or old thick varnish, grind and temper them well together, and it is ready for use. Drying oil and white lead are also frequently used for cementing china and earthen ware; but the cement requires a long time to dry. Where it is necessary the vessel should endure heat or moisture, isinglass glue, with a little tripoli or chalk, is better.

A Cement useful for Turners.—Take rosin one pound, pitch four ounces; melt these together, and while boiling hot, add brick dust, until, by dropping a little upon a stone, you perceive it hard enough; then pour it into water, and immediately make it up into rolls, and it is fit for use: or, take rosin one ounce, pitch two ounces; add red ochre, finely powdered, until you perceive it strong enough. Sometimes a small quantity of tallow is used, according to the heat of the weather; more being necessary in winter than summer. Either of these cements is of excellent use for turners. By applying it to the side of a chuck, and making it warm before the fire, you may fasten any thin piece of wood, which will hold while you turn it; when you want it off again, strike it on the top with a suitable tool, and it will drop off immediately.

A strong Cement for Electrical purposes.—Melt one pound of rosin in a pot or pan, over a slow fire, add thereto as much plaster of Paris, in fine powder, as will make it hard enough, which may be soon known by trial; then add a spoonfull of linseed oil, stirring it all the while, and try whether it is hard and tough enough for your purpose. If it is not sufficiently hard, add more Plaster of Paris; and if not tough enough, a little more linseed oil.

This is as good a cement as possible for fixing the necks of globes or cylinders, or any thing else that requires to be strongly fixed; for it is not easily melted again when cold. Or take rosin one pound, beeswax one ounce, add thereto as much red ochre as will make it of sufficient stiffness, pour it into water, and make it into rolls, and it is fit for use.

This cement is useful for cementing hoops on glasses, or any other mounting of electrical apparatus.

A Cement for Glass Grinders.—Take pitch and boil it; add thereto, and keep stirring it all the while, fine sifted wood ashes, until you have it of a proper temper; a little tallow may be added, as you find it necessary. For small work, to four ounces of rosin add one-fourth of an ounce of beeswax, melted together, and four ounces of whitening, made previously red hot. The whitening should be put in while hot, that it may not have time to imbibe moisture from the atmosphere.

Shellac is a very strong cement for holding metals, glass, or precious stones, while cutting, turning, or grinding them. The metal, &c., should be warmed to melt it. For fastening ruby cylinders in watches, and similar delicate purposes, shellac is excellent.

To Solder or Cement broken glass.—Broken glass may be soldered or cemented in such a manner as to be as strong as ever, by interposing between the parts glass ground up like a pigment, but of easier fusion than the pieces to be joined, and then exposing them to such a heat as will fuse the cementing ingredient, and make the pieces agglutenate without being themselves fused. A glass for the purpose of cementing broken pieces of flint glass may be made by fusing some of the same kind of glass, previously reduced to powder, along with a little red lead and borax, or with the borax only.

Cement for Derbyshire Spar and other Stones.—A cement for this purpose may be made with about seven or eight parts of rosin, and one of beeswax, melted together, with a small quantity of plaster of Paris. If it is wished to make the cement fill up the place of any small chips that may have been lost, the quantity of plaster must be increased a little. When the ingredients are well mixed, and the whole is nearly cold, the mass should be well kneaded together. The pieces of spar that are to be joined, must be heated until they will melt the cement, and then pressed together, some of the cement being previously interposed. Melted sulphur applied to fragments of stones, previously heated by placing them before a fire, to at least the melting point of sulphur, and then joined with the sulphur between, makes a pretty firm and durable joining. Little deficiencies in the stone, as chips out of corners, &c., may also be filled up with melted sulphur, in which some of the powder of the stone has been melted.

A Cement that will stand against boiling water and the pressure of steam.—In joining the flanches of iron cylinders and other parts of hydraulic steam engines, great inconvenience is often experienced from the want of a durable cement. Boiled linseed oil, litharge, and red and white lead, mixed together to a proper consistence, and applied on each side of a piece of flannel, previously shaped to fit the joint, and then interposed between the pieces before they are brought home, as the workmen term it, to their place, by the screws or fastenings employed, make a close and durable joint.

The quantities of the ingredients may be varied without inconvenience, only taking care not to make the mass too thin with oil. It is difficult, in many cases, instantly to make a good fitting of the large pieces of iron work, which renders it necessary sometimes to join and separate the pieces repeatedly, before a proper adjustment is obtained. When this is expected, the white lead ought to predominate in the mixture, as it dries much slower than the red. A workman knowing this fact, can be at little loss in exercising his own discretion in regulating the quantities. It is safest to err on the side of the white lead, as the durability of the cement is no way injured by it, only a longer time is required for it to dry and harden. When the fittings will not admit easily of so thick a substance as flannel being interposed, linen may be substituted, or even paper or thin pasteboard.

This cement answers well also for joining broken stones, however large. Cisterns built of square stones, put together with this cement, will never leak, or want any repairs. In this case the stones need not be entirely bedded in it; an inch, or even less, of the edges that lie next the water, need only be so treated; the rest of the joint may be filled with good lime.

Another Cement that will stand the action of boiling water or steam.—This cement, which is preferable even to the former for steam engines, is prepared as follows: Take two ounces of sal ammoniac, one ounce of flowers of sulphur, and sixteen ounces of cast iron filings, or bor-

ings, mix all well together by rubbing them in a mortar, and keep the powder dry.

When the cement is wanted for use take one part of the above powder and twenty parts of clean iron borings or filings, and blend them intimately by grinding them in a mortar.

Wet the compound with water, and when brought to a convenient consistence, apply it to the joint with a wooden or blunt spatula. By a play of affinities, which those who are at all acquainted with chemistry will be at no loss to comprehend, a degree of action and re-action takes place among the ingredients, and between them and the iron surfaces, which at last causes the whole to unite as one mass.

In fact, after a time, the mixture and the surfaces of the flanches become species of pyrites, holding a very large proportion of iron, all the parts of which cohere strongly together.

Blood Cement.—A cement often used by coppersmiths to lay over the rivets and edges of the sheets of copper in large boilers, to serve as an additional security to the joinings, and to secure cocks, &c. from leaking, is made by mixing pounded quick lime with ox's blood.

It must be applied fresh made, as it soon gets hard. If the properties of this cement were duly investigated, it would probably be found useful for many purposes to which it has never yet been applied, as it is extremely cheap and very durable.

Flour paste.—Flour paste for cementing is formed principally of wheaten flour, boiled in water till it is of a glutinous or viscid consistence. It may be prepared of those ingredients simply for common purposes; but when it is used by book binders, or for paper hangings, it is usual to mix with the flour a fifth or sixth of its weight of powdered rosin or alum, and where it is wanted still more tenacious, gum arabic, or any kind of size may be added.

Japanese Cement, or Rice Glue.—This elegant cement is made by mixing rice flour intimately with cold water, and then gently boiling it. It is beautifully white, and dries almost transparent.

Papers pasted together by means of this cement will sooner separate in their own substance than at the joining, which makes it useful in the preparation of curious paper articles, as tea trays, ladies dressing boxes, and other articles that require layers of paper to be cemented together.

Remedy for Burns.—Take soot from a chimney where wood is burned, rub it fine, and mix one part soot to three parts, or nearly so, of hog's lard, fresh butter, or any kind of fresh grease, that is not salted; spread this upon linen or muslin, or any cotton cloth, for easier and more perfect adaptation. If in any extensive burns or scalds, the cloth should be torn into strips, before putting over the scald. Let the remedy be freely and fully applied, so as perfectly to cover all the burned parts. No other application is required until the patient is well, except to apply fresh applications of the soot, lard, &c. —*United States Gazette.*

Remedy for Whooping Cough.—We have before published a very simple but effectual remedy for this disease, which is again making its round. In the hope of being able to relieve some of those who are suffering, we have been induced to publish the remedy, lest some may not have noticed, and others forgotten it.

Mix the expressed juice of garlick with brandy or common whiskey, in the proportion of half a gill of juice to half a pint of brandy.

The best way of preparing it, when time will permit, is to pour the spirits on whole cloves or garlick, and let it remain several days without using.

This preparation is to be rubbed well in the spine, morning and evening. Where the disease is very severe, it may be rubbed over the breast, and on the palms of the hands and the soles of the feet.

Remedy for Squinting.—I have not deemed it necessary to notice squinting among the diseases of the eye, the cure of it being purely of a mechanical nature. The best contrivance of this kind with which I am acquainted consists of spectacle frames fitted with convex horn, having a small aperture of the pupil, by which means the squinter, if he wishes to see at all, is obliged to accustom himself to

look straight forward.—*Curtis on the Eye.*

Inflammatory Rheumatism, Sciatica, Neuralgia, and Croup.—Dr. F. W. Adams, of Maine, speaks in decided terms of the vinous tincture of the White Helebore (*Veratrum Album*) in the cure of the aforesaid diseases, and recommends that it be prepared by digesting the sliced recent bulbous root in Spanish white wine for six or eight days, in a temperature of eighty or ninety degrees, to its fullest saturation. Of this tincture, when filtrated, an active dose is from a half to one and a half drachms, according to the age and strength of constitution, from twelve years upwards. The preparation on which (he says) I have mostly, though not exclusively depended, is three parts of the above, in combination with one part of the aromatic vinous tincture, or Sydenham's wine of opium, which I have commonly administered in doses as above, commencing with the least, repeating with the proportional increase of one half of the preceding dose every eight hours, until its specific and efficient effects have been procured. These are a peculiar sensation of warmth or heat at the epigastrium, ascending from thence to the fauces, appearing, meanwhile, to penetrate the pulmonary face of the sternum with fullness and slowness of pulse, which latter symptom goes on increasing until the number of pulsations is reduced, in most cases, to thirty or thirty-five in a minute, and they not unfrequently become extinct at the wrist. The sensation of heat at the sternum is soon followed by a different one in the fauces, resembling entirely that denominated globus hystericus, and accompanied by the same anxiety and sense of suffocation. This again is immediately succeeded by nausea and vomiting, which relieve in a great degree the foregoing peculiarly distressing sensation. The vomiting when once excited commonly continues almost incessantly, from three-fourths of an hour to an hour and a half, unloading the stomach effectually of its alimentary, and, mostly, of its mucous contents. Nearly simultaneous with the commencement of vomiting a free perspiration occurs, which continues, with a rapid increase, until the patient is literally drenched, the disease seeming to have been totally dissolved, and eliminated, by cutaneous transpiration, for a state of the most delicious composure succeeds, accompanied by a perfectly quiet and refreshing sleep, which in a few hours enables the subject of a long and painful decrepitude to present himself to his family and friends, in a pleasing contrast of a happy and healthy man.

I have been in the habit of directing the patient to drink freely of a weak and warm ginger tea during the continuance of vomiting.

I have administered the above medicine in cases of croup, which had resisted the effect of almost every popular remedy, to that of full doses of turpeth mineral, and after apparently fatal symptoms had supervened, with the most surprisingly happy result.

I have also prescribed it in several cases of sciatica, or inflammation of the sciatic nerve, with the most complete success. In two cases a perfect recovery was effected in less than four hours, from a tedious and excruciatingly painful disease. In other cases, where the prescription was embarrassed by the timidity of the patient, as in the cases of several females, the medicine was prescribed in undisturbing doses, and yet a perseverance in its use was attended with perfectly satisfactory results.

The above offers no slight suggestion of its probable efficacy in the whole class of acute neuralgia.

I have been induced to try its efficacy as a diuretic in several unpromising cases of general dropsy, and in combination with cantharides, with nitric ether, and with digitalis, assisted by external friction and pressure. I have found it to exceed any expectation I had imbibed of its efficacy. I think it a medicine of very active and efficient powers, and one which promises much to the profession, whenever those powers can be judiciously applied.

I would remark, that I have derived much advantage from its external use, in the form of decoction or infusion, both in local inflammation and in dropsies, for which I suppose veratria will be more than a substitute.

I have found a decoction or infusion of the root of hellebore, in combination with one drachm of opium to the pint, and used

as a lotion, the most effectual application for the removal of superficial acute local inflammation, of any thing I have seen tried.

Veratria, for all external purposes, may perhaps be advantageously substituted for the root.—*Med. Exam.*

BURDOCK IN IMPETIGO.

By Dr. Graves.

I had recently under my care a young man who had suffered greatly from an impetiginous affection, accompanied by varicose veins of the legs; the tibial surfaces of both were covered with ulcers, from which a considerable quantity of purulent and ichoroas fluid exuded, and as his business obliged him to walk about constantly, he suffered a great deal of distress and annoyance. I treated him at first with leeches, and poultices, and afterwards with various astringent applications, but with very little relief; the discharge from the legs was profuse, and the heat, itching, and soreness undiminished.

While in this state he was advised by a friend to take about four or five ounces of burdock root; (*Arctium Lappa*) and having boiled it in a quart of water down to a pint, to drink this quantity of decoction every day in divided doses. He did so; and in the space of three or four days a most remarkable improvement took place. Thinking that the benefit derived might be the result of accident, I made him leave off the burdock for a few days, and found the legs began to get bad again. He resumed the use of it, and is now well. I do not wish to attach more interest to this case than it deserves; but certainly, the decoction of the burdock root operated in a very remarkable manner in improving this gentleman's health, checking the tendency to impetiginous inflammation, and arresting the profuse discharge.

Here is a specimen of the root itself; although it is not mentioned in our pharmacopœia, it held a place at one time in the materia medica, and enjoyed considerable reputation as an alterative remedy. —*London Med. Gaz.*

DEFINITION OF TERMS.

Beginning with the letter D.

Defacto—Something actually in fact, or existing; in contradistinction to de jure, where a thing is only so in justice, but not in fact; as a king de facto is a person that is in actual possession of a crown, but has no legal right to the same; and a king de jure is the person who has a just right to the crown, though he is out of possession of it.

Deliæ, or Delian problem, a problem much celebrated in the writings of the ancients, concerning the duplication of the cube.

Demi-culverin, a piece of ordnance usually four and a half inches bore, 2700 pound weight, 10 feet long, and carrying point-blank 175 paces.

Deneb., an Arabic term, signifying tail, used by astronomers to denote several fixed stars. Thus, deneb elecet, signifies the bright star in the lion's tail; deneb adigege, that in the swan's tail, &c.

Density of bodies, is that property directly opposite to rarity, whereby they contain such a quantity of matter under such a bulk. Accordingly, a body is said to have double or triple the density of another body, when their bulk being equal, the quantity of matter in one is double or triple the quantity of the matter in the other.

Deodand, is where any movable thing inanimate, or beast animate, moves or causes the death of any reasonable creature, by mischance, without the will or fault of himself, or any person.

Desache, in heraldry, is where a beast has its limbs separated from its body; so that they still remain on the escutcheon, with only a small separation from their natural places.

Deson Tort Demesn, in law, a formula, used in action of trespass, by way of reply to the defendant's plea; signifying, that the trespass was his own voluntary and free act.

Duple, among mathematicians, denotes the ratio of 2 to 1. Thus, the ratio of 8 to 4 is duple, or as 2 to 1.

Sub duple ratio, is just the reverse of the former; or as 1 to 2. Such is 4 to 8, or 6 to 12.

Duramater, in anatomy, one of the membranes, as they are called, which surround the brain.

Ectropium, in surgery, is when the

eyelids are inverted, or retracted, so as to show their internal or red surface, and cannot sufficiently cover the eye.

Ectype, among antiquarians, an impression of a medal, seal, or ring, or a figured copy of an inscription, or other ancient monument.

Effluvum, in physiology, a term used by philosophers and physicians to express the minute particles which exhale from most, if not all, terrestrial bodies in form of insensible vapours.

Empyreuma, among chemists and physicians, the fiery taste or offensive smell which brandies, and some other bodies prepared by fire, are impregnated with.

Emulsion, in pharmacy, a soft liquid substance, of a colour and consistence resembling milk.

Enceinte, in fortification, is the wall or rampart which surrounds a place, sometimes composed of bastians or curtains, either faced or lined with brick or stone, or only made of earth. The enceinte is sometimes only flanked by round or square towers, which is called a Roman wall.

Endemic, or Endemical diseases, those to which the inhabitants of particular countries are subject, more than others, on account of the air, water, situation, and manner of living.

Epigraphe, among antiquarians, denotes the inscriptions of a building, pointing out the time when, the persons by whom, the uses, &c., for which it was erected.

Equilibrium, in mechanics, is when the two ends of a lever or balance hang so exactly even and level, as neither to ascend nor descend, but keep in a position parallel to the horizon, which is occasioned by their being charged with an equal weight.

Equiangular, in geometry, an epithet given to figures whose angles are all equal: such are square equilateral triangles, &c.

Equidifferent, numbers, are of two kinds, 1. Continually equidistant is when, in a series of three numbers, there is the same difference between the first and second as there is between the second and third, as 3, 6, 9. And 2. Discretely equidifferent is when, in a series of four numbers or quantities, there is the same difference between the first and second as there is between the third and fourth: such are 3, 6, 7, 10.

Equilateral, in general, something that has equal sides, as an equilateral triangle.

Equilateral Hyperbola, one whose transverse diameter is equal to its parameter; and so all the other diameters, equal to their parameters; in such an hyperbola, the asymptotes always cut one another at right angles in the centre. Its most simple equation, with regard to the transverse axis, is $y2=X2-a2$; and, with regard to the conjugate, $y2=X2 \times a2$, when a is the semi-transverse or semi-conjugate. The length of the curve cannot be found by means of the quadrature of any space, of which a conic section is in any part of the perameter.

Errhines, in pharmacy, are medicines which, when snuffed up the nose, promote a discharge from that part.

Error, in law, signifies an error in pleading, or in the process; and the writ which is brought for remedy thereof, is called a writ of error. A writ of error is a commission to judges of a superior court, by which they are authorized to examine the record upon which a judgment was given in an inferior court, and on such examination, to affirm or reverse the same, according to law.

Eruca, in general, denotes caterpillars of all kinds.

Escalade, in war, a furious attack of a wall or a rampart, carried on with ladders; to pass a ditch, or mount a rampart, without proceeding in form, breaking ground, or carrying on regular works to secure the men.

Estreat, is a true copy or note of some original writing on record, and especially of fines, and amercements imposed in the rolls of a court, and extracted or drawn out thence, and certified into the court of exchequer: whereupon process is awarded to the sheriff to levy the same.

Estrepement, the spoil made by a tenant for life, upon any lands or woods, to the prejudice of the reversioner.

Etching, is a manner of engraving on copper, in which the line or stroke, instead of being cut with a tool or graver, are corroded with aquafortis.

Ethics, or Morality, the science of manners or duty, which it traces from man's nature and condition, and shows to terminate in his happiness; or in other words, it is the knowledge of our duty and felicity, or the art of being virtuous and happy.

Ethmoidal, in anatomy, one of the common sutures of the skull, which goes round the os ethmoids, from which it derives its name, separating it from the bone in contact with it.

Ethopœia, a draught or a description, expressing the manners, passions, genius, tempers, aims, &c. of any person.

Experiments in boiling Wheat.—Three parcels of wheat, the first in its native state, the second having been limed two days, the third was placed in lime for upwards of two weeks. These parcels were tied up separately, and boiled over a quick fire for fifteen minutes. The wheat, in its native state, had sprouted; that which had been two days in lime was still further advanced, while the last sample presented the appearance of healthy vegetation. This wheat being sown, has made its appearance in a healthy state.—*Genesee Farmer.*

Note.—The above experiment shows some important facts, and may be productive of some sure method to destroy the embryo of some depredators, which in certain situations adhere to seeds and grain, and prey upon vegetation. P.

From the Genesee Farmer.

SOILING CATTLE.

The above is the term applied to the system of feeding animals with green feed during the summer; the animals being kept in stables, and the food cut and fed to them there, instead of allowing them to gather it for themselves in the field. Von Thaer, the great Prussian agriculturist, in relating the experience of Baron Bulow on this subject, lays down the following as incontrovertible facts:

"1. A spot of ground which when pastured would only be food sufficient for *one* head, will abundantly maintain *four* when left in the stable.

"2. Soiling affords at least double the quantity of manure from the same number of cattle: for the best summer manure is produced in the stable, and carried to the fields at the most proper periods of its fermentation; whereas when dropped on the pasture or meadow, and exposed to the action of the air and sun, its power is much wasted.

"3. Cows that are accustomed to soiling will yield much more milk when kept in this manner, and fattening cattle will increase much faster in weight.

"4. They are less subject to accidents and diseases—they are protected from the flies that torment them in the fields during the warm weather, and they do not suffer from the heat of the summer."

Experiments in this country have been made which in the main establish the above position of Von Thaer. The only serious objection that we have heard, is the labour required during the summer season, when work is in great request in the field, and difficult to be procured at any price. Men can, however, be hired for this labour if necessary, as well as for any other, and the policy of doing so rests on the mere question of profit and loss.

If, as Sinclair states, thirty-three head of cattle were soiled on seventeen and a half acres from the 20th of May to the 1st of October, when the same cattle would have required at least fifty acres in pasture, it is clear that the use of the thirty-three acres saved by soiling, at the lowest rates would have paid for far more extra labour than would have been required, independent of the superior advantages of the system. One man would have taken care of the thirty-three head of cattle without difficulty; and the extra crops that might be grown on the thirty-three acres might be saved; but the process must be inferior indeed, not to compensate the labour of half a dozen men for five months. The experience of the Hon. Josiah Quincy fully establishes these facts and inferences in regard to the benefit of soilings.

During the past years, as appears from a paper in the N. E. Farmer, Mr. Holt, a gentleman of East Haddam in Connecticut, sensible of the advantages of the soiling system, but experiencing some difficulty in finding a proper succession of food, especially the latter part of the sea-

son, followed the example of a farmer near New London, in sowing corn broad cast to be cut when wanted.

The following he has given as the results of his experiment:

On the 15th of June, 1836, about sixteen square rods of ground, which had been well manured and well ploughed, were sown broad cast with horse tooth, (gourd seed or southern corn) at the rate of four bushels of seed to the acre. The seed was then lightly ploughed in with a small horse plough, after which the ground was rolled and harrowed. On the 10th of August following, he began to cut upon the green crop of corn stalks on the above described ground. The stalk which grew from the sixteen rods of ground afforded forage for a horse from the 19th of August to the 8th of October, and also the principal part of the food of a cow from the 5th of September to the 8th of October, making fifty days keeping for the horse and 33 for the cow.

On the fourth of September, when this corn was five to eight feet high, but had not eared or tasselled out, the produce of one square rod was cut up, and while green it weighed three hundred and seventy-five pounds. This was at the rate of thirty tons to the acre. This three hundred and seventy-five pounds was dried, and on the 27th of October weighed eighty-six and a quarter pounds, which is at the rate of 13,800 pounds, or about seven tons to the acre.

The advantage of sowing the horse tooth corn, instead of some of the smaller sorts, are, the horse tooth being a taller kind, makes a much greater amount of fodder. An acre of corn sowed this way on good ground, would probably afford green forage for 30 cows a month, or for eight horses for the same length of time.

Such is the substance of Mr. Holt's paper, and it seems to point out a mode in which Cobbett's project in keeping a cow to an acre the year round can be realized. Perhaps there is no food more grateful or healthful to the ox or the horse than that of the leaves and stalks of corn, when secured at the proper time and in a careful manner. The quantity of nutritive matter the stalks contain, even under the present injudicious mode of treating it, is very great, and if cut and steamed as it should be, would add most materially to the means of feeding; and every one who has travelled at the south knows the avidity with which the northern as well as the southern horse feeds on corn leaf fodder. We would add here, that in our opinion much of the relief, not to say cure, experienced by horses from the north subject to the heaves, when taken to the south, arise from substituting the clean grateful corn leaf as food, in the room of the too frequently mouldy, and always dusty hay of the north.

In a season of drought like the past, an acre or two of corn like Mr. Holt's sown broad cast, and of good growth, would have been a most material aid in supplying the many half starved cattle and horses that were to be seen even in our fertile western New York with the most nourishing food; and if not wanted for that purpose in the summer, by being cut and dried, would make a supply of winter food far greater and more valuable than could be obtained in a dry state in any other way.

The system of soiling it is evident require rich lands to grow the food; and it is clear there is no method so well calculated as this to keep lands rich. We think it might be made a most profitable part of our mode of farming on our rich grain growing farms, by enabling us to keep greater quantities of stock than we are now able to do; thus securing at once greater sources of comfort and profit, and the most effectual means of retaining the fertility of our soils.

CHILBLAINS.

Many persons, especially children, suffer from chilblains, although this troublesome affection is often met with in the most healthy constitutions; yet when the disease proceeds to a very great extent and degree of intensity, and occurs with violence, where the exciting cause, exposure to changes of temperature has not been sudden or remarkable, we may then conclude that the sufferer's diathesis is decidedly scrofulous. This affection ought consequently to excite the attention of parents; for although in general it is merely a local ailment, yet in some children it indicates a general weakness of the constition, and in all, occasions much pain and

annoyance. Sir Benjamin Brodie, by his admirable observations on the nature and cure of corns, published in the 17th volume of the Medical Gazette, has shown that affections, vulgarly reputed to be beneath the dignity of the medical profession, may afford a legitimate and ample field for our interference and assistance. In order to prevent the formation of chilblains, we must endeavour to protect the skin from the operation of the usual exciting cause of the disease, and, in addition to cautioning the children to avoid exposing their hands or feet to rapid transitions from cold to heat, we should endeavour to render the skin capable of bearing moderate changes of temperature with impunity. This is best effected by washing the hands several times a day, at first with tepid and afterwards with cold water, mixed with a small portion of spirits or of *eau de Cologne*.

Some parents do much injury by making their children wear flannel or woolen gloves, even in the house. Stimulating liquids, such as strong brine, have long been deservedly popular as preventives of chilblains, and were recommended by Dioscorides; but none of those usually employed seem to me as efficacious as one which I was the first to use; viz. a solution of sulphate of copper in water, in the proportion of ten grains to the ounce. This must be diligently applied to affected or suspected parts of the skin with a camel's hair pencil; and as soon as the moisture dries off, the skin should be well smeared over with spermaceti ointment.

The sulphate of copper lotion may be applied two or three evenings in succession, until it has produced a manifest effect on the skin; it must be then discontinued for a few nights, again however to be resumed as soon as the natural soft and tender texture of the skin seems about to return. You must be careful to enjoin the application of the spermaceti after each use of the lotion. By this simple plan, commenced early in winter, many children, previously martyrs to chilblains, have been completely protected. It is probable that the nitrate of silver would answer equally well, did it not discolour the skin in so unseemly a way.—*Dr. Graves on Chilblains.*

HUNTER ON CHILBLAINS.

Chilblains are the common effects of these causes, viz. the want of power in the system to generate heat. Cold is a powerful obstructor of the natural animal powers, whilst at the same time it is exciting action, producing irritable inflammation and death. It is a true cause of mortification.

Indolent swellings from cold arise from two different modes of action:

1st. When so gradually applied as not to excite irritable inflammation, but a gradual sluggishness.

2nd. When it produces irritable inflammation from the parts being weakened. Cold does not immediately obstruct the natural actions of the whole, or part, but excites the whole or part to another action, viz. the production of heat. The extremities, from their great distance from the seat of the living power, and from being smaller, are most liable to this. Thus these parts become first irritable, and then inflamed; but it is an increased disposition to act, with lessened powers. Hence the effects of cold are greater or less, according to the constitution. The weakly, the fair, and the delicate, have the least power of generating heat. From the foregoing effects of cold we are led to a rational cure, first to remove the cause, then to apply warmth, or rather to keep the parts temperate.

Chilblains commonly get well in summer. The cure, perhaps, should be divided according to the two stages of the disease, viz. the irritable and indolent; but how far the treatment should correspond in this way, I cannot say. They have been cured when they looked purple and livid, by gentle stimulants, as oleum terebinthinæ, or camphorated spirits of wine. Such applications bring on the florid red of inflammation, which generally terminates well, for they seem to counteract the stimulus or irritation of cold.

Steeping the parts in warm vinegar has done much good; when they ulcerate, the same exciting mode seems best. But they are sometimes so irritable as to require quieting; for which purpose a poultice or decoction of poppy heads is equal to any thing.

When the itching begins, rubbing the

feet over with pounded chalk will be effectual to prevent it; the rubbing is useful, and the chalk keeps the feet warm by being a bad conductor of heat.

The invisible causes of indolent dispositions are also various. The first of the spontaneous is a diseased increase of growth.

2nd. Interstitial swelling.

3d. New formed substance.

This division, according to the mode of increase, is into three kinds, viz. increase of natural parts, the interstitial, and the tumour. All these are liable to happen in every part of the body. These increases are either known by the sight or by the feel.

AGRICULTURAL CHEMISTRY.

(Continued from p. 78.)

Combustion in fact, in common cases, is the process of the solution of a body in oxygen, as happens when sulphur or charcoal is burnt; or the fixation of oxygen by the combustible body in a solid form, which takes place when most metals are burnt, or when phosphorus inflames, or the production of a fluid from both bodies, as when hydrogen and oxygen unite to form water.

When considerable quantities of oxygen or of chlorine unite to metals, or inflammable bodies, they often produce acids; thus sulphurous, phosphoric, and boracic acids, are formed by a union of considerable quantities of oxygen with sulphur, phosphorus, and boron: and muriatic acid gas is formed by the union of chlorine and hydrogen.

When smaller quantities of oxygen or chlorine unite with inflammable bodies or metals, they form substances not acid, and more or less soluble in water; and the metallic oxides, the fixed alkalies, and the earths, all bodies connected by analogies, are produced by the union of metals with oxygen.

The composition of any compounds, the nature of which is well known, may be easily learned from the numbers representing their elements; all that is necessary is to know how many proportions enter into union. Thus *potassa*, or the pure caustic vegetable alkali, consists of one proportion of potassium and one of oxygen, and its constitution is consequently 75 potassium, 15 oxygen.

Carbonic acid is composed of two proportions of oxygen, 30, and one of carbon, 11, 4.

Again, *lime* consists of one proportion of calcium and one of oxygen, and it is composed of 40 of calcium and 15 of oxygen.

And *Carbonate of lime*, or pure chalk, consists of one proportion of carbonic acid, 41.4, and one of lime, 55.

Water consists of two proportions of hydrogen, 2, and one of oxygen, 15; and when water unites to other bodies in definite proportions, the quantity is 17, or some multiple of 17, *i. e.* 34, or 51, or 68, &c.

Soda, or the mineral alkali, contains two proportions of oxygen to one of sodium.

Ammonia, or the volatile alkali, is composed of six proportions of hydrogen and one of azote.

Amongst the earths, *Silica*, or the earth of flints, probably consists of two proportions of oxygen to one of silicum; and *Magnesia*, *Strontia*, *Baryta or Barytes*, *Alumina*, *Zircona*, *Glusina*, and *Ittria*, of one proportion of metal and one of oxygen.

The *metallic oxides* in general consist of the metals united to from one to four proportions of oxygen; and there are, in some cases, many different oxides of the same metal; thus there are three oxides of lead; the yellow oxide or massicot, contains two proportions of oxygen; the red oxide or minium, three; and the *puce coloured oxide*, four proportions.

Again, there are two *oxides of copper*, the *black* and the *orange;* the black contains two proportions of oxygen, the orange one.

For pursuing such experiments on the composition of bodies as are connected with agricultural chemistry, a few only of the undecompounded substances are necessary; and amongst the compounded bodies, the common acids, the alkalies, the earths, are the most essential substances. The elements found in vegetables, as has been stated in the introductory lecture, are very few. Oxygen, hydrogen, and carbon, constitute the greatest part of their

organized matter. Azote, phosphorus, sulphur, manganesum, iron, silicum, calcium, aluminum, and magnesium, likewise, in different arrangements, enter into their composition, or are found in the agents to which they are exposed; and these twelve undecompounded substances are the elements, the study of which is of the most importance to the agricultural chemist.

The doctrine of definite combinations, as will be shown in the following lectures, will assist us in gaining just views respecting the composition of plants and the economy of the vegetable kingdom; but the same accuracy of weight and measure, the same statical results which depends upon the uniformity of the laws that govern dead matter, cannot be expected in operations where the powers of life are concerned, and where a diversity of organs and of functions exist.

The classes of definite inorganic bodies, even if we include all the crystalline arrangements of the mineral kingdom, are few, compared with the forms and substances belonging to animated nature. Life gives a peculiar character to all its productions; the power of attraction and repulsion, combination and decomposition, are subservient to it; a few elements, by the diversity of their arrangement, are made to form the most different substances, and similar substances are produced from compounds which, when superficially examined, appear entirely different.

LECTURE III.

On the Organization of Plants. Of the roots, trunk, and branches. Of their structure. Of the Epidermis. Of the cortical and alburnous parts of leaves, flowers, and seeds. Of the chemical constitution of the organs of plants, and the substances found in them. Of mucilaginous, saccharine, extractive, resinous and oily substances, and other vegetable compounds, their arrangements in the organs of plants, their composition, changes and uses.

Variety characterizes the vegetable kingdom, yet there is an analogy between the forms and the functions of all the different classes of plants, and on this analogy the scientific principles relating to their organization depend.

Vegetables are living structures distinguished from animals by exhibiting no signs of perception or of voluntary motion; and their organs are either organs of nourishment or of reproduction, organs for the preservation and increase of the individual, or for the multiplication of the species.

In the living vegetable system there are to be considered, the exterior form, and the interior constitution.

Every plant examined as to external structure displays at least four systems of organs, or some analogous parts.

First, the *Root.*

Secondly, the *Trunk* and *Branches*, or *Stem.*

Thirdly, the *Leaves.*

And fourthly, the *Flowers* or *Seeds.*

The *root* is that part of the vegetable which least impresses the eye; but it is absolutely necessary. It attaches the plant to the surface, is its organ of nourishment, and the apparatus by which it imbibes food from the soil.

The roots of plants, in their anatomical division, are very similar to the trunk and branches. The root may indeed be said to be a continuation of the trunk, terminating in minute ramifications and filaments, and not in leaves; and by burying the branches of certain trees in the soil, and elevating the roots in the atmosphere, there is, as it were, an inversion of the functions—the roots produce buds and leaves, and the branches shoot out into radical fibres and tubes. This experiment was made by Woodward on the willow, and has been repeated by a number of physiologists.

When the branch or root of a tree is cut transversely, it usually exhibits three bodies—the bark, the wood, and the pith; and these again are individually susceptible of a new division.

The bark when perfectly formed is covered by a thin cuticle or *epidermis*, which may be easily separated. It is generally composed of a number of laminae or scales, which in old trees are usually in a loose and decaying state. The epidermis is not vascular, and it merely defends the interior parts from injury. In forest

trees, and in the larger shrubs, the bodies of which are firm, and of strong texture, it is a part of little importance; but in the reeds, the grasses, canes, and the plants having hollow stalks, it is of great use, and is exceedingly strong, and in the microscope seems composed of a kind of glassy net-work, which is principally siliceous earth.

This is the case in wheat, in the oat, in the different species of equisetum, and, above all, in the rattan, the epidermis of which contains a sufficient quantity of flint to give light when struck by steel, or two pieces rubbed together produce sparks. This fact first occurred to me in 1798, and it led to experiments, by which I ascertained that siliceous earth existed generally in the epidermis of the hollow plants. The siliceous epidermis serves as a support, protects the bark from the action of insects, and seems to perform a part in the economy of these feeble vegetable tribes, similar to that performed in the animal kingdom by the shell of the crustaceous insects.

Immediately beneath the epidermis is the *parenchyma*. It is a soft substance, consisting of cells filled with fluid, having almost always a greenish tint. The cells in the parenchymatous part, when examined by the microscope, appear hexagonal. This form, indeed, is that usually affected by the cellular membranes in vegetables, and it seems to be the result of the general reaction of the solid parts, similar to that which takes place in the honeycomb.

This arrangement, which has been usually ascribed to the skill and artifice of the bee, seems, as Dr. Woolaston has observed, to be merely the result of the mechanical laws which influence the pressure of cylinders composed of soft materials, the nests of solitary bees being uniformly circular.

The innermost part of the bark is constituted by the *cortical layers*, and their numbers vary with the age of the tree. On cutting the bark of a tree of several years standing, the productions of different periods may be distinctly seen, though the layer of every particular year can seldom be accurately defined.

The cortical layers are composed of fibrous parts, which appear interwoven, and which are transverse and longitudinal. The transverse are membranous and porous, and the longitudinal are generally composed of tubes.

The functions of the parenchymatous and cortical parts of the bark are of great importance. The tubes of the fibrous parts appear to be the organs that receive the sap; the cells seem destined for the elaboration of its parts, for the exposure of them to the action of the atmosphere, and the new matter is annually produced in the spring, immediately on the inner surface of the cortical layer of the last year.

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OF AGRICULTURE, SCIENCE, AND ART.

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The object of this paper is to concentrate and preserve, in a form suitable for future reference, the most useful and interesting articles on the aforesaid subjects. Each number will contain sixteen octavo pages, printed on good paper, and when a sufficient amount is published to form a volume of convenient size, an alphabetical table of contents will be published and forwarded to subscribers, in order for binding. This number, shows the general plan of the work.

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NEW INVENTED STEAM ENGINE.

At the British Alkali Works, Stoke-Prior near Broomsgrove, a steam engine has been invented by a laboring mechanic, and is daily in full operation, which will certainly supercede every other now in use, and that, too, in a very short period of time; as the simplicity of its construction, the smallness of its size, and the almost nothingness of its cost, will necessarily bring it speedily into notice among all persons whose business may require the aid of so useful an auxiliary. Its size is not more than twice that of a man's hat, and the expense of a five horse power, will not exceed in cost, half a score of pounds. Its form is cylindrical, being about eighteen inches in diameter, and twenty-two deep. The steam is admitted through a hole in a hollow circular belt, (attached to a wall,) upon which it revolves, and works it by a diagonal action, against an upright piston, being forced out by pressure of a diagonal plate, which divides the interior into two portions. The rotary action is beautifully managed by means of a perfectly spherical steam-tight joint, at the end of a fixed inclined arm, towards which joint the upper and lower surfaces of the interior part of the cylinder are made to slope, after the form of an hour glass. Upon these, the diagonal plate performs its revolutions; such movement being permitted through an opening, (from the circumference to the centre,) equal in width to the thickness of the before mentioned piston; up and down the sides of which it continually works. To the centre of the bottom of the cylinder, is fixed a shaft, having attached to it a wheel which communicates the motion that may be required; and this is all the machinery of which it consists!

When, therefore, we consider the saving of weight, of metal, size and expense, which will necessarily be gained by its adoption, and look at the incalculable advantages which such desiderata afford to steam navigation, our scientific friends will not consider us too bold in asserting that this invention will speedily revolutionize the whole system in this department in mechanics.—Patents have been procured from every European government, and from the American; no secret is made at the works, in shewing it to the public, either in action, or in separate pieces, and in a model which is kept for the purpose.—*Mining Journal.*

IMPROVEMENTS IN STEAM BOILERS, AND SAVING FUEL IN MANUFACTURES.

These consist in the employment of air highly heated, to assist in generating steam in boilers, and in the process of evaporation in manufactures. The air is heated by being carried through iron boxes, or troughs, placed in the current of the flame behind the bridge of the furnace. The current of air through the trough effectually protects the metal from being injured, even in fires so fierce as to vitrify brick, and speedily to melt cast iron in juxtaposition with the trough.

When thus heated, the air is carried in straight tubes through the water in the boiler, entering at the back, and passing off in front. Being unmixed with the smoke, it does not soil the tubes, which, therefore, rapidly transmit the heat; and the air in its passage is effectually cooled down to the heat of water. In this state it is conducted under the ash-pit, thus feeding the fire with air at the heat of 212 degrees, from which, as repeated analyses have shown that it has parted with little or none of its oxygen, important benefits arise; the fire is saved the necessity of heating up to that degree the whole air which passes through it, and the process of combustion is otherwise beneficially promoted. The ash-pit is closed with doors, and the draught of the chimney establishes and keeps up the requisite current of air for the purpose of combustion through the heating trough, the cooling tubes, the fire, and the flues. The additional heating surface thus gained by the tubes in the boiler, exceeds the fire surface, or bottom of the boiler, by fully one-half.—The saving of fuel compared with the ordinary furnace and boiler is estimated at 33 per cent.

The diminution of the boiler also tends to add to its strength; and the increased facility in transmitting to the water, the heat derived from the fire, arising from the greater heating surface afforded by the tubes, must still further operate to prevent the imminent hazard arising in marine boilers, from the exertions of the engine men to generate steam more rapidly. By the intensity of the heat thus produced, many parts of the boiler and flues, especially those where incrustations have been formed on the bottom, or where the water spaces have been too much contracted, become over-heated and consequently weakened and ultimately destroyed. Whatever tends safely to accelerate and facilitate the transmission of the heat to the water, obviously diminishes the necessity to contract the water spaces, and the temptation to force the fire. It is also important that the heat which is absorbed by the air, is withdrawn from the fire, at the point at which it is fiercest, and is by a proper distribution of the tubes, applied to the portions of the water farthest removed from the direct influence of the fire. If it shall be found, as we have reason to expect, that hot-air used in the furnace will enable anthracite coal to be burned, it is not easy to see to what extent of saving this discovery may lead in steam navigation; this coal being vastly more powerful than any other. It is no small advantage to the public, and no slight recommendation of this plan, that not only does it not interfere with any other improvements for economy of fuel now in use, but it is rather an addition to, and may be used in conjunction with them, and also that it may be easily adapted to almost any existing furnaces, boilers, and processes of manufacture, at an expense altogether trifling, contrasted with the benefit resulting from its use.—*Mining Journal.*

IMPROVEMENT OF A COMMON FIRE-PLACE.

BY M. SAUL.

Upon the grate is fixed a cast-iron plate with a circular aperture in the centre. It is 8½ inches in diameter, which just takes a common tea-kettle, and answers well for other sized pans, as I find it is of no moment, the pan being larger than the aperture. By this plan the heat is confined in the grate; and by several experiments I have proved that any thing will much sooner boil in this closed grate, than in an open one, and it also throws out a greater heat in the room and prevents smoke; and when the fire is not wanted for cooking, there is a plate to cover the aperture. It also consumes less fuel, and is a sure remedy for a smoky chimney. The whole heat may be made to act on an oven placed at one side of the fire by turning a damper in the flue. A small hole is made in the top of the plate, to admit any smoke that may arise when putting on fuel, or changing kettles or pans. The top plate rests on the top bar of the grate and on the brick work at the back, and another plate in front.

Arck Mag.

IMPORTANT TO FARMERS.

It may not be generally known to our agricultural readers, that the vegetative powers of wheat are greatly increased by

its being kiln-dried previously to being sown. A friend of ours, an extensive farmer in this district, in the month of October last, thrashed out a quantity of wheat from the stook the day after it was cut, but finding it too damp to be used as seed, was induced to dry it in the kiln. A field of considerable extent was sown with the grain so prepared, with the exception of two ridges on each side, which were sown a few days afterwards with wheat, after it had remained a full week in the stook and been properly *wun*. The idea of sowing wheat after it had been kiln-dried was treated as absurd and ridiculous by several of his neighbors, and an eminent and extensive agriculturist asked him if he was so plenty of wheat that he meant to sow his ground a second time. Notwithstanding this unfavorable opinion, the farmer persevered, and sowed several bushels more, until he had twenty acres completed. Experience is the surest test of any improvement, and in this instance our friend has had his hopes more than realized. It is a remarkable fact, that the wheat thus prepared, by being dried on the kiln, has not only brairded more thickly, but is much stronger and healthier in appearance than that which sprung from the wheat dried by the operation of the clements.—*Kelso Chronicle.*

THE CRANBERRY.

Until lately we believe nobody has thought of cultivating the Cranberry, any more than the Whortleberry or the Persimmon. It has been looked on as the natural product of swamps which were good for nothing else, and though the fruit was a favorite in the markets, the gatherers trusted to nature to keep the supply equal to the demand. A gentleman in Barnstable, Massachusetts, has, however, discovered that it is as susceptible of cultivation and improvement as the Strawberry. On about an acre of ground he has raised for the last ten years an average of about seventy bushels a season, sometimes a hundred. The following account of his Cranberry yard is from the Barnstable Journal.—*N. Y. Evening Post.*

Sandy bog-land is the best adapted to the growth of the Cranberry plant, and it should be kept well drained. Captain Hall has a tract of about four acres enclosed, which he calls his Cranberry yard, of a damp, sandy soil, surface nearly level, and where not planted with Cranberries, covered with rushes and swamp brush. The Cranberry vines were set around on the borders of the "yard," some on land elevated two or three feet above the general surface. The vines grow most vigorously, and the berries are of a better quality and more abundant where the soil is most sandy and damp. In very dry seasons, the Cranberries are liable to be eaten and destroyed by worms; but they are in general, under skilful management, as certain a crop as any kind of grain or garden vegetable.

The manner of transplanting is simple. Holes are dug four feet apart; only they are made deeper than for corn; into each of these sods of vines are placed. The Cranberry has creeping roots, spreads very rapidly, and in three years from the time of planting will entirely cover the ground. If the land is overgrown with bushes they must first be removed; but it is not necessary to destroy rushes, for the Cranberry vine will do it in a few years. When the land is very low, or covered with a thick growth of weeds and rushes, Capt. Hall practises spreading over it a quantity of beach sand before planting.—The fall is the best season for transplanting. No other cultivation is performed or required, than to keep the land drained, and cattle from injuring the vines. The Cranberries sell from $1 to $1,50 per bushel, and the cost of picking is 20 cents per bushel.

DR. GRAVES ON THE TREATMENT OF EPISTAXIS.

Permit me now, gentlemen, to direct your attention to the treatment of one form of the bleeding at the nose. It not unfrequently happens that epistaxis constitutes the only ailment to which young persons are liable. I was consulted by two gentlemen within the last year, the one eighteen, the other twenty-eight years of age; they were both healthy in every other respect, and were both liable to bleeding from the nose: sometimes

slight, sometimes copious, and then producing a degree of debility proportionate to the extent of the hæmorrhage ; no disturbance of the digestive organs, of the heart, or of any viscus or function, was discoverable. There seemed to be but one defect in the constitution, scarcely explicable except on the somewhat mechanical hypothesis of a superabundance of blood, accompanied, perhaps, by a defect in the process of sanguification, whereby the blood's fluidity was altered. These ideas, borrowed from the now antiquated humoral pathology, served to indicate the method of treatment ; and having no better guide to follow, I proceeded to put the plan thus suggested into execution ; I accordingly advised my patients to live as dry as possible, or, in other words, to restrict themselves to a minimum of drink.

I directed them at the same time to take about half a drachm of dilute nitric acid daily, in divided doses. Although the reasoning which led to its adoption is scarcely tenable, yet the remarkable success of the treatment renders the result worth recording.

Hippocrates, in his curious and instructive work on diet, insists much on attention being paid to the quantity of drink allowed to patients in different diseases ; it is singular, however, that he nowhere speaks of restricting the quantity of drink in cases of hæmorrhage.

Dr. Williams has lately recommended the dry treatment in catarrhal affections of the lungs attended with increased secretion. In young persons, when the sputa are abundant and easily gotten up, I can attest the efficacy of an almost total abstinence from drink. Not long ago, I was called to see a young lady, then on a visit to the house of the venerable Dr. Percival. She had been blistered, and had taken large quantities of squills, ipecacuanha, antimonial wine, and other expectorants, and had refrained from solid food, and indulged freely in demulcent ptisans, whey, tea, &c.; these means, with confinement in her room, had been continued about a week without the slightest benefit ; the cough was incessant, depriving her altogether of sleep, and accompanied with much wheezing, and an abundant easy expectoration. All remedies were laid aside, an almost total abstinence from drink observed, and a strikingly rapid cure effected. In his work on diet, Hippocrates gives some hints worth attending to ; thus in cases of constipation he recommends a very varied diet, and he does so on good grounds, for a simple uniform diet is very apt to occasion constipation. Hippocrates lays much stress on different sorts of exercise in different states of health ; riding, walking, running. Riding and walking, have also their specified varieties, not merely as to duration and velocity, but as to direction, for he carefully distinguishes locomotion according as it is continued in straight lines, in curves, or in greater or less circles, on flat or on hilly ground, &c. &c. Exercise, in curves or in circles, appears to have been a favorite gymnastic remedy among the Greeks ; it is quite neglected, but perhaps undeservedly, for running, riding, or walking, in curves or circles, must bring a number of muscles into play which are comparatively unemployed in rectilinear progression. The effects on the circulating and nervous system, must be likewise different, as is evident from the remarkable disturbance they undergo in the circular swing.—*Lon. Med. Gaz.*

ADULTERATION OF QUININE.

M. Pelletier, of Paris, states that if twenty drops of the pure and concentrated sulphuric acid be poured upon twenty grains of suspected Quinine, the solution will present a beautiful crimson color, more or less intense according to the quantity of salicine present. The adulteration of one part of salicine with ninety-nine of Quinine, is, by these means, easily discovered.—*Lancet.*

HUNTER ON TETANUS.

Dr. Hunter says, " Those most susceptible to this disease are of weakly, delicate frames, and of suspicious minds, and not of strong and robust ones. In warm climates it is most frequent, and consequently it is seldom found in cold weather. The cramp is most frequent in warm climates, and bad fits are most frequent in bed, for warmth seems to have a peculiar effect in producing a particular dispo-

sition in the nerves. *Treatment:* The first appearance of a cure is a recovery of strength, as weakness is a predisposing cause; and the first indication should be to strengthen the system. I should recommend every thing to produce extreme external cold, as cold applications, consisting of snow with salt to the part affected, and the patient should be put into an ice-house for a time, or sent to a cold climate as soon as possible. I know of no internal medicine."

SUB-CARBONATE OF IRON IN WHOOPING COUGH.

In the November number of the Dublin Journal of Medicine, Dr. Lombard, of Geneva, announces that he found the remedy a specific in a late epidemic at Geneva. He pushed the medicine to doses of twenty-four, and even thirty-six grains a day, in young children, and the result of his experience was, that it enjoys a remarkable property to make the fits less violent, and diminishes their number, and after a certain number of days to cure entirely the whooping-cough.—*Medical Journal.*

HUNTER ON CORNS.

The cuticle admits of being thickened from pressure in all parts of the body; hence we find, that on the soles of the feet of those who walk much, the cuticle becomes very thick; also on the hands of laboring men. We find this wherever there is pressure, as on the elbow, upper part of the little toe, ball of the great toe, &c. The immediate and first cause of this thickening would appear to be the stimulus of necessity given to the cutis by this pressure, the effect of which is an increase of the cutis, and a saculus is often formed at the root of the great toe, between the cutis and the ligaments of the joints, arising from the same cause, to guard the ligaments below. Sometimes when the pressure is uncommonly great, inflamation takes place in this part, especially if there are corns; the saculus suppurates and opens internally, and this forms what I believe is called a bunion. The saculus then closes again, and leaves the parts much as they were before. The cuticle is not only thickened from pressure for salutary purposes, but it is also carried to disease. A corn is a thickened cuticle arising from external pressure, which is preternatural and continued.—Uncommon preternatural pressure on the surface, must always affect the cuticle more or less, producing a disposition in it to guard itself: but pressure is capable of producing another effect, which is according to the amount of pressure. When applied in a moderate degree, it gives a disposition to the cutis to continue the growth of the cuticle, forming layer upon layer. By this continuation of growth the cuticle becomes thicker, but if the pressure becomes too violent, then a diseased increase of the cuticle takes place, commonly in a very small portion of the part pressed, often in a point. This thickened part being pressed from without, commonly sinks its own thickness into the cutis, which is the cause of the pain, and troublesome symptoms. The cuticle being formed in layers, peals off in layers, and if inflamation attacks the cutis underneath, this takes place, and hence the term onion, which has been applied to corns. There is often a sort of joint formed by a saculus mucus under the cutis, allowing of motion in the corn. If this inflames and suppurates, a cure is often effected. When corns are of long standing and run pretty deep, they generally produce a degree of indolence in the healthy action of the parts pressed on, which makes the cure tedious. The cure of corns is of three kinds, viz: natural, palliative, and radical. The first is by removing the primary cause, or pressure; which is done by leaving off shoes, or by introducing a soft substance, as plaster, between the corn and shoe. Two plasters are necessary, one with a hole opposite to the corn, and another to be applied over this; and these should be continued as long as the cause is continued; leaving off the pressure is the best mode, and then the effects are easily removed.

The paliative consists in removing as much as possible the external surface, which relieves the pressure. This is done by holding the corn half an hour in warm water, when it swells, and then paring off as much as possible of it. It is diff-

cult to remove the whole without injuring the surrounding cutis, which is often of bad consequence in old people, fatal inflammation and mortification having been caused by it. The radical cure consists, in removing the whole corn, or thickened cutis. The cuticle may be raised here, as it is in every other part, by blisters: but its thickness prevents this effect taking place so easily. Warm stimulating plasters will in general be sufficient. The causes of corns when carried too far, often produce inflammation and suppuration, and whichever way the suppuration is produced, it is liable, if not attended to, to become very tedious; for the skin having a greater disposition to heal than the parts underneath, produces a fistula: so that such sores should be dressed to the bottom, and if they are indolent at the bottom, should be stimulated by appropriate dressings.

CHILBLAINS CURED BY BALSAM OF COPAIBA.

Dr. W. S. W. Ruschenberger, of the U. S. Navy, states, in a communication in the Medical Examiner, (No. 5,) that he treated a number of cases of chilblain occurring among the crews of the U. S. ships Falmouth and Peacock, in the years 1833 and 1837, by smearing the parts affected with balsam of copaiba. All the cases, he says, where ulceration had not taken place, were entirely relieved by one or two applications, and very few required more than a third application of the remedy.

When this communication appeared the Editor of this Journal was performing his tour of duty at the Philadelphia Orphan Asylum, where there were thirty-two children affected with chilblains. He was induced by the representation of Dr. R. to try the balsam of copaiba in a few cases, and the result was so satisfactory that he had the application made to all of them. In every one the relief was most prompt, and in two or three weeks the whole were cured.

METHOD OF CLEANING GLASS.

Reduce to very fine powder a piece of indigo, moisten a rag, apply it to teh powder, and rub the glass over with it, then wipe it well with a dry cloth. Very finely sifted ashes applied in the same manner by a rag dipt into brandy or spirits will answer as well; but Spanish white ought to be rejected, as it is apt to take off the polish of the glass.—*Journ. Com.*

TO PREVENT IRON FROM RUSTING.

Heat cast iron vessels pretty hot, and rub them well with a woolen cloth dipped in train oil, they may be exposed to the weather, without being injured, a long time.—*Farm. Mag.*

VALUABLE INFORMATION FOR WATCH-MAKERS.

A combination of Platina, Silver, and Copper (the relative proportions not stated,) is found to be a superior article for the pivots of wheels to turn in, as oil has no effect upon it.—*Phila. Gaz.*

ROHAN POTATO.

This potato is very large, excellent in quality, and productive beyond all other potatoes. The product of one potato the past season, is two and a quarter bushels. That of one peck, sixteen and a half bushels. And the product of four pounds is eighteen bushels, 1173 pounds. Can any one give information where these potatoes can be procured.—*Northampton Courier.*

DEFINITION OF TERMS—(CONTINUED.)

Letter E.

Earths.—The term *earth* is applied in common life, to denote a tasteless, inodorous, dry, uninflammable, sparingly-soluble substance, which is difficultly fusible, and of a moderate specific gravity. Several of the earths are found in a state of purity in nature; but their general mode of occurrence is in intimate union with each other, and with various acids and metallic oxides. Under these circumstances, they constitute by far the greatest part of the strata, gravel and soil, which go to make up the mountains, valleys and plains of our globe. Their number is ten, and their names are *silex*, *alumina*, *magnesia*, *lime*, *barites*, *strontites*, *zircon*, *glucine*, *yttria* and *thorina*. The four first have long been known to mankind; the remainder have been discover-

ed in our own times. Silex exists nearly pure, in large masses, forming entire rocks, as quartz rock, and constituting the chief ingredient in all granite rocks and sandstones, so that it may safely be asserted to form more than one-half of the crust of the earth. Alumine is found pure in two or three exceedingly rare minerals, but, in a mixed state, is well known as forming clays and a large family of rocks, usually called *argillaceous.*

Lime, an earth well known from its important uses in society, occurs combined with carbonic acid, in which state it forms limestone, marble, chalk, and the shells of snails. It exists, also, upon a large scale, in combination with sulphuric acid, when it bears the name of *gypsum.*

Magnesia is rare in a state of purity, but enters largely into the composition of some of the primary rocks, especially of the limestones. The remaining eight (if we except barytes, which, in combination with sulphuric acid, is often met with in metallic veins.) are only known to the chemist as occurring in the composition of certain minerals, which, for the most part, are exceedingly rare.

The earths are very similar to the alkalies, (q. v.) forming with the acids, peculiar salts, and resembling the alkalies likewise in their composition.

They consist of peculiar metals in combination with oxygen, and compose the greatest part of the solid contents of the globe. They differ from the alkalies principally in the following peculiarities: they are incombustible, and cannot, in their simple state, be volatilized by heat; with different acids, especially the carbonic, they form salts insoluble, or soluble only with much difficulty; and with fat oils, soaps insoluble in water. They are divided into two classes, the alkaline and proper earths. The former have a greater similarity to the alkalies, in their active state, they are soluble in water, and these solutions may be crystallized. They change the vegetable colors almost in the same way as alkalies, and their affinity for acids is sometimes stronger than that of the alkalies. They combine with sulphur, and form compounds perfectly similar to the sulphuretted alkalies. With carbonic acid, they form insoluble salts, which, however, become soluble in water by an excess of carbonic acid. The alkaline earths are as follows: 1, barytes, or heavy earth, so called from its great weight; 2, strontites (q. v.;) both these earths are counted among the alkalies by many chemists, on account of their easy solubility in water; 3, calcareous earth, or lime, forms one of the most abundant ingredients of our globe; 4, magnesia is a constituent of several minerals. The proper earths are wholly insoluble in water, infusible at the greatest heat of our furnaces, and, by being exposed to heat, in a greater or less degree, they lose their property of easy solubility in acids. Some of them are incapable of combining with carbonic acid, and the remainder form with it insoluble compounds. They are the following: 1, alumine; 2, glucine; which is found only in the beryl and emerald, and a few other minerals; 3, yttria is found in the gadolinite, in the yttrious oxide of columbium, &c.; 4, zirconia is found less frequently than the preceding, in the zircon and hyacinth; 5, silex. The earths were regarded as simple bodies until the brilliant researches of Sir Humphrey Davy proved them to be compounds of oxygen with peculiar bases, somewhat similar to those of the alkalies, potassium and sodium. Some of the heavier of the earths had often been imagined to be analogous to the metallic oxides; but every attempt to effect their decomposition or reduction, had proved unsuccessful. After ascertaining the compound nature of the alkalies, Davy submitted the earths to the same mode of analysis by which he had effected that fine discovery. The results obtained in his first experiments were less complete than those afforded with the alkalies, owing to the superior affinity between the principles of the earths, as well as to their being less perfect electrical conductors. By submitting them to galvanic action, in mixture with potash, or with metallic oxides, more successful results were obtained; and a method employed by Berzelius and Pontin, of placing them in the galvanic circuit with quicksilver, terminated very perfectly in affording the bases of barytes and lime,

in combination with this metal. By the same method, Sir H. Davy decomposed strontites and magnesia; and, by submitting silex, alumine, zircon, and glucine to the action of the galvanic battery, in fusion with potash or soda, or in contact with iron, or by fusing them with potassium and iron, appearances were obtained sufficiently indicative of their decomposition, and of the production of bases of a metallic nature. Thorina, the last discovered earth, was decomposed by heating the chloride of thorium with potassium. The metallic bases of the earths approach more nearly than those of the alkalies to the common metals, and the earths themselves have a stricter resemblance than the alkalies to metallic oxides. Viewing them as forming part of a natural arrangement, they furnish the link which unites the alkalies to the metals. Accordingly, many of the more recent systems of chemistry treat of all these bodies as forming a single group, under the name of the metallic class.

Still (as Dr. Ure justly remarks,) whatever may be the revolutions of chemical nomenclature, mankind will never cease to consider as earths, those solid bodies composing the mineral strata, which are incombustible, colorless, not convertible into metals by all the ordinary methods of reduction, or, when reduced by scientific refinements, possessing but an evanescent metallic existence.—*Encyc. Amer.*

SIR H. DAVY'S AGRICULTURAL CHEMISTRY.

(Continued from page 96, No. 6.)

It has been shown by the experiments of Mr. Knight, and those made by other physiologists, that the sap descending through the bark, after being modified in the leaves, is the principal cause of the growth of the tree; thus, if the bark is wounded, the principal formation of new bark is on the upper edge of the wound, and when the wood has been removed, the formation of new wood takes place immediately beneath the bark: yet it would appear from the late observations of M. Palisot de Beauvois, that the sap may be transferred to the bark, so as to exert its nutritive functions, independent of any general system of circulation. That gentleman separated different portions of bark from the rest of the bark in several trees, and found that in most instances the separated bark grew in the same manner as the bark in its natural state. The experiment was tried with most success on the lime tree, the maple and the lilac; the layers of bark were removed in August, 1810, and in the spring of the next year, in the case of the maple and the lilac, small annual shoots were produced in the parts where the bark was insulated.

The wood of trees is composed of an external or living part, called *alburnum* or *sap-wood*, and of an internal and dead part, the *heart-wood*. The alburnum is white, and full of moisture, and in young trees and annual shoots it reaches even to the pith. The alburnum is the great vascular system of the vegetable through which the sap rises, and the vessels in it extend from the leaves to the minutest filaments in the roots.

There is in the alburnum a membranous substance composed of *cells* which are constantly filled with the sap of the plant, and there are in the vascular system several different kinds of *tubes*. Mirbel has distinguished four species, the *simple tubes*, the *porous tubes*, the *tracheæ*, and the *false tracheæ*.—The tubes, which he has called simple tubes, seem to contain the resinous or oily fluids peculiar to different plants.

The porous tubes likewise contain these fluids; and their use is probably that of conveying them into the sap for the production of new arrangements.

The tracheæ contain fluid matter, which is always thin, watery, and pelucid, and these organs, as well as the false tracheæ, probably carry off water from the denser juices, which are thus enabled to consolidate for the production of new woods.

In the arrangement of the fibres of the wood, there are two distinct appearances. There are series of white and shining laminæ which shoot from the centre towards the circumference, and these constitute what is called the *silver grain* of the wood.

There are likewise numerous series of concentric layers which are usually called the *spurious grain*, and their number denotes the age of the tree.

The silver grain is elastic and contractile, and it has been supposed by Mr. Knight, that the change of volume produced in it by change of temperature is one of the principal causes of the ascent of the sap. The fibres of it seem always to expand in the morning and contract at night; and the ascent of the juices, as was stated in the last lecture, depends principally on the agency of heat. The silver grain is most distinct in forest trees; but even annual shrubs have a system of fibres similar to it. The analogy of nature is constant and uniform, and similar effects are usually produced by similar organs.

The *pith* occupies the centre of the wood, its texture is membranous; it is composed of cells, which are circular towards the extremity, and hexagonal in the centre of the substance. In the first infancy of the vegetable, the pith occupies but a small space. It gradually dilates, and in annual shoots and young trees offers a considerable diameter. In the more advanced age of the tree, acted on by the heart-wood, pressed by the new layers of the alburnum, it begins to diminish, and in very old forest trees disappears altogether.

Many different opinions have prevailed with regard to the use of pith. Dr. Hales supposed, that it was the great cause of the expansion and development of the other parts of the plants, that being the most interior, it was likewise most acted upon of all the organs, and that from its reaction the phenomena of their growth resulted.

Linnæus, whose lively imagination was continually employed in endeavors to discover analogies between the animal and vegetable systems, conceived "that the pith performed for the plant the same functions as the brain and nerves in animated beings." He considered it as the organ of irritability and the seat of life.

The latest discoveries have proved, that these two opinions are equally erroneous. Mr. Knight has removed the pith in several young trees and they continued to live and to increase.

It is evidently then only an organ of secondary importance. In early shoots, in vigorous growth it is filled with moisture, and it is a reservoir, perhaps, of fluid nourishment, at the time it is most wanted. As the heart-wood forms, it is more and more separated from the living part, the alburnum; its functions become extinct, it diminishes, dies, and at last disappears.

The *tendrils*, the *spines*, and other similar parts of plants are analogous in their organization to the branches, and offer a similar cortical and alburnous organization. It has been shown, by the late observations of Mr. Knight, that the directions of tendrils, and the spinal form they assume depend upon the unequal action of light upon them, and a similar reason has been assigned by Mr. Decandolle to account for the turning of plants towards the sun; that ingenious physiologist supposes that the fibres are shortened by the chemical agency of the solar rays upon them, and that consequently, the parts will move towards the light.

The leaves, the great sources of the permanent beauty of vegetation, though infinitely diversified in their forms are in all cases similar in interior organization, and perform the same functions.

The alburnum spreads itself from the foot stalks, into the very extremity of the leaf; it retains its vascular system and its living powers; and its peculiar tubes, particularly the tracheæ, may be distinctly seen in the leaf.

The green membranous substance may be considered as an extension of the parenchyma, and the fine and thin covering as the epidermis. Thus the organization of the roots and branches may be traced into the leaves, which present, however, a more perfect, refined and minute structure.

The great use of the leaves is for the exposure of the sap to the influence of the air, heat, and light. Their surface is extensive, the tubes and cells very delicate, and their texture porous and transparent.

In the leaves much of the water of the sap is evaporated; it is combined with new principles and fitted for its organizing functions, and probably passes in its prepared state, from the extreme tubes of the alburnum into the ramifications of the cortical tubes, and then descends through the bark.

On the upper surface of the leaves, which is exposed to the sun, the epidermis is thick but transparent, and is composed of matter possessed of little organization which is either principally earthy, or consists of some homogeneous chemical substance. In the grasses it is partly siliceous, in the laurel resinous, and in the maple and thorn it is principally constituted by a substance analogous to wax. By these arrangements any evaporation, except from the appropriated tubes, is prevented.

On the lower surface the epidermis is a thin transparent membrane full of cavities, and it is probably altogether by this surface that moisture and the principles of the atmosphere necessary to vegetation are absorbed. If a leaf be turned, so as to present its lower surface to the sun, its fibres will twist so as to bring it as much as possible into its original position; and all leaves elevate themselves on the foot stalk during their exposure to the solar light, and, as it were, move toward the sun.

This effect seems in a great measure dependant upon the mechanical and chemical agency of light and heat. Bonnet made artificial leaves, which when a moist sponge was held under the lower surface and a heated iron above the upper surface, turned exactly in the same manner as the natural leaves.

This, however, can be considered only as a very rude imitation of the natural process.

What Linnæus has called the sleep of the leaves, appears to depend wholly upon the defect of the action of light and heat, and the excess of the operation of moisture.

This singular but constant phenomenon had never been scientifically observed, till the attention of the botanist of Upsal was fortunately directed to it. He was examining particularly a species of lotus, in which four flowers had appeared during the day, and he missed two in the evening; by accurate inspection he soon discovered that these two were hidden by the leaves which had closed round them. Such a circumstance could not be lost upon so acute an observer.

He immediately took a lantern, went into the garden and witnessed a series of curious facts before unknown. All the simple leaves of the plants he examined, had an arrangement totally different from their arrangement in the day; and the greater number of them were seen closed or folded together.

The sleep of leaves is in some cases capable of being produced artificially. Decandolle made this experiment on the sensitive plant. By confining it in a dark place in the day time, the leaves soon closed; but on illuminating the chamber with many lamps, they again expanded. So sensible were they to the effects of light and radiant heat.

In the greater number of plants the leaves annually decay, and are reproduced; their decay takes place either at the conclusion of summer, as in very hot climates, when they are no longer supplied with sap, in consequence of the dryness of soil and the evaporating powers of heat; or in the autumn, as in the northern climates at the commencement of the frosts. The leaves preserve their functions in common cases no longer than there is a circulation of fluids through them. In the decay of the leaf, the color assumed seems to depend upon the nature of the chemical change, and the acids are generally developed, it is usually either reddish brown or yellow; yet there are great varieties. Thus in the oak, it is bright brown; in the beech, orange; in the elm, yellow; in the vine, red; in the sycamore, dark brown; in the cornel tree, purple; and in the woodbine, blue.

The cause of the preservation of the leaves of evergreens through the winter is not accurately known.

From the experiments of Hales it appears that the force of the sap is much less in the plants of this species, and probably there is a certain degree of circulation throughout the winter; their juices are less watery than those of other plants, and probably less liable to be congealed by cold, and they are defended by stronger coatings from the action of the elements.

The production of the other parts of the plant takes place at the time the leaves are most vigorously performing their functions. If the leaves are stripped off

from a tree in the spring it uniformly dies, and when many of the leaves of forest trees are injured by blasts, the trees always become stagheaded and unhealthy.

The leaves are necessary for the existence of the individual tree, the *flowers* for the continuance of the species. Of all the parts of the plants they are the most refined, the most beautiful in their structure and appear as the master-work of nature in the vegetable kingdom. The elegance of their tints, the variety of their forms, the delicacy of their organization, and the adaptation of their parts, are all calculated to awaken our curiosity, and excite our admiration.

In the flower there are to be observed, 1st, the *calyx*, or green membranous part forming the support of the colored floral leaves. This is vascular, and agrees with the common leaf in its texture and organization; it defends, supports, and nourishes the more perfect parts. 2d, the *corolla*, which consists either of a single piece, when it is called monopetalous, or of many pieces, when it is called polypetalous. It is usually very vivid in its color, is filled with an almost infinite variety of small tubes of the porous kind; it incloses and defends the essential parts in the interior, and supplies the juices of the sap to them. These parts are, 3d, the *stamens* and the *pistils*.

The essential part of the stamens are the summit or *anthers*, which are usually circular and of a highly vascular texture, and covered with a fine dust called the *pollen*.

The pistil is cylindrical, and surmounted by the *style;* the top of which is generally round and protuberant.

In the pistil, when it is examined by the microscope, congeries of spherical forms may usually be perceived, which seem to be the bases of future seeds.

It is upon the arrangement of the stamens and the pistils, that the Linnæan classification is founded. The numbers of the stamens and pistils in the same flower, their arrangements, or their division in different flowers, are the circumstances which guided the Swedish philosopher, and enabled him to form a system admirably adapted to assist the memory, and render botany of easy acquisition; and which, though it does not always associate together the plants most analogous to each other in their general characters, is yet so ingeniously contrived as to denote all the analogies of their most essential parts.

The pistil is the organ which contains the rudiments of the seed, but the seed is never formed as a reproductive germ, without the influence of the pollen, or dust on the anthers.

This mysterious impression is necessary to the continued succession of the different vegetable tribes. It is a feature which extends the resemblances of the different orders of beings, and establishes, on a great scale, the beautiful analogy of nature.

The ancients had observed, that different date trees, bore different flowers, and that those trees producing flowers which contained pistils bore no fruit, unless in the immediate vicinity of such trees as produced flowers containing stamens. This long established fact strongly impressed the mind of Malpighi, who ascertained several analogous facts with regard to other vegetables. Grew, however, was the first person who attempted to generalize upon them, and much just reasoning upon the subject may be found in his works. Linnæus gave a scientific and distinct form to that which Grew had only generally observed, and has the glory of establishing what has been called the sexual system, upon the basis of minute observations and accurate experiments.

The *seed*, the last production of vigorous vegetation, is wonderfully diversified in form. Being of the highest importance to the resources of nature, it is defended above all other parts of the plant; by soft pulpy substances, as in the esculent fruits, by thick membranes, as in the luguminous vegetables, and by hard shells, or a thick epidermis, as in the palms and grasses. In every seed there is to be distinguished, 1st, the *organ* of *nourishment;* 2d, the nascent plant, or the *plume;* 3d, the nascent root, or the *radicle*.

In the common garden bean, the organ of nourishment is divided into two lobes called *cotyledons;* the plume is the small white point between the upper part of the

lobes, and radicle is the small curved cone at their base.

In wheat, and in many of the grasses, the organ of nourishment is a single part, and these plants are called *monocotyledonous*. In other cases it consists of more than two parts, when the plants are called *phycotyledonous*. In the greater number of instances, it is, however, simply divided into two, and is *dicotyledonous*.

The matter of the seed, when examined in its common state, appears dead and inert; it exhibits neither the forms nor the functions of life. But let it be acted upon by moisture, heat and air, and its organized powers are soon distinctly developed. The cotyledons expand, the membranes burst, the radicle acquires new matter, descends into the soil, and the plume rises towards the free air. By degrees, the organs of nourishment of dicotyledonous plants become vascular, and are converted into seed leaves, and the perfect plant appears above the soil. Nature has provided the elements of germination on every part of the surface; water and pure air and heat are universally active, and the means for the preservation and multiplication of life, are at once simple and grand.

To enter into more minute details on the vegetable physiology would be incompatible with the objects of these lectures. I have attempted only to give such general ideas on the subject, as may enable the philosophical agriculturist to understand the functions of plants; those who wish to study the anatomy of vegetables, as a distinct science, will find abundant materials in the works of the authors I have quoted, page 9, and likewise in the writings of Linnæus, Desfontaines, Decandolle, de Saussure, Bonnet, and Smith.

The history of the peculiarities of structure in the different vegetable classes, rather belong to botanical than agricultural knowledge. As I mentioned in the commencement of this lecture, their organs are possessed of the most distinct analogies, and are governed by the same laws. In the grasses and palms, the cortical layers are larger in proportion than the other parts; but their uses seem to be the same as in forest trees.

In bulbous roots, the alburnous substance forms the largest part of the vegetable; but in all cases it seems to contain sap, or solid materials deposited from the sap. The slender and comparatively dry leaves of the pine and the cedar perform the same functions as the large and juicy leaves of the fig tree, or the walnut.

Even in the cryptogamia, where no flowers are distinct, still there is every reason to believe that the production of seed is effected in the same way as in the more perfect plants. The mosses, and lichens, which belong to this family, have no distinct leaves, or roots, but they are furnished with filaments which perform the same functions; and even in the fungus and the mushroom there is a system for the absorption and aeration of the sap.

It was stated in the last lecture, that all the different parts of plants are capable of being decomposed into a few elements. Their uses as food, or for the purposes of the arts, depend upon compound arrangements of those elements which are capable of being produced either from their organized parts, or from the juices they contain; and the examination of the nature of these substances, is an essential part of agricultural chemistry.

Oils are expressed from the fruits of many plants, resinous fluids exude from the wood; sacharine matters are afforded by the sap; and dying materials are furnished by the leaves, or petals of flowers; but particular processes are necessary to separate the different compound vegetable substances from each other, such as maceration, infusion, or digestion in water, or spirits of wine; but the application and the nature of these processes will be better understood, when the chemical nature of the substances is known; the consideration of them will, therefore, be reserved for another place in this lecture.

The compound substances found in vegetables are, 1, gum or mucilage, and its different modifications; 2, starch; 3, sugar; 4, albumen; 5, gluten; 6, gum elastic; 7, extract; 8, tannin; 9, indigo; 10, narcotic principle; 11, bitter principle; 12, wax; 13, resins; 14, camphor; 15, fixed oils; 16, volatile oils; 17, woody-fibre; 18, acids; 19, alkalies; earths, metallic oxides and saline compounds.

I shall describe generally the properties and composition of these bodies, and the manner in which they are procured.

1. *Gum* is a substance which exudes from certain trees; it appears in the form of a thick fluid, but soon hardens in the air, and becomes solid; when it is white, or yellowish, white more or less transparent, and somewhat brittle, its specific gravity varies from 1300 to 1490.

There is a great variety of gums, but the best known are gum arabic, gum senegal, gum tragacanth, and the gum of the plum or cherry tree. Gum is soluble in water, but not soluble in spirits of wine.

If a solution of gum be made in water, and spirits of wine or alcohol be added to it, the gum separates in the form of white flakes. Gum can be made to inflame only with difficulty; much moisture is given off in the process, which takes place with a dark smoke and feeble blue flame, and a coal remains.

The characteristic poperties of gum are its easy solubility in water, and its insolubility in alcohol. Different chemical substances have been proposed for ascertaining the presence of gum, but there is reason to believe that few of them afford accurate results; and most of them (particularly the metallic salts,) which produce changes in solutions of gum, may be conceived to act rather upon some saline compounds existing in the gum, than upon the pure vegetable principle. Dr. Thomson has proposed an aqueous solution of silica in potassa as a test of the presence of gum; in solutions he states that the gum and silica are precipitated together:—this test, however, cannot be applied with correct results in cases when acids are present.

Mucilage must be considered as a variety of gum; it agrees with it in its most important properties, but seems to have less attraction for water.

According to Hermbstadt, when gum and mucilage are dissolved together in water, the mucilage may be separated by means of sulphuric acid;—mucilage may be procured from linseed, from the bulbs of the hyacinth, from the leaves of the marsh-mallows, from several of the lichens, and from many other vegetable substances.

From the analysis of M.M. Gay Lussac and Thenard, it appears that gum arabic contains in 100 parts of carbon 42.23, of oxygen 50.84, and of hydrogen 6.93, with a small qantity of saline and earthy matter, or of carbon 42.23, oxygen and hydrogen in the proportions necessary to form water—57.77. This estimation agrees very nearly with the definite proportions of 11 of carbon, 10 of oxygen, and 20 of hydrogen.

All the varieties of gum and mucilage are nutritious as food. They either partially or wholly lose their solubility in water by being exposed to a heat of 500° or 600° Fahrenheit, but their nutritive powers are not destroyed unless they are decomposed. Gum and mucilage are employed in some of the arts, particularly in calico printing; till lately, in this country the calico printers used gum arabic, but many of them at the suggestion of Lord Dundonald, now employ the mucilage from lichens.

2. *Starch* is procured from different vegetables, but particularly from wheat or potatoes. To make starch from wheat, the grain is steeped in cold water till it becomes soft, and yields a milky juice by pressure; it is then put into sacks of linen, and pressed in a vat filled with water: as long as any milky juice exudes, the pressure is continued; the fluid gradually becomes clear and a white powder subsides, which is starch.

Starch is soluble in boiling water, but not in cold water, nor in spirits of wine. According to Dr. Thomson, it is a characteristic property of starch to be soluble in a warm infusion of nut-galls, and to form a precipitate when the infusion cools.

Starch is more readily combustible than gum; when thrown upon red-hot iron, it burns with a kind of explosion, and scarcely any residuum remains.

According to Gay Lussac and Thenard, 100 parts of starch are composed of,—

Carbon, with a small quantity of saline and earthy matter,	43.55
Oxygen, - - - -	49.68
Hydrogen, - - - -	6.77
Or Carbon, - - - -	43.55
Oxygen and hydrogen in the proportions necessary to form water,	56.45

Supposing this estimation correct, starch may be conceived to be constituted by 15 proportions of carbon, 13 of oxygen, and 26 of hydrogen.

Starch forms a principal part of a number of esculent vegetable substances. Sowans, cassava, salop, sago, all of them owe their nutritive powers principally to the starch they contain.

Starch has been found in the following plants:

Burdock (Arctium lappa,) Deadly Nightshade (Atropa belladonna,) Bistort (Polygonum bistorta,) White Bryony (Bryonia alba,) Meadow Saffron (Colchicum autumnale,) Dropwort (Spirea filipendula,) Buttercup (Ranunculus bulbosos,) Figwort (Scrophularia nodosa,) Dwarf Elder (Sambucus ebulus,) Common Elder (Sambucus nigra,) Foolstones (Orchis morio,) Alexanders (Imperatorio ostruthium,) Henbane (Hyoscyamus niger,) Broad-leaved dock (Rumex obtusifolius,) Sharp pointed Dock (Rumex acutus,) Water Dock (Rumex aquaticus,) Wake Robin (Arum maculatum,) Salep (Orchis mascula,) Fleur de luce or Water Flag, (Iris pseudocorous,) Stinking Gladwyn (Iris fœtidissima,) Earth Nut (Bunium bulbœastanum.)

3. *Sugar* in its purest state is prepared from the expressed juice of the *Saccharum officinarum*, or sugar cane; the acid in this juice is neutralized by lime, and the sugar is crystallized by the evaporation of the aqueous parts of the juice, and slow cooling: it is rendered white by the gradual filtration of water through it. In the common process of manufacture, the whitening or refining of sugar is only affected in a great length of time: the water being gradually suffered to percolate through a stratum of clay above the sugar. As the coloring matter of sugar is soluble in a saturated solution of sugar, or syrup, it appears that refining may be much more rapidly and economically performed by the action of syrup of colored sugar.* The sensible properties of sugar are well known. Its specific gravity, according to Fahrenheit, is about 1.6. It is soluble in its own weight of water at 50°; it is likewise soluble in alcohol, but in smaller proportions.

Lavoisier concluded from his experiments, that sugar consists in 100 parts of—

28 carbon,
8 hydrogen,
64 oxygen.

Dr. Thomson considers 100 parts of sugar is composed of—

27.5 carbon,
7 8 hydrogen,
64.7 oxygen.

According to recent experiments of Gay Lussac and Thenard, sugar consists of—

42.47 of carbon, and
57.53 of water, or its elements.

Lavoisier's and Dr. Thomson's analyses agree very nearly with the proportions of—

3 of carbon,
4 of oxygen,
8 of hydrogen.

Gay Lussac's and Thenard's estimation gives the same elements as in gum: 11 of carbon, 10 of oxygen, 20 of hydrogen.

It appears from the experiments of Proust, Achard, Goettling and Parmentier, that there are many different species of sugar ready formed in the vegetable kingdom. The sugar which most nearly resembles that of the cane, is extracted from the sap of the American Maple, *Acer saccharinum*. This sugar is used by the North American farmers, who procured it by a kind of domestic manufacture. The trunk of the tree is bored early in the spring, to the depth of about two inches; a wooden spout is introduced into the hole; the juice flows for about five or six weeks. A common sized tree, that is, a tree from two to three feet

* A French gentleman lately in this country (England) stated to the West India planters that he was in possession of a very expeditious and economical method of purifying and refining, which he was willing to communicate to them for a very great pecuniary compensation. His terms were too high to be acceded to. Conversing on the subject with Sir John Banks, I mentioned to him, that I thought it probable that raw sugar might be easily purified by passing syrup through it, which would dissolve the coloring matter. The same idea seems to have occurred about the same time, or before, to Edward Howard, Esq., who has since proved its efficacy experimentally, and has published an account of his process.

in diameter, will yield about 200 pints of sap, and every 40 pints of sap afford about a pound of sugar. The sap is neutralized by lime, and deposits crystals of sugar by evaporation.

The sugar of grapes has been lately employed in France as a substitute for colonial sugar. It is procured from the juice of ripe grapes by evaporation, and the action of pot-ashes; it is less sweet than common sugar, and its taste is peculiar: it produces a sensation of cold while dissolving in the mouth; and it is probable contains a larger proportion of water or its elements. The roots of the beat (Beta vulgaris and cicla,) afford a peculiar sugar, by boiling, and the evaporation of the extract: it agrees in its general properties with the sugar of grapes, but has a slightly bitter taste. *Manna*, a substance which exudes from various trees, particularly from the Fraxinus ornus, a species of ash, which grows abundantly in Sicily and Calabria, may be regarded as a variety of sugar, very analogous to manna; it has been extracted by Fourcroy and Vauquelin, from the juice of the common onion, (Alium cepa.)

Besides the crystallized and solid sugars, there appears to be a sugar which cannot be separated from water, and which exists only in a fluid form; it constitutes a principal part of molasses, or treacle; and it is found in a variety of fruits: it is more soluble in alcohol than solid sugar.

The simplest mode of detecting sugar, is that recommended by Margraaf. The vegetable is to be boiled in a small quantity of alcohol: solid sugar, if any exists, will separate during the cooling of the solution. Sugar has been extracted from the following vegetable substances:— The sap of the Birch (Betula alba,) of the Sycamore (Acer pseudoplatanus,) the Bamboo (Arundo bambos,) Maize (Zea mays,) Cow Parsnip (Heracleum sphondylium,) Cocoa nut tree (Cocos nucifera,) Walnut tree (Juglans alba,) American Aloe (Agave americana,) Dulse (Facus palmatus,) Common Parsnip (Pastinica sativa) St. John's bread (Ceratonia siliqua,) the fruit of the common Arbutus (Arbutus unedo,) and other sweet tasted fruits; the roots of the Turnip, (Brassica papa,) of the Carrot (Daucus carota,) Parsley, (Apium petroselinum,) the flower of the Euxine, Rhododendron, (Rhododendron ponticum,) and from the nectarium of most other flowers.

The nutritive properties of sugar are well known. Since the British market has been overstocked with this article from the West India Islands, proposals have been made for applying it as the food of cattle; experiments have been made which proved that they may be fattened by it; but difficulties connected with the duties laid on sugar, have hitherto prevented the plan from being tried to any extent.

4. *Albumen* is a substance which has only lately been discovered in the vegetable kingdom. It abounds in the juice of the papaw-tree, (Carica papaya:) when this juice is boiled the albumen falls down in a coagulated state. It is likewise found in mushrooms, and in different species of funguses.

Albumen in its pure form is a thick, glairy, tasteless fluid; precisely the same as the white of an egg; it is soluble in cold water; its solution, when not too diluted, is coagulated by boiling, and the albumen separates in the form of thin flakes. Albumen is likewise coagulated by acids and by alcohol: a solution of albumen gives a precipitate when mixed with a cold solution of nut-gall. Albumen when burnt produces a smell of volatile alkali, and affords carbonic acid and water; it is, therefore, evidently principally composed of carbon, hydrogen, oxygen and azote.

According to the experiments of Gay Lussac and Thenard, 100 parts of albumen from the white of the egg are composed of carbon 52.883; oxygen 23.872; hydrogen 7.540; azote 15.705. This estimation would authorize the supposition that albumen is composed of 2 proportions of azote, 5 oxygen, 9 carbon, 23 hydrogen. The principal part of the almond, and of the kernels of many other nuts, appears from the experiments of Proust, to be a substance analogous to coagulated albumen.

The juice of the fruit of the Ochra (Hibiscus esculentus) according to Dr. Clark, contains a liquid albumen in such quan-

tities, that it is employed in Dominica as a substitute for the white of eggs in clarifying the juice of sugar-cane.

Albumen may be distinguished from other substances by its property of coagulating by the action of heat or acids, when dissolved in water. According to Dr. Bostock when the solution contains only one grain of albumen to 1000 grains of water, it becomes cloudy by being heated. Albumen is a substance common to the animal as well as to the vegetable kingdom, and much more abundant in the former.

Fire Extinguisher —These are either *simple* or *compound* solutions. One of the former consists of 75 gallons of water and 9 gallons of the strongest solution of wood ashes. Among the latter,—To 75 gallons of water, with 18 quarts of the strongest solution of wood ashes, add 18 quarts of fine clay, reduced to powder,—or 15 quarts of the strongest herring-pickle, and 15 quarts of red ochre, with 75 gallons of water,—or burnt alum 30 lbs., green vitriol in powder 40 lbs., cinabrese, or red ochre pulverized, 20 lbs., Potters' or other clay finely powdered and sifted 200 lbs., water 620 lbs.—Another,—Dissolve such a quantity of pot-ash in cold water as that fluid is capable of holding in solution, wash or daub with it all the boards, wainscotting, shingles, &c., which are intended to be prepared. Then dilute the same liquor with a little water, add to it such a portion of fine yellow clay as will make the mixture of the consistence of the common paint employed on wood ; and lastly, stir into it a small quantity of flour paste, in order to combine both substances intimately. With this mixture all wooden materials ought to be coated three or four times similar to painted work. The proportions and quantity recommended to cover a square rood (French measure and weight) of deal boards is 20 lbs. of sifted yellow clay, 1½ lbs. of flour for making the paste, and 1 lb. of pot-ash. It is said that wood covered with this substance never bursts into flame; and that most of the moveable wooden furniture of a house may be covered with it so that it may be reduced to coals without communicating fire to the house and spreading the conflagration (as is frequently done where this process is not adopted,) thereby giving time for the inmates to escape and remove their valuable articles of furniture.

Frost counteracted.—As the blossoms of fruit trees are more particularly affected by early frosts, the following plan has been recommended to counteract the injurious effects of the same.—A rope is to be interwoven among the branches of the tree, and one end of it immersed in a pail of water. This rope it is said will act as a conductor and convey the effects of the frost from the tree to the water.—Both hemp and straw have been recommended for this purpose.

Friction, in medicine, is the act of rubbing a diseased part with oils, unguents, and other matters, in order to ease, relieve and cure it. Friction is also performed with flannel, which is highly recommended particularly to sedentary persons, who will find much benefit, particularly in the morning before eating. *Medicated* frictions, or the introduction of the most active medicines into the human system, might be attended with the most beneficial effects, especially in all chronical diseases, instead of the stomach being selected for the application of all remedies.

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OF AGRICULTURE, SCIENCE, AND ART.

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The object of this paper is to concentrate and preserve, in a form suitable for future reference, the most useful and interesting articles on the aforesaid subjects. Each number will contain sixteen octavo pages, printed on good paper, and when a sufficient amount is published to form a volume of convenient size, an alphabetical table of contents will be published and forwarded to subscribers, in order for binding. This number, shows the general plan of the work.

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From M. Faraday's Lecture.

GURNEY'S OXY-OIL LAMP.

In the Catopric system practised in our light-houses, a light of seven-eighths of an inch in diameter is placed in the focus of a parabola, which light gives 15 degrees of divergence, and consequently each reflector illuminated 15 degrees of the horizon. In the Dioptric system, as practised on the French coasts, a light of three and a half inches in diameter is necessary to give the required divergence. The lime light, though one of great intensity, gives no divergence; when placed in a parabola, it throws parallel rays; and when placed in the centre of the Polyzonal lens, could not be made to give one degree of divergence. In the spring of 1835, Mr. Gurney proposed, by combining oxygen with the flame of wax or oil, to obtain a light of great power to which these objections would not apply. In explanation of this light, we must first observe the well known fact, that oxygen increases the brilliancy of burning bodies to a very great extent; thus sulphur, which burns in atmospheric air with a pale blue and scarcely visible flame, when put into oxygen, gives a very intense light, and phosporous, when so surrounded, gives out a light so intense that the eye cannot bear it. The same happens with charcoal, and with the flame of oil or wax, or other bodies which contain it. Dr. Priestly proposed to supply the common argand burner with oxygen instead of common air, and made a long series of experiments with a view of producing a light of this description. All flame is hollow, or, in other words, consists of a thin film or bubble of ignited matter, which surrounds and contains a quantity of the decomposed combustible body supplying it. In the flame of spirits of wine, the interior of the film is chiefly filled with hydrogen; in that of oil or wax it is filled with separated carbon—olefiant gas. Dr. P. applied oxygen to the outside of the film or bubble, or rather in the argand lamp, which he used, double cylindrical films. The outside portion of the flame consists, in its burning state, of half consumed carbon in the act of combination with the atmosphere. The oxygen, therefore, in Dr. P.'s arrangement, met with carbon in a half state of combination, and produced only a brilliancy in proportion. Mr. Gurney proposed to introduce the oxygen into the interior of the bubble, and to strike the film, or its outside surface where the carbon was pure and uncombined. He did so; and succeeded in the construction of this light for the Catopric system; there are four small flames in a line of about three-eighths of an inch in diameter each; the oxygen is introduced by a small jet, the light from each jet is equal in quantity to two and a half, making in all, ten ordinary argand burners. The divergence of it in a parabola is fifteen degrees. The light for the polyzonal lens consists of a circular series of seventeen films or bubbles of flame—and stuck on the inte-

rior by as many jets; the diameter of the whole is three and a half inches, the same as the French lamp; it gives the same divergence, with a power equal to sixty argands. The French lamp only ten. Mr. Gurney's lamp is cheaper than the French, in the proportion of twelve to seventeen, taking all wear and tear into account. Oxygen is obtained by heating black oxide of manganese, which is found in large quantities in Cornwall and Devonshire. *London Athenæum.*

The London Literary Gazette of Feb. 23, says, "The cost of oxygen is a great addition to the expense of oil, &c. The value of a pint of oil is about ten pence, which is calculated to burn, say for one hour, the oxygen required for that measure, and that time in the oxy-lamp would be ten cubic feet, and its value would be twenty pence. Here is an addition of double the cost of the oil, and the light cannot be obtained for less than 2*s.* 6½*d.* But compare this with the other arrangements. To produce the same light for the same time, not now taking into consideration the form or dimensions of the light (that question being settled) it would take 37½ argands, which would consume 2½ pints of oil, and cost 2*s.* 6*d.* The same light in Fresnels would incur a charge of 3*s.* 11*d.* Thus it is shown satisfactorily, that in every respect, Gurney's oxy-oil lamp is superior for light-house purposes, to any other ever invented. It possesses, also, many advantages, which our space will not permit us to describe.

FUEL.

Doctor Black divides fuels into five classes. The first comprehends the fluid inflammable bodies; the second, peat or turf; the third, charcoal of wood; the fourth, pit-coal charred; and the fifth, wood, or pit-coal, in a crude state, and capable of yielding a copious and bright flame. The fluid inflammables are considered as distinct from solid, on this account, that they are capable of burning upon a wick, and become in this way the most manageable sources of heat; though, on account of their price, they are never employed for producing it in great quantities, and are only used when a gentle degree, or a small quantity of heat, is sufficient. The species which belong to this class are alcohol and different oils. The first of these, alcohol, when pure and free of water, is as convenient and manageable a fuel for producing moderate or gentle heats as can be desired. Its flame is perfectly clean, and free from any kind of soot; it can easily be made to burn slower or faster, and to produce less or more heat, by changing the size or number of the wicks upon which it burns; for, as long as these are fed with spirit, in a proper manner, they continue to yield flame of precisely the same strength.

The cotton, or other materials, of which the wick is composed, is not scorched or consumed in the least, because the spirit with which it is constantly soaked is incapable of becoming hotter than 174° Fahrenheit, which is considerably below the heat of boiling water. It is only the vapor that arises from it which is hotter, and this, too, only in its outer parts, that are most remote from the wick, and where only the combustion is going on, in consequence of communication and contact with the air. At the same time, as the alcohol is totally volatile, it does not leave any fixed matter, which by being accumulated on the wick, might render it foul, and fill up its pores.

The wick, therefore, continues to imbibe the spirit as freely, after some time, as it did at the first. These are qualities of alcohol as a fuel. But these qualities belong only to a spirit that is very pure. If it be weak, and contain water, the water does not evaporate so fast from the wick as the more spirituous part; and the wick becomes, after some time, so much soaked with water, that it does not imbibe the spirit properly. The flame becomes much weaker, or is altogether extinguished. When alcohol is used as a fuel, therefore, it ought to be made as strong or free from water, as possible.

Oil, although fluid like spirit of wine, and capable of burning in a similar manner, is not so convenient in many respects. It is disposed to emit soot; and this, applying itself to the bottom of the vessel exposed to it, and increasing in thickness, forms, by degrees, a soft and spongy medium, through which heat is not so freely and quickly transmitted. It is true,

we can prevent this entirely by using very small wicks, and increasing the number, if necessary, to produce the heat required. Or we may employ one of those lamps, in which a stream of air is allowed to rise through the middle of the flame, or to pass over its surface with such velocity as to produce a more complete inflammation than ordinary. But we shall be as much embarrassed in another way ; for the oils commonly used, being capable of assuming a heat greatly above that of boiling water, scorch and burn the wick, and change its texture, so that it does not imbibe the oil so fast as before. Some have attempted a remedy, by making the wick of incombustible materials, as asbestos, or wire; but still, as the oil does not totally evaporate, but leaves a small quantity of gross, fixed, carbonaceous matter, this, constantly accumulating, clogs the wick to such a degree, that the oil cannot ascend, the flames become weaker, and, in some cases, are entirely extinguished.

There is, however, a difference among the different oils in this respect, some being more totally volatile than others. But the best are troublesome in this way, and the only remedy is, to change the wicks often, though we can hardly do this and be sure of keeping always an equal flame.

The second kind of fuel mentioned, peat, is so spongy, that, compared with the more solid fuels, it is unfit to be employed for producing very strong heats. It is too bulky for this; we cannot put into a furnace, at a time, a quantity that corresponds with the quick consumption that must necessarily go on when the heat is violent. There is, no doubt, a great difference in this respect among the different kinds of this fuel; but this is the general character of it. However, when we desire to produce and keep up, by means of cheap fuel, an extremely mild, gentle heat, we can hardly use any thing better than peat. But it is best to have it charred, or burnt to a black coal. The advantages gained by having it charred are considerable. When it is prepared for use in that manner, it is capable of being made to burn more slowly and gently, or will bear, without being extinguished altogether, a greater diminution of the quantity of air with which it is supplied, than any other of the solid fuels.

The next fuel in order is the charcoal of wood. This is prepared by piling up billets of wood into a pyramidal heap, with several spiracles, or flues, formed through the pile. Chips and brush-wood are put into those below, and the whole is so constructed as to kindle throughout in a very short time. It would burst out into a blaze, and be quickly consumed to ashes, were it not covered all over with earth or clay, beaten close, leaving openings at all the spiracles. These are carefully watched; and whenever the white, watery smoke is observed to be succeeded by thin, blue and transparent smoke, the hole is immediately stopped, this being the indication of all the watery vapor being gone, and the burning of the true coaly matter commencing. Thus is a pretty strong heat raised through the whole mass, and all the volatile matters are dissipated by it, and nothing now remains but the charcoal. The holes being all stopped in succession, as this change of the smoke is observed, the fire goes out for want of air. The pile is now allowed to cool. This requires many days; for, charcoal being a very bad conductor of heat, the pile long remains red hot in the centre, and, if opened in this state, would instantly burn with fury.

Small quantities may be procured at any time, by burning wood in close vessels. Little pieces may be very finely prepared, at any time, by plunging the wood into lead red hot. This kind of fuel is much used by chemists, and has many good properties. It kindles quickly, emits few watery or other vapors, while burning, and, when consumed, leaves few ashes, and those very light. They are, therefore, easily blown away, so that the fire continues open, or pervious to the current of air which must pass through it to keep it burning. This sort of fuel, too, is capable of producing as intense a heat as can be obtained by any; but in violent heats it is quickly consumed, and needs to be frequently supplied.

Fossil coals charred, called *cinders*, or

cokes, have, in many respects, the same properties as charcoal of wood; as kindling more readily in furnaces than when they are not charred, and not emitting watery, or other gross smoke, while they burn. This sort of charcoal is even greatly superior to the other in some properties. It is a much stronger fuel, or contains the combustible matter in greater quantity, or in a more condensed state. It is, therefore, consumed much more slowly on all occasions, and particularly when employed for producing intense melting heats. The only inconveniences that attend it are, as it consumes, it leaves much more ashes than the other, and these much heavier too, which are, therefore, liable to collect in such quantity as to obstruct the free passage of air through the fire; and further, that when the heat is very intense, these ashes are disposed to melt or vitrify into a tenacious, drossy substance, which clogs the grate, the sides of the furnace, and the vessels. This last inconvenience is only troublesome, however, when the heat required is very intense.

In ordinary heat, the ashes do not melt, and though they are more copious and heavy than those of charcoal of wood, they seldom choke up the fire considerably, unless the bars of the grate be too close together. This fuel, therefore, is preferable, in most cases, to the charcoal of wood, on account of its burning much longer, or giving much more heat before it is consumed. The heat produced by equal quantities, by weight, of pit-coal, wood-charcoal, and wood itself, is nearly in proportion of 5, 4, and 3. The reason why both these kinds of charcoal are preferred, on most occasions, in experimental chemistry, to crude wood, or fossil coal, from which they are produced, is, that the crude fuels are deprived, by charring, of a considerable quantity of water, or some other volatile principles which are evaporated during the process of charring, in the form of sooty smoke or flame.

These volatile parts, while they remain in the fuel, make it unfit (or less fit) for many purposes in chemistry. For, besides obstructing the vents with sooty matter, they require much heat to evaporate them; and therefore the heat of the furnace, in which they are burned, is much diminished and wasted by every addition of fresh fuel, until the fresh fuel is completely inflamed, and restores the heat to its former strength. But these great and sudden variations of the heat of a furnace are quite inconvenient in most chemical processes.

In the greater number of chemical operations, therefore, it is much more convenient to use charred fuel, than the same fuel in its natural state. It is proper to be on our guard against the dangerous nature of the burnt air which arises from charcoal of all kinds. Charcoal burns without visible smoke. The air arising from it appears to the eye as pure and as clear as common air. Hence it is much used by those persons who are studious of neatness and cleanliness in their apartments. But this very circumstance should make us more watchful against its effects, which may prove dangerous, in the highest degree, before we are aware of it. The air arising from common crude fuel is, no doubt, as bad, but the smoke renders it disagreeable before it becomes dangerous.

The first sensation is a slight sense of weakness; the limbs seem to require a little attention, to prevent falling. A slight giddiness succeeds, accompanied by a feeling of a flush or glow in the face and neck. Soon after, the person becomes drowsy, would sit down, but commonly falls, insensible of all about him, and breathes strong, snoring as in an apoplexy. If the person is alarmed in time, and escapes in the open air, he is commonly seized with a violent headache, which gradually abates. But when the effect is completed, as above described, death very soon ensues, unless relief be obtained. There is usually a foaming at the mouth, a great flush or suffusion over the face and neck, and every indication of an oppression of the brain, by this accumulation of blood. The most successful treatment is, to take off a quantity of blood immediately, and throw cold water on the head repeatedly. A strong stimulus, such as hartshorn, applied to the soles of the feet, has also a very good effect.

The fifth and last kind of fuel is wood,

or fossil coals, in their crude state, which it is proper to distinguish from charcoals of the same substances. The difference consists in their giving a copious and bright flame, when plenty of air is admitted to them, in consequence of which they must be considered as fuels very different from charcoal, and adapted to different purposes. Flaming fuel cannot be managed like the charcoal. If little air be admitted it gives no flame, but sooty vapor, and a diminution of heat. And if much air be admitted to make those vapors break out into flame, the heat is too violent.

These flaming fuels, however, have their particular uses, for which the others are far less proper. For flame, when produced in great quantity, and made to burn violently, by mixing it with a proper quantity of fresh air, by driving it on the subject, and throwing it into whirls and eddies, which mix the air with every part of the hot vapor, gives a most intense heat. This proceeds from the vaporous nature of flame, and the perfect miscibility of it with the air. As the immediate contact and action of the air are necessary to the buring of every combustible body, so the air, when properly applied, acts with far greater advantage on flame than on the solid and fixed inflammable bodies; for when air is applied to these last, it can only act on their surface, or the particles of them that are outermost; whereas, flame being a vapor or elastic fluid, the air by proper contrivances, can be intimately mixed with it, and made to act on every part of it, external and internal, at the same time. The great power of flame, which is the consequence of this, does not appear when we try small quantities of it, and allow it to burn quietly, because the air is not intimately mixed with it, but acts only on the outside, and the quantity of burning matter in the surface of a small flame is too small to produce much effect. But when flame is produced in large quantity, and is properly mixed and agitated with air, its power to heat bodies is immensely increased. It is therefore peculiarly proper for heating large quantities of matter to a violent degree, especially if the contact of solid fuel with such matter is inconvenient.

Flaming fuel is used, for this reason, in many operations performed on large quantities of metal, or metallic minerals, in the making of glass, and in the baking or burning of all kinds of earthen ware.

The potter's kiln is a cylindrical cavity filled from the bottom to the top with columns of ware: the only interstices are those that are left between the columns; and the flame, when produced in sufficient quantity, is a torrent of liquid fire, constantly flowing up through the whole of the interstices, which heats the whole pile in an equal manner. Flaming fuel is also proper in many works or manufactories, in which much fuel is consumed, as in breweries, distilleries, and the like. In such works, it is evidently worth while contrive the furnaces, so that heat may be obtained from the volatile parts of the fuel, as well as from the fixed; for when this is done, less fuel serves the purpose than would otherwise be necessary.

But this is little attended to, or not understood, in many of those manufactories. It is not uncommon to see vast clouds of black smoke and vapor coming out of their vents. This happens in consequence of their throwing too large a quantity of crude fuel into the furnace at once. The heat is not sufficient to inflame it quickly, and the consequence is a great loss of heat. The quantity of watery fluid contained in fuel greatly affects the amount of heat it produces; much more, indeed, than is commonly admitted in practice. It is a well known law in chemistry, that the evaporation of liquids, or their conversion into steam, consumes and renders latent a great amount of caloric. When green wood, or wet coals, are added to the fire, they abstract from it, by degrees, a sufficient part of its heat to convert their own sap or moisture into steam, before they are capable of being burnt. And as long as any considerable part of this fluid remains unevaporated, the combustion goes on slowly, the fire is dull, and the heat feeble. Green wood commonly contains a third, or more, of its weight of watery fluid, the quantity varying according to the greater or less porosity of different trees. Nothing is further from true economy than to burn green wood,

or wet coal, on the supposition that, because they are more durable, they will in the end prove more cheap. It is true, their consumption is less rapid; but to produce a given amount of heat, a far greater amount of fuel must be consumed. Wood that is dried under cover is better than wood dried in the open air, being more free from decomposition.

ACETOUS ETHER IN DEAFNESS.

The vapor of Acetous Ether has been recently discovered by Kramer, a German artist, to be a most effectual remedy for a species of this distressing malady, hitherto considered incurable. We perceive by the last number of Dunglison's Medical Intelligencer, that it has been recently employed by Dr. Bolton of this city, with remarkable success.

Richmond Whig.

SILVER SEPARATED FROM OTHER SUBSTANCES BY ELECTRO-MAGNETISM.

The late discovery of Baquere, to extract the minutest portions of silver when contained in its ores, bids fair to be of incalculable benefit to this country, where the production of the precious metals has, from various causes, been much retarded. Electro-magnetism is the power which forces the silver, however tenaciously adhering to its various metals, salts, or acids, and however small the proportions of the same to the other substances may be, even one part in a thousand, to separate, and appear in a pure metallic state.—*Alex. Gaz.*

LIMITS OF SPEED ON RAILWAYS.

Dr. Lardner has discovered, by experiments recently made on the Liverpool and Manchester railway, that the atmosphere is an opponent to railway speed, more formidable than has ever been suspected. At thirty two miles an hour, the resistance it offers, is nearly 80 per cent. of all that steam power has to encounter, and it increases in a proportion so much greater than the speed, that there is not the slightest possibility of any such velocity of transit being gained as some (and none among them more than Dr. Lardner, himself) have anticipated. It is ascertained that even forty miles an hour cannot be maintained except at a cost which amounts politically to a prohibition.—*Penn. Intel.*

USEFUL HINTS.

Apply common table salt to remove fruit stains from linen before the stain becomes dry, this will keep it damp until it is taken to the wash; when without any further trouble, or attention, it will entirely disappear by the usual process of washing. Spirits of salt, oxalic acid, salt of lemons, are the usual applications to extract those unsightly stains, *iron mould or rust*, all of which require great caution to be observed to prevent injury to the fabric, that the article be well rinsed after the application, till on applying the tongue to it, no acid taste remains.

Mahogany tables are polished by the use of *white soap*, white and yellow wax; grate a quarter of an ounce of white soap, hold it over a fire in an earthen vessel with a pint of water until it is dissolved, then add the same weight of white and yellow wax cut into small pieces; as soon as the whole is incorporated, it is fit for use. Clean the table well, dip a piece of flannel into this varnish while warm, apply it to the table as quickly as possible, then let it remain a short time, then rub it in well with a stiff brush in every direction, afterwards with a clean woolen cloth; this will produce a very brilliant gloss.

Fam. Mag.

CLARKE ON THE MULBERRY TREE AND SILK WORM.

This is a large duodecimo volume, embellished with appropriate engravings, by John Clarke, superintendent of the Morodendron Silk Company of Philadelphia. The book contains a history of silk in Asia, Europe, Africa, and America. The second part treats of the various kinds of mulberry and their culture, on the value of trees, their products, &c. On the worm, its nature, diseases, preventives, remedies, &c.

The character of the worm from the first day, to the close of its useful life, preparing the cocoons, reeling the silk, coloring, &c.

The work seems to be a perfect manual. We of course are not prepared to decide

upon its merits, but it contains prima facie evidence of its great worth. The work is for sale by Thomas, Copperthwaite & Co.

United States Gazette.

THE SYRIAN SHEEP,

Brought to this country, by Commodore Elliot, may be seen at the Malhausen Works, below the Navy Yard. The fleece of this animal is that used in the manufacture of the Cashmere shawl of the East.—*Ib.*

A NEW ALLOY.

The American Sentinel states, that the French Academy is investigating a new alloy of zinc and copper, that resists sulphuric acid of 20 degrees concentration. It costs but little more than zinc. Tin and lead are also added for certain purposes, in proportions that will not augment the cost more than a farthing a pound.

CHERRIES, ETC.

Cherries and all kinds of berries may be kept a year, by partially drying them, until they are wilted—then put them into wide necked bottles, cork them tight, put a coating of sealing wax over the corks, or tye a cork plaster over them;—a cork plaster may be made by dipping pieces of thin silk into a solution of isinglass, glue and water, then dip silk in the white of eggs several times, dry them, and they are fit for use. Jars of sweetmeats may also be kept a long time in the same way.

An effectual method of preserving eggs fresh and sweet, many months: dip them in hot oil or lard while fresh, place them in a box of dry bran, chaff or sand, keep them in a cool place.

CEMENT.

A strong cement for mending earthen ware may be made by mixing equal quantities of flour and powdered alum, intimately with cold water; heat the mixture gradually, stirring it all the while until it boils; use it when hot—let the articles cemented be perfectly dry before using them.

FRUIT TREES.

While young, no tree should be permitted to bear a large quantity of fruit, and if it abound in blossoms, the fruit should be gathered as soon as formed, leaving only half a dozen of the produce to ascertain its size and quality; by this measure the trees will not only produce larger and finer fruit, but by being kept clear, the leading and collateral branches will every year become more vigorous. Nor ought any young plant, or newly engrafted tree be permitted to *run mop-headed,* as it will make no progress, till each branch has acquired a determined leader; for, if the growth of a tree be prevented, it will be extremely difficult to throw such energy into the system, as to enable it to grow freely. As long as fruit trees continue in the nursery, it will be requisite to cut down the head, in order to give strength and symmetry to the stem; it will also be useful to shorten most of the grafts, lest they should be blown out by the wind; these operations likewise contribute to swell the buds. In selecting the branches of fruit trees to be preserved and trained, care should be observed that the branches which grow from the main trunk or body of the tree, shall not be at too acute an angle, nor that the trunk terminate at two branches which meet at too acute an angle, forming what is usually termed a *main fork;* in either case (particularly in the peach tree,) there is always a liability in those parts to be rent asunder by the force of wind, or by the weight of fruit; but this danger is prevented in a great degree by allowing only those branches to remain, which issue from the main trunk alternately on opposite sides at different distances from the ground, and no two branches permitted to remain opposite to each other, and the whole branches of the tree selected so as to preserve its general strength, and at the same time permit the air and light between the branches sufficient to ripen the fruit; no rule can be laid down upon this subject except those of *general* character, the judgment of the person performing the operation of pruning must always direct the *particular* operation. A tree generally grows with a more per-

fect form without pruning, where the soil is fertile, than in that of a different character.

In cultivating fruit trees, two objects are desirable; these are, a quick return of the capital invested, and healthy vigorous trees, but as it is difficult to accomplish both in the same tree, it is suggested for the consideration of those interested upon this subject, that the first named object be attained by converting large branches into trees by the Chinese method. (*See page* 14 *of this work.*) By these means an orchard, bearing fruit, could be formed in less than two years, without injury to the tree, or trees, from which it was taken, because the branches thus converted into trees might be selected from those which are required to be removed, for the benefit of the parent tree.—The other object could be attained, by planting several seeds at or near where each tree is required in the orchard, and be cultivated in the manner recommended for the peach tree. (*See page* 35.)

The most vigorous of these may be suffered to remain, and such of them as produce good fruit, will furnish a supply of grafts to improve those which naturally produce fruit of an inferior quality; or in case none of them bear fruit of a quality sufficiently valuable; grafts may be produced from other sources to improve the whole of them, by inserting them in the branches, at a considerable distance above the main trunk or body of the tree: the whole body of each tree, and the branches below the grafts, will partake of, or combine all the health and vigor naturally arising from a young tree, and will serve to receive other grafts in case of disease in those first inserted. The usual method of forming the bodies, or trunks of trees is by inserting bearing branches at the root, frequently practised by nursery men, should never be adopted where a healthy vigorous tree is required. The body of a tree should always be produced from the seed, and the branches also, where the fruit is of a good kind; and where grafts are selected, they shoud be such as are known to be produced from the seed within a few years, the shorter the period the better.

FOOD FOR PLANTS.

In a select collection of *Memoirs*, published by the *Free Society of Agriculture, Arts and Commerce*, in the Department of Ardenne, the following vegetative liquor is recommended for promoting the growth, as well as the flowering, of bulbous roots in apartments, during the winter. Take three ounces of nitre, one ounce of sea salt, half an ounce of salt of tartar, half an ounce of sugar, and one pint of rain water. Let the salts be gradually dissolved in a glazed earthen vessel; and when the solution is completed, add the sugar, and filter the whole. About eight drops of this liquid must be poured into every flower-glass filled with rain or river water: these vessels should be kept constantly full, and the water be renewed every tenth or twelfth day; a similar portion of the vegetative liquor being added each time. In order to insure success, the glasses ought to be placed on the corner of a chimney piece, where a fire is regularly kept in cold seasons.

FOOD.

The aliment of children ought to be adapted to their age, and the strength of their digestive powers. Hence they ought by no means to be fed immoderately or promiscuously, with every kind of food, as by this indulgence, the first passages are distended and their stomachs gradually acquire an unnatural craving for victuals before the preceding meal is properly assimilated ; one kind of aliment only should be given at each meal. Sudden changes from liquid to solid food, and a multiplicity of incongruous mixtures, in immediate succession, such as broth, or soup, meat, boiled or roasted, after taking milk, fruit, &c., should be carefully avoided.

All stimulating dishes prepared for adults, as well as beer, wine, spices, coffee, and other heating liquors should be carefully withheld from children.

A due proportion of vegetable and animal substances with the addition of acids during the summer months, is alike agreeable to the taste and conducive to health. In a salted state, meat not only loses a considerable part of its gelatinous

and spirituous particles, but it likewise becomes oppressive to the digestive organs, and imparts a degree of acrimony to the human fluids which has a remarkable tendency to generate putrid diseases, such as the scurvy of mariners. Hence it would be a desirable object to ascertain by accurate experiments whether beef, pork, &c. might not be kept fresh at sea for many months, merely by burying it in charcoal-powder, of which it could be easily divested by proper ablution. This important subject deserves the researches of patriotic inquirers.

With respect to the quantity of food, there is one general rule, which ought never to be disregarded, namely, to cease eating when the first cravings of appetite are satisfied, so as to renovate the waste which the body has apparently sustained. By a strict adherence to this principle many distressing complaints arising from intemperance might be effectually obviated.

DEFINITION OF TERMS.

Letter F.

Frost, is that state of the atmosphere which causes water and other liquids to congeal or freeze. In cold countries, the frost frequently proves fatal to mankind. Where animation is suspended, the following directions should be strictly adhered to, and every exertion used to restore life. No external warmth of any kind must be applied to frozen persons, till the internal or vital heat be excited; when the former also should be carefully and very gradually adopted to the manifest degree of the latter. Hence the whole process should be performed either in the open air, or in a cold room; the body cautiously carried in a posture somewhat erect to the nearest dwelling; the head turned gently toward the right side, and the clothes carefully taken off, without injuring the skin or bending the limbs. These precautions are necessary, as rough treatment may easily occasion dislocations of the joints, or fractures of the bones. Next, the whole naked frame, excepting the face, should be covered with a bed of snow from twelve to eighteen inches in thickness, or if this cannot be procured, cold water and ice may be substituted, and clothes successively dipped in it may be spread over the whole body, especially the head and breast. After continuing these affusions, gentle frictions with flannel or soft brushes, likewise immersed in cold fluids, should be commenced, alternately making use of the shower bath, and persevering in these attempts for an hour at least, when the body ought to be left undisturbed for some minutes. If no signs of life appear, clysters of cold water, with oil and vinegar, or six ounces of brandy, are to be given, and the former process again and again repeated; so that five or six hours sometimes elapse, before any symptoms of animation are perceptible. As soon, however, as there is the least prospect of recovery, *warm* fomentations must be resorted to; the degree of friction cautiously increased, and the patient placed in bed between two robust persons; emollient clysters prepared; and when he is able to swallow, a cup of tea with a little vinegar, wine or brandy, may be allowed. In many desperate instances, however, it will perhaps be proper to perform venesection, or introduce air into the lungs by means of common bellows; or to have recourse to the electrifying machine, or the earth bath, &c. but such cases must be submitted to the judgment of a physician. In Russia, frozen parts of the human system are kept constantly covered with goose grease until a cure is effected, and in the United States, that of common fowls is used.—Preparations of camphor, either that of camphorated spirits or opodeldoc, has also been used with beneficial results.

Fasts, a term used to denote abstinence from food, particularly for religious reasons. Fasting is injurious to delicate and debilitated habits, particularly in the early part of the day, because the fluids of the body, after circulating several hours without any alimentary refreshment, at length acquire a putrid tendency, which is extremely injurious to the whole human system.

Fermentation

Is strictly speaking a chemical process, and of considerable importance in domestic economy; particularly in the fermen-

tation of bread, wine, beer, and cider.* The most essential requisites in every process of fermentation, are,

1. That the substance be in a fluid state.

2. That there be a proper degree of warmth, that is, in general between 70° and 80° of Fahrenheit's thermometer; and

3. That the atmosphere be not entirely excluded from the fermenting bodies, nor that they be exposed to a current of air.

Filtration in chemistry as well as domestic economy, is the process of straining or filtering liquors, by means of woolen, cotton, or linen, paper, or other materials. The common filters are of two kinds, namely: simple pieces of paper or cloth, through which the fluid is passed; or similar materials are twisted up in the same manner as skeins or wicks; they are first wetted, then squeezed, and one end put into the vessel which contains the liquor to be filtered; the other end is to be suspended out of the vessel, lower than the surface of the liquor, the purest parts of which drop gradually out of the vessel, leaving behind the coarser particles. Sometimes they are made to operate while the liquor is passing upwards in an inverted syphon.

SIR H. DAVY'S AGRICULTURAL CHEMISTRY.

(Continued from page 112.)

5. *Gluten* may be obtained from wheaten flower by the following process: The flower is to be made into a paste, which is to be cautiously washed, by kneading it under a small stream of water, till the water has carried off from it all the starch; what remains is gluten. It is a tenacious, ductile, elastic substance. It has no taste. By exposure to air it becomes of a brown color. It is very slightly soluble in cold water, but not soluble in alcohol. When a solution of it in water, is heated, the gluten separates in the form of yellow flakes; in this respect it agrees with albumen, but differs from it in being infinitely less soluble in water. The solution of albumen does not coagulate when it contains much less than 1000 parts of albumen, but it appears that gluten requires more than 1000 parts of cold water for its solution.

Gluten, when burnt, affords similar products to albumen, and probably differs very little from it in composition. Gluten is found in a great number of plants; Proust discovered it in acorns, chesnuts, horse chesnuts, apples, and quinces; barley, rye, peas, and beans; likewise in the leaves of rue, cabbage, cresses, hemlock, borage, saffron, in the berries of the elder, and in the grape. Gluten appears to be one of the most nutritive of the vegetable substances; and wheat seems to owe its superiority to other grain, from the circumstance of its containing it in larger quantities.

6. *Gum Elastic* or *Caoutchouc*, is procured from the juice of a tree, which grows in the Brazils, called Haeva. When the tree is punctured, a milky juice exudes from it, which gradually deposites a solid substance, and this is gum elastic.

Gum elastic is pliable and soft, like leather, and becomes softer when heated. In its pure state, it is white; its specific gravity is 9335. It is combustible, and burns with a white flame, throwing off a dense smoke, with a very disagreeable smell. It is insoluble in water and in alcohol; it is soluble in ether, volatile oils, and in petroleum; and may be procured from ether in an unadultered state, by evaporating its solution in that liquid. Gum elastic seems to exist in a great variety of plants; amongst them are, *Jatropha elastica*, *Ficus indica*, *Artocarpus integrifolia*, and *Urceola elastica*.

Bird lime, a substance which may be procured from the holly, is very analogous to gum elastic in its properties. Species of gum elastic may be obtained from

*As the value of fermented liquids depend upon the retention of the largest possible quantity of carbonic acid. It is suggested for the consideration of brewers and cider manufacturers, that in vessels containing liquids, whilst undergoing vinous fermentation, the vent for the escape of the gas shall be as small as possible, consistent with the safety of the vessel; that the gas be made to pass through a tube in form of a syphon, and discharged under the surface of water, in such a manner that atmospheric air shall not supply the place of carbonic acid gas in the vessel, and that in the passage of the gas the largest possible quantity shall be retained in water for domestic purposes, so as to partake of the properties of spring water.

the misletoe, from gum mastic, opium, and from the berries of the *smilax caduca*, in which last plant it has been lately discovered by Dr. Barton.

Gum elastic, when distilled, affords volatile alkali, water, hydrogen and carbon, in different combinations. It therefore consists principally of azote, hydrogen, oxygen and carbon; but the proportions in which they are combined, have not yet been ascertained. Gum elastic is an indigestible substance, not fitted for the food of animals; its uses in the arts are well known.

7. *Extract*, or the *extractive principle*, exists in almost all plants. It may be procured in a state of tolerable purity from saffron, by merely infusing it in water, and evaporating the solution. It may likewise be obtained from catechu, or *Terra Japanica*, a substance brought from India. This substance consists principally of astringent matter, and extract; by the action of water upon it, the astringent matter is first dissolved, and may be separated from the extract. Extract is always more or less colored; it is soluble in alcohol and water, but not soluble in ether. It unites with alumina when that earth is boiled in a solution of extract, and it is precipitated by the salts of alumina, and by many metallic solutions, particularly the solution of muriate of tin.

From the products of its distillation, it seems to be composed principally of hydrogen, oxygen, carbon, and a little azote.

There appears to be almost as many varieties of extract as there are species of plants. The difference of their properties, probably in many cases depends upon their being combined with small quantities of other vegetable principles, or, to their containing different saline, alkaline, acid, or earthy ingredients. Many dying substances seem to be of the nature of extractive principle, such as the red coloring matter of madder, and the yellow dye, procured from weld.

Extract has a strong attraction for the fibres of cotton or linen, and combines with these substances, when they are boiled in a solution of it. The combination is made stronger by the intervention of mordants, which are earthy or metallic combinations, that unite to cloth, and enable the coloring matter to adhere more strongly to its fibres.

Extract, in its pure form, cannot be used as an article of food, but it is probably nutritive when united to starch, mucilage, or sugar.

8. *Tannin*, or the tanning principle, may be procured by the action of a small quantity of cold water, on bruised grape seeds, or pounded gall-nuts; and by the evaporation of the solution to dryness. It appears as a yellow substance, possessed of a highly astringent taste. It is difficult of combustion. It is very soluble, both in water and alcohol, but insoluble in ether when a solution of glue, or isinglass (*gelatine*) is mixed with an aqueous solution of tannin, the two substances, i. e. the animal and vegetable matters, fall down in combination, and form an insoluble precipitate.

When tannin is distilled in close vessels, the principal products are charcoal, carbonic acid, and inflammable gases, with a minute quantity of volatile alkali. Hence its elements seem the same as those of extract, but probably in different proportions. The characteristic property of tannin is its action upon solutions of isinglass or jelly; this particularly distinguishes it from extract, with which it agrees in most other chemical qualities.

There are many varieties of tannin, which probably owe the difference of their properties to combinations with other principles, especially extract, from which it is not easy to free tannin. The purest species of tannin is that obtained from the seeds of the grape; this forms a white precipitate, with a solution of isinglass. The tannin from gall-nuts resembles it in its properties. That from sumach affords a yellow precipitate; that from kino a rose colored; that from catechu a fawn colored one.

The coloring matter of Brazil wood, which Mr. Chevreul considers as a peculiar principle, and which he has called *Hematine*, differs from other species of tannin, in affording a precipitate with gelatine, which is soluble in abundance of hot water. Its taste is much sweeter than that of the other varieties of tannin, and it may perhaps be regarded as a substance intermediate between tannin and extract.

Tannin is not a nutritive substance, but is of great importance in its application to the art of tanning. Skin consists almost entirely of jelly or *gelatine*, in an organized state, and is soluble by the long continued action of boiling water. When skin is exposed to solutions containing tannin, it slowly combines with that principle; its fibrous texture and coherence are preserved; it is rendered perfectly insoluble in water, and is no longer liable to putrefaction; in short, it becomes a substance in chemical composition, precisely analogous to that furnished by the solution of jelly and the solution of tannin.

In general, in this country, the bark of the oak is used for affording tannin in the manufacture of leather; but barks of some other trees, particularly the Spanish chesnut, have lately come into use.

The following table will give a general idea of the relative value of different species of barks. It is founded on the result of experiments made by myself.

Table of numbers exhibiting the quantity of tannin afforded by 480 lbs. of different barks, which express nearly their relative values:

Average of entire bark of middle sized Oak, cut in spring,	29 lbs.
Average of Spanish chesnut,	21 "
Leicester willow, large size,	33 "
Elm,	13 "
Common willow, large	11 "
Ash,	16 "
Beech,	10 "
Horse chesnut,	9 "
Sycamore,	11 "
Lombardy poplar,	15 "
Birch,	8 "
Hazel,	14 "
Black thorn,	16 "
Cappice oak,	32 "
Oak cut in autumn,	21 "
Larch cut in autumn,	8 "
White interior cortical layers of old bark,	72 "

The quantity of the tanning principle in barks, differs in different seasons; when the spring has been cold, the quantity is smallest. On an average, 4 or 5 lbs. of good oak bark are required to form 1 lb. of leather. The inner cortical layers in all barks contain the largest quantity of tannin. Barks contain the greatest proportion of tannin, at the time the buds begin to open—the smallest quantity in winter.

The extractive or coloring matters found in barks, or in substances used in tanning, influence the quality of the leather. Thus skin tanned with gall-nuts, is much paler than skin tanned with oak bark, which contains a brown extractive matter.—Leather made from catechu is of reddish tint. It is probable that in the process of tanning, the matter of skin and the tanning principle first enters into union, and that leather, at the moment of its formation, unites to the extractive matter. In general, skins in being converted into leather, increase in weight about one third*; and the operation is most perfect when they are tanned slowly. When skins are introduced into very strong infusions of tannin, the exterior parts immediately combine with that principle, and defend the interior parts from the action of the solution. Such leather is liable to crack and to decay by the action of water.

The precipitates obtained from infusions containing tannin by isinglass, when dried, contain, at a medium rate, about 40 per cent. of vegetable matter. It is easy to obtain the comparative value of different substances for the use of the tanner, by comparing quantities of precipitate afforded by infusions of given weights mixed with solutions of glue or isinglass.

To make experiments of this kind, an ounce, or 480 grains of the vegetable substance in coarse powder, should be acted upon by half a pint of boiling water. The mixture should be frequently stirred, and suffered to stand 24 hours; the fluid should then be passed through a fine linen cloth, and mixed with an equal quantity of solution of gelatine, made by dissolving glue, jelly, or isinglass in hot water, in the proportion of a drachm of glue or isinglass, or six table spoons full of jelly, to a pint of water. The precipitate should be collected by passing the mixture of the solution and infusion through folds of blotting paper, and the paper exposed to the air till its contents are quite dry.

If pieces of paper of equal weights are used, in cases of which different vegetable

* This estimation must be considered as applying to *dry* skin and *dry* leather.

substances are employed, the difference of the weights of the papers when dried, will indicate with tolerable accuracy, the quantities of tannin contained by the substances, and their relative value, for the purposes of manufacture. Four-tenths of the increase of weight in grains must be taken, which will be in relation to the weights in the table.

Besides the barks already mentioned, there are a number of others which contain the tanning principle. Few barks indeed are entirely free from it. It is likewise found in the wood and leaves of a number of trees and shrubs, and is one of the most generally diffused of the vegetable principles. A substance very similar to tannin has been formed by Mr. Hatchett, by the action of heated diluted nitric acid on charcoal, and evaporation of the mixture to dryness. From 100 grains of charcoal, Mr. Hatchett obtained 120 grains of artificial tannin, which, like natural tannin, possessed the property of rendering skin insoluble in water.

Both natural and artificial tannin form compounds with the alkalies and the alkaline earths; and these compounds are not decomposible by skin. The attempts that have been made to render oak bark more efficient as a tanning material by infusion in lime water, are consequently founded on erroneous principles. Lime forms with tannin a compound not soluble in water. The acids unite to tannin, and produce compounds that are more or less soluble in water. It is probable that in some vegetable substances tannin exists, combined with alkaline or earthy matter; and such substances will be rendered more efficacious for the use of the tanner; by the action of diluted acids.

9. *Indigo* may be produced from wood (*Isatis tinctoria,*) by digesting alcohol on it, and evaporating the solution. White crystalline grains are the substance in question. The indigo of commerce is principally brought from America. It is procured from the *Indigofera argentea*, or wild indigo, the *Indigofera disperma*, or Gautimala indigo, and the *Indigofera tinctoria*, or French indigo. It is prepared by fermenting the leaves of those trees in water. Indigo in its common form appears as a fine, deep blue powder, it is insoluble in water, and but slightly soluble in alcohol; its true solvent is sulphuric acid: 8 parts of sulphuric acid dissolve 1 part of indigo; and the solution diluted with water forms a very fine blue dye.

Indigo, by its distillation, affords carbonic acid gas, water, charcoal, ammonia, and some oily and acid matter: the charcoal is in very large proportion. Pure indigo, therefore, most probably consists of carbon, oxygen, hydrogen, and azote.

Indigo owes its blue color to combination with oxygen. For the uses of the dyers it is partly deprived of oxygen, by digesting it with orpiment and lime water, when it becomes soluble in the lime water, and of a greenish color. Cloths steeped in this solution combine with the indigo; they are green when taken out of the liquor, but become blue by absorbing oxygen when exposed to air.

Indigo is one of the most valuable and most extensively used of the dying materials.

10. The *narcotic principle* is found abundantly in *opium*, which is obtained from the juice of the white poppy (*Papurea album.*)

To procure the narcotic principle, water is digested upon opium: the solution obtained is evaporated till it becomes of the consistence of a syrup. By the addition of cold water to this syrup, a precipitate is obtained. Alcohol is boiled on this precipitate; during the cooling of the alcohol, crystals fall down. These crystals are to be again dissolved in alcohol, and again precipitated by cooling: and the process is to be repeated till their color is white; they are crystals of narcotic principle. The narcotic principle has no taste nor smell. It is soluble in about 400 parts of boiling water; it is insoluble in cold water: it is soluble in 24 parts of boiling alcohol, and in 100 parts of cold alcohol. It is very soluble in all acid menstrua.

It has been shown by De Rosne, that the action of opium on the animal economy depends on this principle. Many other substances besides the juice of the poppy, possess narcotic properties; but they have not yet been examined with much attention.—The *Lactuca sativa*, or garden let-

tuce, and most of the other lactucas yield a milky juice, which when inspissated has the characters of opium, and probably contains the same narcotic principle.

11. The *bitter principle* is very extensively diffused in the vegetable kingdom; it is found abundantly in the hop (*Humiulus lupilus;*) in the common broom (*Spartium scoparium;*) in the chamomile (*Anthemis noblis;*) and in quassia, *amara*, and *excelsa*. It is obtained from those substances by the action of water or alcohol, and evaporation. It is usually of a pale yellow color; its taste is intensely bitter. It is very soluble, both in water and alcohol, and has little or no action on alkaline, acid, saline or metallic solution. An artificial substance, similar to the bitter principle, has been obtained by digesting diluted nitric acid, on silk, indigo, and the wood of the white willow. This substance has the property of dying cloth of a bright yellow color; it differs from the natural bitter principle in its power of combining with the alkalies; in union with the fixed alkalies it constitutes crystallized bodies, which have the property of detonating by heat or percussion.

The natural bitter principle is of great importance in the art of brewing; it checks fermentation, and preserves fermented liquors; it is likewise used in medicine.

The bitter principle, like the narcotic principle, appears to consist principally of carbon, hydrogen, and oxygen, with a little azote.

12. *Wax* is found in a number of vegetables; it is procured in abundance from the berries of the wax-myrtle (*Myrica cerifera*,) it may be likewise obtained from the leaves of many trees; in its pure state it is white. Its specific gravity is 9.662; it melts at 155 degrees; it is dissolved by boiling alcohol, but it is not acted upon by cold alcohol; it is insoluble in water; its properties as a combustible body are well known.

The wax of the vegetable kingdom seems to be precisely of the same nature as that afforded by the bee.

From the experiments of M.M. Gay Lussac and Thenard it appears that 100 parts of wax consist of—

Carbon	81.784
Oxogen	5.544
Hydrogen	12.672
or otherwise, Carbon	81.784
Oxygen and hydrogen in the proportions necessary to form water	6.300
Hydrogen	11.916—which

agrees very nearly with 37 proportions of hydrogen, 21 of charcoal, 1 of oxygen.

Fly (*Hessian or wheat*).—The following are the remarks of Joseph Cooper, Esq., of New Jersey, on the subject of guarding wheat from this insect; after stating the advantages of late sowing in fertile soil, he says:

"*I am convinced, from the above and other experiments, that if the farmers all through a neighbourhood would prevent as much as possible such grain as is nutritive to the Hessian Fly from vegetating in the period between harvest and the latter end of September, have their land in a good state of cultivation, and sow about the beginning of October, or even later, and of the kind of grain which comes forward most rapidly in the spring, they would receive little injury from wheat fly;*" and as the early Virginia wheat was produced from a plant selected by an observant farmer from his other wheat, there is no doubt that other sorts of grain might be improved by a selection of such particular plants as ripen earliest and are superior in other respects.

EASY METHOD OF DETECTING THE COUNTERFEIT COIN NOW IN CIRCULATION.

The following simple experiment, which has laid the foundation of one of the most splendid of modern sciences, readily enables any person to discover spurious coin. Take a clean slip of common sheet zinc, about two inches by one-half, and lay it upon the tongue; place a genuine silver coin under the tongue, and on bringing the silver and zinc together a pungent and disagreeable taste will be perceived. Substitute now a coin suspected to be counterfeit in place of the genuine coin, and a very slight, if any, taste will be perceived. The false coin of half dollars, dimes, and half dimes, is made mostly of

German silver, and produces scarcely any galvanic action with a piece of zinc. The above test is almost infallible, and recommends itself from its simplicity.—*National Intelligencer.*

SWIFTNESS OF BIRDS.

The smallest bird, says M. Virey, can fly several leagues in an hour; the hawk goes commonly at the rate of a league in four minutes, or above forty miles in an hour. A falcon of *Henry Second* was flown from Fontainbleau, and found by its ring at Malta the next day. One sent from Canaries to Andalusia, returned to Teneriffe in sixteen hours; a distance of near seven hundred miles, which it must have gone at the average rate of twenty-four miles an hour. Gulls go seven hundred miles to sea and return daily; frigate birds have been found at twelve hundred miles from any land. Upon their migration, he states as a known fact, that cranes go and return at the same date, without the least regard to the state of the weather, which shows no doubt, if true, a most peculiar instinct; but these, and indeed, all facts which we find stated by a writer so much addicted to painting and colouring, must be received with a degree of suspicion, for which no one but M. Virey is to be blamed. The accounts, however, of the swiftness of birds, I can well credit, from an experiment which I made when travelling on a railway. While going at the rate of thirty miles an hour, I let fly a bee; it made its circles as usual, and surrounded us easily. Now if there was no current of air or draft to bear it along, this indicated a rate of ninety miles an hour; and even allowing for a current, the swiftness must have been great. I should, however, wish to repeat the experiment before being quite sure of so great a swiftness in so small an insect.

TRANSPORTATION OF GOODS BY RAIL-ROADS, M'ADAMIZED ROADS, AND CANALS.

The Baltimore American of April 9th, states that goods are now transported from that city by the way of York, Wrightsville, and the Pennsylvania canal and rail-road to Pittsburg. The transportation of goods is done in portable car bodies, which, after being packed in Baltimore, are locked up and not opened again till they reach Pittsburg. These cars are water-proof, and there is no handling of goods, nor liability to damage from the weather, or depredations while on the route. Each car body will contain about 6000 pounds of merchandize, a train of which is despatched daily to York by the rail-road. At York the car body is transferred by simple machinery from the rail-road to a platform road wagon in three minutes, and is conveyed on the turnpike to Columbia, where by similar machinery, it is transferred to the canal boat, and despatched without delay to Pittsburg. Each canal boat carries ten car bodies, or thirty tons of merchandize. —*Lord Brougham's Dissertation on Science.*

SUPERIORITY OF ELASTIC CABLES.

Mr. Hennessey, the inventor of the *elastic life boat*, has addressed a letter to the editor of the Liverpool Mercury, in which he shows the great superiority of cables fabricated of elastic materials, over those of a different character, especially in riding out a heavy gale of wind. The following is an extract from the letter:— "Many years ago I was mate of a vessel of 350 tons. We were lying in Gibralter roads, with a thirteen inch hemp cable and best bower anchor down; the morning was fine, the master and chief part of the crew went on shore for water, &c., and before they were ready, it came on to a blow so hard that they could not return to the ship. I had what seamen call the long service out; but as the gale was still increasing, I gave cable to the end clenched to the foremast. I had on board a nine inch bass cable of 120 fathoms, never wet, which I bent in place of a hemp cable to the second bower. This bass is a kind of grass, very cheap in Portugal, called *spartha*, in the language of that country. We run up the forestaysail, gave the ship a broad sheer, and let go the grass cable under foot. The gale increased to a tempest,—such as I never saw before or since; although in ballast riding head to wind, and having a very quick sheer abaft, we had to fix the dead lights, or she would have filled through the cabin windows, whilst riding by the hemp cable. At twelve at night the bower burst, the ship brought up by the grass cable, and although the wind and sea in-

creased, she never pitched even her tronsom in, but rode like a duck for twenty-four hours during the gale. There were twenty-two sail, mostly fine ships, in the roads at the time; all of which went on shore, but the one I belonged to, and two small craft that had grass cables. So much for elasticity."—*U. S. Gazette.*

CONSEQUENCE OF THE PUNCTURE OF A NEEDLE.

A case is reported in the last number of the Boston Medical and Surgical Journal of the amputation of a foot of a lady, (rendered necessary to save the life of the patient,) who trod upon a cambric needle which entered half its length into the heel; although the needle was extracted entire and she was able to keep about her household work for two days before the pain arising from the puncture compelled her to send for Medical assistance—*U. S. Gazette.*

STRETCHING IN SHEEP.

This disease is discovered by the sheep stretching itself apparently to the extent of its power every few seconds. The causes are supposed to be too great a degree of dryness in the food and too much moisture from rains applied to the spine and other parts of the back, combined with the loss of heat naturally arising from cold wet rains lodging upon the back in large quantities, and retained there for a considerable time by the wool. The *remedy* recommended by some persons engaged in raising sheep, is, to give the animal a little spring water with common salt dissolved in it; and to cover the back of such sheep as are exposed to cold rains with a piece of oil (or other waterproof) cloth, the whole length of the spine, and to the width of three or four inches upon each side of it. Cheap cotton cloth (muslin) properly prepared by dipping it in boiled or drying oil, and suffering it to become dry, is said to answer for this purpose; the cloth thus prepared is to be cut into strips sufficiently long to cover the spine (or back bone) and six or eight inches in width; this may be confined to the wool, with the middle directly over the spine by any glutinous substance that will not injure the wool nor destroy the cloth.

An easy method to produce new varieties of Vegetables—Potato.—Select as many balls or apples from the earliest potato tops as may be required; put them in a dry place, in a cellar, and at the usual time of planting in the spring, these balls or apples may be planted in the garden in good soil, about three-fourths of an inch deep, these will probably produce several kinds, and of different degrees of value. The best kinds may be selected for planting the succeeding year, and which may be continued until a better variety is produced to supply the place of it. A small quantity of balls or apples, planted in this way each year, would be the most certain method of insuring a constant supply of new varieties in place of those which decrease in value from age. Other vegetables, of every kind, including fruit trees, are worthy of attention, as subject also to depreciation from age. A succession of the best of each kind might be kept up by planting a few seeds of each annually and cultivating only the best.

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OBSERVER AND RECORD
OF AGRICULTURE, SCIENCE, AND ART.

EDITED BY D. PEIRCE.

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The object of this paper is to concentrate and preserve, in a form suitable for future reference, the most useful and interesting articles on the aforesaid subjects. Each number will contain sixteen octavo pages, printed on good paper, and when a sufficient amount is published to form a volume of convenient size, an alphabetical table of contents will be published and forwarded to subscribers, in order for binding. This number, shows the general plan of the work.

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MR. DEYERLEIN'S METHOD OF MAKING BRICK, TILES, ETC.

The machinery by which this process is to be effected, consists of a box, or receptacle, into which clay or other matter is to be put, and also of a plug or forcing instrument, by which the clay is forced out of the receptacle during the operation, through suitable openings in one end of the containing box, which gives the respective parts the required shape. The motion or effect is imparted to the forcing instrument, by mill-work, or other well known mechanical means; and the articles when made, are received on a proper carriage for conveying them away. Another carriage may also be used for supporting the combined parts of the apparatus during the time of working, or for conveying them from place to place when necessary.

The patentee having described the apparatus generally, and illustrated its several parts by figures, states the process of the operation to the following effect. It is necessary to have two or more wheelbarrows, such as before described, for conveying away the bricks after they are made, and one of these being hooked on to each muzzle or mouth-piece of the machine, through which the clay is to pass, it will be fit for operation. The clay should not be made so wet as usual. The piston or forcing instrument is first drawn to one end of the box, by means of the wheel-work with which it is connected, and the other part of the receptacle is then filled with the clay or other materials. The piston being then put in motion, the clay is forced through the orifice in the mouth-piece of the box, and received on the wheelbarrow attached to it for that purpose; having the shape of the opening through which they have passed. If the receptacle be a double box, or have a mouth-piece at each end, while this operation is performing, the other end is filled with clay, which the returning stroke of the piston forces through the other end, and so on alternately. By this operation the clay will be formed into bars of the size and shape of the openings in the machine; and the person who attends, separates them into the required lengths by a proper instrument guided by grooves perpendicular to the surface of the wheelbarrow; or rather to the axis of the bars. In the apparatus which the patentee has described, each stroke forms seven bars of the breadth and thickness of a brick, but of sufficient length to be cut into four; and by this means every home and out stroke of the machine, fifty-six bricks are produced; and more or less may be obtained at a stroke according to the number of openings in the mouth-piece, and the power of the first mover. Tiles, mouldings, &c., may be made in the same manner, by merely changing the mouth-piece for one adapted to the particular purpose.

Observations.—The machinery we think well calculated to diminish the la-

bor required in the present process of brick-making, and consequently to reduce the price at which they can be afforded; a circumstance of great public importance. We therefore recommend its adoption wherever it can be conveniently used.

METHOD OF APPLYING A FILTERING-STONE FOR PURIFYING WATER.

By Mr. William Moult.—Trans. Society of Arts, vol. 28.

The method of using the filtering stone which is here proposed is that of placing it in the water to be purified, by which means the water presses against the outside of the filter, and, oozing through its pores, fills the stone, from which it is to be conveyed into a proper receptacle. In the drawing of the apparatus which Mr. Moult sent to the society, the stone is suspended in the cistern by a ring round the inside of it, upon which a projecting part round the top of the stone rests. "By this mode of filtration, the impurities of the water are deposited in the bottom of the cistern, instead of being left in the bottom of the stone, as in the usual mode." Mr. Moult also states, that double the quantity of pure water is procured by this method in the same time; and that he has used an apparatus of this kind with great success for more than three years.

Observations.—The above may be considered in many respects as operating upon the same principle as *filtering* by *ascent*, which is highly preferable to that in common use, in which the filtration is performed in a *contrary* direction.

The Society voted to Mr. Moult a silver medal for the above communication.

Retrospect.

THE EFFECT OF TEMPERATURE IN PRESERVING VEGETABLES.

Potatoes at the depth of one foot in the ground, produce shoots near the end of spring; at the depth of two feet they are very short and never come to the surface, and between three and five feet cease to vegetate. In consequence of observing these effects, several parcels of potatoes were buried in a garden at the depth of three feet and a half, and were not removed till after intervals of one and two years. They were then found without any appearance of germination, and possessing their original freshness, firmness, goodness, and taste.

Poppy, a Preventive of the Wheat Fly.—S. Beden of Michigan in a letter to the editor of the *Cultivator*, recommends the common poppy to be sown, either in the fall or early in the spring, among wheat, as a preventive of injury from fly; and states, that, for twenty years, he has sown poppies in his garden, and where they were, he had not been troubled with fly, bug, nor insect, on any vegetable even in his field, among his wortzell and ruta bagas.

The common poppies have prevented the ravages of all flies, bugs, and insects. He also gives it as his opinion, that grain soaked in brine, and then rolled in wood ashes, would be protected from the insect; and that ashes is preferable to lime for this purpose.

USEFUL EFFECTS OF IODINE AS A MEDICINE.

Dr. Coindet has been employing Iodine in the treatment of goitres and scrofulo with a success surpassing his most sanguine hopes.

It is introduced into the system by means of rubbing, in the same manner as other mineral ointments—out of twenty-two patients, who had all very large goitres—half of them were completely cured in the space of from four to six weeks, and the others in a greater or less degree.—*Reg. Arts. and Sci.*

MEDICINAL PROPERTIES OF IRON.

Iron is one of the most valuable articles of the Materia Medica. The protoxide acts as a genial stimulant and tonic in all cases of chronic debility, not connected with organic congestion or inflammation. It is peculiarly efficacious in chlorosis.—It appears to me that the peroxide and its combinations are almost uniformly irritating, causing heart burn, febrile heat, and quickness of pulse. Many chalybeate mineral waters contain an exceedingly minute quantity of protocarbonate of iron, and yet exercise an astonishing power in recruiting the exhausted frame. I believe their virtues to be derived

simply from the metal being oxidized to a minimum, and diffused by the agency of a mild acid through a great body of water, in which state it is rapidly taken up by the lacteals, and speedily imparts a ruddy hue to the wan countenance.—I find that these qualities may be imitated exactly by dissolving three grains of sulphate of iron, and sixty grains of bicarbonate of potash in a quart of cool water with agitation in a close vessel.

URE.—*ib.*

ACTION OF SULPHUR ON IRON.

Colonel A. Evans has remarked that although sulphur has so strong an action on heated wrought iron as immediately to form holes in it, yet it does not at all affect gray cast iron. A plate of wrought iron, .63 of an inch in thickness, heated to whiteness, and held against a roll of sulphur, $\frac{6}{10}$ of an inch in diameter, was in fourteen seconds pierced through with a perfectly cylindrical hole. Another bar, about 2 inches in thickness, was pierced by the same means in fifteen seconds.

Good steel was pierced even more rapidly than the iron, but a piece of gray cast iron, well scaled and heated till nearly infusion, was not at all affected by the application of sulphur to its surface, not even a mark being left.—A crucible was made of cast iron, and some iron and sulphur put into it; on applying heat the iron and sulphur soon fused together, but the cast iron underwent no change.

Ann. de Chim.

SOFT IRON THAT WILL CUT HARDENED STEEL.

Mr. Perkins has tried the experiment with complete success, by placing a circular plate of soft iron, $\frac{1}{20}$ of an inch thick in a lathe, and when it was made to revolve with a speed equal to 10,000 feet of its circumference in a minute deep incisions were made by the iron in a common steel file.

Here are 10,000 feet of the periphery of the circular plate rubbed violently against a portion of the file not exceeding $\frac{1}{8}$ of an inch where it touches. A clearer idea will be afforded of the velocity and consequent force with which the iron strikes against the file, by bringing the 10,000 feet into eighths of inches, which makes 960,000, so that the steel receives that number of rubs in a minute of time, or 16,000 in a second of time, (producing a heat which we should suppose to be sufficient to fuse the steel,) the friction on the file being unremitting; while the friction upon the iron plate (supposing it to be 8 inches in diameter,) was about 200 times less than that of the file, the plate being cooled also in its passage through the air at every revolution.

Thus, then, it would appear that the steel received perhaps 400 times more heat than the iron, while it has not the capacity to receive an equal quantity without being melted. A proof of which is perhaps afforded by what is called "striking a light" with flint and steel. By the collision, a portion of the steel struck off is ignited and melted, while a blow of equal force upon iron, with a flint, will produce no effect.—Again, iron retains its solid form at what is called a welding heat—which is a degree of heat at which steel passes into a fluid state.—*ib.*

TO WHITEN IVORY THAT HAS BECOME RED OR YELLOW.

Boil alum in pure water, so much as will make it look white; into this immerse your ivory, and let it remain in an hour; then rub the ivory with a cloth, wipe it clean with *wet* linen rags and lay them in a moistened cloth to prevent their drying too quickly, which causes them to crack. *ib.*

PHENOMENA OBSERVED IN PROVING THE STRENGTH OF IRON BARS.

It is interesting and important to note the changes that iron undergoes in proving bolts or bars. It seems perfectly rigid and unaffected by any force less than $\frac{5}{9}$ of its measure of strength, when a change is indicated by small exfoliations, or scales, from its surface. This is the consequence of the bolt stretching, and necessarily lessening in diameter, and a certain proof of its yielding is the phenomenon of its becoming sensibly warm: the heat increases in the ratio of the strain, and when the rupture takes place, which is generally near the middle, it is

almost too hot to hold. I have found that a 2 inch bolt, 12 feet long, and 2 inches diameter was torn asunder horizontally by a machine, which is on the lever principle, like the weigh-bridges in the Royal Dock Yards, with a strain of 82 tons; it began to stretch with 47 tons, and lenghtening during the experiment 2 feet 9 inches, and was reduced at the point of rupture to 1 $\frac{5}{8}$ inches diameter.—*Capt. Brown's Report on the proposed St. Catharine's Bridge.—ib.*

SIR H. DAVY'S AGRICULTURAL CHEMISTRY.

(Continued from p. 126.)

13. *Resin* is very common in the vegetable kingdom. One of the most usual species is that afforded by the different kinds of fir. When a portion of the bark is removed from a firtree in the spring, a matter exudes, which is called turpentine; by heating this turpentine gently, a volatile oil rises from it, and a more fixed substance remains; this substance is resin.—The resin of the fir is the substance commonly known by the name of rosin; its properties are well known. Its specific gravity is 1072. It melts readily, burns with a yellow light, throwing off much smoke.

Resin is insoluble in water either hot or cold; but very soluble in alcohol. When a solution of resin in alcohol is mixed with water, the solution becomes milky; the resin is deposited by the stronger attraction of the water for the alcohol.

Resins are obtained from many other species of trees. *Mastich*, from the *Pistacia lentiscus; elemi*, from the *Amyris elemifera; copal*, from the *Rhus copallinum; sandarach*, from the common juniper. Of these resins copal is the most peculiar. It is the most difficultly dissolved in alcohol; and for this purpose must be exposed to that substance in vapor, or the alcohol employed must hold camphor in solution. According to Gay Lussac and Thenard, 100 parts of common resin contain:

Carbon	75.944
Oxygen	13.337
Hydrogen	10.719
Or of carbon	75.944
Oxygen and hydrogen in the proportions necessary to form water	15.156
Hydrogen in excess	8.900

According to the same chemists, 100 parts of copal consists of

Carbon	76.811
Oxygen	10.606
Hydrogen	12.585
Or carbon	76.811
Water or its elements	12.052
Hydrogen	11.137

From these results, if resin be a definite compound, it may be supposed to consist of 8 proportions of carbon, 12 of hydrogen, and 1 of oxygen.

Resins are used for a variety of purposes. Tar and pitch principally consist of resin, in a partially decomposed state. Tar is made by the slow combustion of the fir; and pitch by the evaporation of the more volatile parts of tar.

Resins are employed as varnishes, and for these purposes are dissolved in alcohol or oils. Copal forms one of the finest. It may be made by boiling it in powder with oil of rosemary, and then adding alcohol to the solution.

14. *Camphor* is procured by distilling the wood of the camphor tree (*Laurus camphora,*) which grows in Japan. It is a very volatile body, and may be purified by distillation. Camphor is a white, brittle, semitransparent substance, having a peculiar odor, and a strong acrid taste. It is very slightly soluble in water, more than 100,000 parts of water are required to dissolve 1 part of camphor. It is very soluble in alcohol; and by adding water in small quantities at a time to the solution of camphor in alcohol, the camphor separates in a crystallized form. It is soluble in nitric acid, and is separated from it by water.

Camphor is very inflammable; it burns with a bright flame, and throws off a great quantity of carbonaceous matter. It forms, in combustion, water, carbonic acid, and a peculiar acid called *camphoric* acid.

No accurate analysis has been made of camphor, but it seems to approach to the resins in its composition, and consists of carbon, hydrogen, and oxygen.

Camphor exists in other plants besides the *Laurus camphora*. It is procured from species of the laurus growing in

Sumatra, Borneo, and other of the East India Isles. It has been obtained from thyme (*Thymus serpillum,*) marjorum (*Origanum majorana,*) ginger tree (*Amonium zingiber,*) sage (*Sulvis officinalis.*) Many volatile oils yield camphor by being merely exposed to the air. An artificial substance very similar to camphor has been formed by M. Kird, by saturating oil of turpentine with muriatic acid gas (the gaseous substance procured from common salt by the action of sulphuric acid.) The camphor procured in well conducted experiments amounts to half of the oil of turpentine used. It agrees with common camphor in most of its sensible properties; but differs materially in its chemical qualities and composition. It it not soluble without decomposition in nitric acid. From the experiments of Gehlen, it appears to consist of the elements of oil of turpentine, carbon, hydrogen, and oxygen, united to the elements of muriatic gas, chlorine, and hydrogen.

From the analogy of artificial to natural camphor, it does not appear improbable that natural camphor may be a secondary vegetable compound, consisting of camphoric acid and volatile oil. Camphor is used medicinally, but it has no other application.

15. *Fixed oil* is obtained by expression from seeds and fruits; the olive, the almond, linseed, and rapeseed afford the most common vegetable fixed oils. The properties of fixed oils are well known. Their specific gravity is less than that of water; that of olive and of rapeseed oil is 913; that of linseed and almond oil 932; that of palm oil 968; that of walnut and beechmast oil 923. Many of the fixed oils congeal at a lower temperature than that at which water freezes. They all require for their evaporation a higher temperature than that at which water boils. The products of the combustion of oil are water and carbonic acid gas.

From the experiments of Gay Lussac and Thenard, it appears that olive oil contains, in 100 parts,

Carbon - - - - -	77.213
Oxygen - - - - -	9.427
Hydrogen - - - -	13.360

This estimation is a near approximation to 11 proportions of carbon, 20 hydrogen, and 1 oxygen.

The following is a list of fixed oils, and of the trees that afford them.—Olive oil, from the olive tree (*Olea Europea;*) linseed oil, from the common and perennial flax (*Linum usitatissimum et perenne;*) nut oil, from the hazelnut (*Coryllus avellana;*) walnut (*Juglans regia;*) hemp oil, from the hemp (*Cannabis sativa;*) almond oil, from the sweet almond (*Amygdalus communis;*) beech oil, from the common beech (*Fagus sylvatica;*) rapeseed oil, from the rapes (*Brassica napus et campestris;*) poppy oil, from the poppy (*Papaver somniferum;*) oil of sesamum, from the sesamum (*Sesamum orientale;*) cucumber oil, from the gourds (*Cucurbitapepo et malapepo;*) oil of mustard (*Sinapis nigra et arvensis;*) oil of sunflower, from the annual and perennial sunflower (*Helianthus annuus et perennis;*) castor oil, from the palma christi (*Ricinus communis;*) tobacco (*Nicotiana tabacum et rustica;*) plum kernel oil, from the plum tree (*Prunus domestica;* grapeseed oil, from the vine (*Vitis vinifera:*) butter of cocoa, from the cocoa tree (*Theobrama cacoa;*) laurel oil, from the sweet bay tree (*Laurus nobilis.*)

The fixed oils are very nutritive substances; they are of great importance in their applications to the purposes of life. Fixed oil, in combination with soda, forms the finest kind of hard soap. The fixed oils are used extensively in the mechanical arts, and for the preparation of pigments and varnishes.

16. *Volatile oil,* likewise called *essential oil,* differs from fixed oil, in being capable of evaporation by a much lower degree of heat; in being soluble in alcohol, and in possessing a very slight degree of solubility in water.

There is a great number of volatile oils, distinguished by their smell, their taste, and their specific gravity, and other sensible qualities. A strong and peculiar odor may however be considered as the great characteristic of each species; the volatile oils inflame with more facility than the fixed oils, and afford by their combus-

tion different proportions of the same substances, water, carbonic acid, and carbon.

The following specific gravities of the different volatile oils were ascertained by Dr. Lewis.

Oil of Sassafras	1094
Cinnamon	1035
Cloves	1034
Fennel	997
Dill	994
Penny royal	978
Cummin	975
Mint	975
Nutmegs	948
Tansy	946
Caraway	940
Criganum	940
Spike	936
Rosemary	934
Juniper	911
Oranges	888
Turpentine	792

The peculiar odors of plants seem, in almost all cases, to depend on the peculiar volatile oils they contain. All the perfumed distilled waters owe their peculiar properties to the volatile oils they hold in solution. By collecting the aromatic oils, the fragrance of flowers, so fugitive in the common course of nature, is as it were, embodied and made permanent.

It cannot be doubted that the volatile oils consist of carbon, hydrogen, and oxygen; but no accurate experiments have as yet been made on the proportions in which these elements are combined.

The volatile oils have never been used as articles of food; many of them are employed in the arts, in the manufacture of pigments and varnishes; but their most extensive application is as perfumes.

17. *Woody fibre* is procured from the wood, bark, leaves, or flowers of trees by exposing them to the repeated action of boiling water and boiling alcohol. It is the insoluble matter that remains, and is the basis of the solid organized parts of plants. There are as many varieties of woody fibre as there are plants and organs of plants; but they are all distinguished by their fibrous texture, and their insolubility.

Woody fibre burns with a yellow flame, and produces water and carbonic acid in burning. When it is distilled in close vessels, it yields a considerable residuum of charcoal. It is from woody fibre, indeed, that charcoal is procured for the purposes of life.

The following table contains the results of experiments made by Mr. Mushet, on the quantity of charcoal afforded by the different wood.

100 parts of Lignum vitæ	26.8	charcoal.
Mahogany	25.4	"
Laburnum	24.5	"
Chestnut	23.2	"
Oak	22.6	"
American black beech	21.4	"
Walnut	20.60	"
Holly	19.9	"
Beech	19.9	"
Americ. maple	19.9	"
Elm	19.5	"
Norway pine	19.2	"
Sallow	18.4	"
Ash	17.9	"
Birch	17.4	"
Scottish fir	16.4	"

MM. Gay Lussac and Thenard have concluded from their experiments on the wood of the oak and the beech, that 100 parts of the first contain:

Of Carbon	52.53
Oxygen	41.78
Hydrogen	5.69

and 100 parts of the second:

Of Carbon	51.45
Oxygen	42.73
Hydrogen	5.82

Supposing woody fibre to be a definite compound these estimations lead to the conclusion, that it consists of 5 proportions of carbon, 3 of oxygen, and 6 of hydrogen, or 57 carbon, 45 oxygen, and 6 hydrogen.

It will be unnecessary to speak of the applications of woody fibre. The different uses of the woods, cotton, the barks of trees, are sufficiently known. Woody fibre appears to be an indigestible substance.

18. The acids found in the vegetable kingdom are numerous; the true vegetable acids, which exist ready formed in the juices or organs of plants, are the *oxalic*, *citric*, *tartaric*, *benzoic*, *acetic*, *malic*, *galic*, and *prussic* acid.

A NEW SPECIES OF ROOF.

Continued from page 14.

The roofs are much flatter than for slating, (the common proportion being one foot in height to twelve in breadth,) the couples are no more than three inches in breadth by one and a half deep, and upon these are laid half inch deals, dressed with a plane on the edges, so as to prevent intervals at the joints; and the external covering is sheathing paper. The sheets are prepared by being dipped in tar, at nearly the boiling point, that it may the more readily penetrate, and after drying for two days, are again dipped in tar at a lower temperature; they are then nailed on the roof in the same manner as slates, overlapping each other exactly in the same manner; and, above the whole is laid a coat of tar, boiled to the consistency of pitch, on which fine smithy ashes are passed through a seive while cooling to diminish the combustibility, and to prevent the liquefaction of the tar. Mr. William Ramsey, a chemist, of Glasgow, is related to have used, instead of common tar, the tar extracted from wood, in the formation of pyroligneous acid, and, by a peculiar composition, to have made it assume as close a texture and as bright a polish as marble.

Observations.—The species of roof here described, will soon be extensively adopted where wood and slates are scarce, provided its durability can be ascertained. The building in Greenock, thus roofed, which has lasted twenty years, affords a presumption in its favor; but we cannot recommend it till it has stood the test of repeated experiments.

MANGANESE USED IN THE MANUFACTURE OF IRON AND STEEL.

In the Annales de Chimie, M. Gazeran has given a paper on the subject, in which he states that in the German founderies, particularly about Nassau-Siegen they used the black ore of manganese with the iron ore in making steel; he advises that from 4 to 5 per cent. of manganese should be mixed with the ores that do not contain it naturally, and states that the best German steel contains 2.16 per cent. of manganese and 1 of carbon. It is proposed to use manganese with iron stone in the manufacture of crude iron, in various proportions according to the nature of the ore.

ON PROPAGATING FRUIT TREES BY ABSCISION.

Continued from page 15.

It is conceived that a longer period would be necessary to succeed with this operation in Europe, because vegetation is so much slower here than in India, where Dr. Howison, made his experiments; but he thinks that an additional month would be adequate to make up for the deficiency of climate.

The advantages of this method are stated to be, that a farther growth of three or four years is sufficient, when the branches are of any considerable size to bring them to their full bearing state; whereas, eight or ten years would be otherwise necessary. This he saw proved from experiment at Prince of Wales' Island. The writer's experience does not allow him to speak of the success with which this method might be applied to forest trees, but he little doubts of its succeeding, and the adoption of it is recommended at all events in multiplying such plants, natives of warmer climates, whose seeds do not come to maturity in this country. He has besides frequently remarked that such branches of fruit-trees as were under the operation of abscision at the time of bearing, were more laden with fruit than the rest of the tree, which is attributed to a plethora or fulness, occasioned by the communication between the branches and trunk being cut off by the division of the bark, and has observed that the roots from a branch under this operation were longer in shooting into the ball of straw, when the tree was in leaf, than at another time, on which account he recommends the spring as the best season for making experiments.

Observations.—This mode of propagating trees, which prevails in many parts of Eastern Asia, is deserving the notice of our horticulturists at home; and from the prevailing inclination to pursue that branch of science, we have no doubt of being soon able to communicate experiments of this mode of propagation in our own country.

FALSE GILDING AND WHITE-WASHING.

Continued from page 15.

The paper thus gilded, is cut into the shape of the flowers, and pasted on the walls or columns. The interstices are filled up with oil-colors; the oil for which is composed of two parts of linseed oil, and one of the above mentioned elastic gum.

At Seringapatam they cover the (chunam) stucco of their walls with a thin coat of (suday) fine clay, mixed with size; then a coating of (balapum) pulverized potstone; and finish the wall with a coating of eight parts of very fine ground (abracum) mica, with one of pulverized potstone, and one of size. The wall thus treated, shines like the scales of fishes, and has a splendid appearance when lighted up; but, in the day-time, walls covered with potstone alone look better.

ON THE PRESERVATION OF ANIMAL SUBSTANCES.

The Chinese are said to prepare their pork for travelling by pressing out the juices, and the preparation of brawn is somewhat similar. If meat were subjected to the action of a screw-press, or, where that machine is wanting, or a greater pressure required, it may be placed between iron plates in a frame of wood, and the plates brought closer by wedges, on the principle of an oil mill. Experiment would soon determine the necessary pressure for preserving it for any limited time, without much injury to its being dressed as usual.

CAUSES OF THE DECAY OF WOOD, AND THE MEANS OF PREVENTING IT.

In the Bath Society's papers, Dr. Parry has suggested the cause of decay in timber, viz: heat and moisture, and proposes that drying oils, either by themselves or boiled with metallic oxides, be used to form a coat to exclude the moisture. As an additional strength to this varnish, he proposes a mixture of silecious or flinty sand with it; this sand may be easily procured from the seaside, and the currants of roads and rivers; in using it, however, it should be first cleared from all saline impregnations, by washing in several waters, and any sand may be obtained of any fineness desired, by mixing it with water in a tub, and after having stirred the whole well together, pouring out the muddy (turbid) water, from which the sand will settle, by its own gravity, in a state fit for use, when dried.

Another process recommended, is to cover the wood with a coat of drying oil, and immediately drege the coat with a layer of charcoal, finely pulverized or powdered, and contained in muslin, and in a day or two, brushing off what is loose, and giving the surface a coat of paint in the usual manner; this forms a firm and solid crust.

Dry rot is supposed to be produced by moisture, also combined with a certain temperature, and a preparation of a resinous kind, mixed with a certain proportion of bees-wax, is recommended as a preventive. The proportion of ingredients, and the mode of mixing them, recommended, are as follows: "Take 12 ounces of rosin, and 8 ounces of roll brimstone, each coarsely powdered, and 3 gallons of train oil; heat them slowly, gradually adding 4 ounces of bees-wax, cut in small bits; frequently stir the liquor, which, as soon as the solid ingredients are dissolved, will be fit for use."

It is recommended to dress every part of wood work, with this composition, twice over before the parts are put together, and once afterwards.

While preparing the varnish, it is recommended that an earthen vessel be employed, and that the fire be made in the open air, for whenever oil is brought to the boiling point, 600° of Fahrenheit's thermometer, the vapor immediately catches fire, and though a lower degree of temperature than that of boiling should be used in the process; it is not always practicable to regulate the heat, or to prevent the overflowing of the materials; in either of which cases the melting within doors would be dangerous.

DESCRIPTION OF A FORCING (HOT) HOUSE.

Mr. T. A. Knight pronounces the best form for the glass roof is that where the rays from the sun fall perpendicularly on the root, and as the rays fall most powerfully on the root when the

light comes almost perpendicularly on the glass, it is important to know by what elevation of the roof the greatest quantity of light can be made to pass through it. To ascertain this point, he made many experiments, and the result of them has satisfied him that that the best elevation in the latitude of 52 degrees, is about that of 34 degrees, considering the different periods of the year. The vinery which he has made, is placed at this elevation, and the building, which is forty feet long, is heated by a single fire place; the flue goes entirely round without touching the walls, and in the front, a space of two feet is left between the flue and the wall, in the middle of which space the vines, which are trained to the roofs, about eleven inches from the glass, are planted; and as both the wall and the flue are placed on arches, the vines are enabled to extend their roots in every direction, the air is usually admitted at the ends only, where all the sashes are made to slide, but in the roof only about four feet of the upper end of every third light is made to lift up by hinges, to give air in the event of very hot, and calm weather, and this method of giving air is preferred to the usul one of letting the lights slide down, because when the former plan is adopted, no additional shade is thrown upon the plants.

He recommends that no upright glass be used, and that, where the roof is extended, the front part of the interior of the building may be made sufficiently low at the floor to give the required room between that and the roof.

Mr. Knight uses the following substances to stop the bleeding of vines when pruned, viz: Four parts of scraped cheese, and one of calcined oyster shells, and presses this composition strongly into the pores of the wood, and it instantly stops the flowing of the sap; the largest branches may, of course, be taken off at any season of the year with safety.

Remarks.—Agreeably to the principles above stated, which appear to be founded on the immutable laws of optics, the elevation most proper for the roof of a forcing house, may be easily ascertained in any latitude, by placing it so that the rays of the sun shall pass through the glass at about the same relative direction as that above described.

ON A METHOD OF TRAINING FRUIT TREES.

The account which is here given by Mr. Knight, is confined to the Peach-tree, though he thinks that the same mode, with a little variation, is applicable, even with superior advantages to the cherry, plum, and pear; and observes, that when trees by any means are deprived of the motion which their branches naturally receive from winds, the forms in which they are trained operate more powerfully on their permanent health and vigor than is generally imagined.

The peach-trees which are the subject of this paper were plants of one year old only, and were headed down as usual early in the spring, and two shoots only were trained from each stem in opposite directions, and in an elevation of above five degrees; and when either of the two shoots did not grow with equal luxuriance, Mr. K. either depressed the strongest or gave a greater elevation to the weakest; by which means both were made to acquire, and to preserve an equal degree of vigor. These shoots grew with great luxuriance, as they received the whole sap of the plant, and in the course of the summer attained the length of four feet. Many lateral shoots being also emitted from the luxuriant branches, which however were all pinched off at the second leaf, and in the succeeding winter were pruned down close. This form, it is observed, might be advantageously given to trees in the nursery, as it would require very little trouble or expense.

As many branches were suffered to spring from each shoot in the succeeding season as could be conveniently trained without shading each other; and by selecting the strongest and earliest buds towards the points of the last year's branches, and the weakest and latest near their base, nearly an equal degree of vigor was obtained to each shoot in the year, and by this method also a greater surface of leaf was exposed to the light, without placing any of the leaves so as to shade others, than could have been effect-

ed by any other method of training; and the growth of the trees was so great from this arrangement that some of them at two years old were fifteen feet wide, and the young acquired in every part the most perfect maturity. In the succeeding winter the shoots of the last season were alternately shortened and left their whole length, and were then prepared to afford an abundant and regular blossom in the succeeding spring. In the autumn of the third year the shoots of the internal branches were trained backwards from the original shoots so that the central part of each tree was formed of fine bearing wood; and the size and general health of the trees afforded evidence of a more regular distribution of the sap than Mr. Knight had witnessed in any other mode of training.

It is remarked, that in this method of pruning, little use was made of the knife during the winter; and, Mr. Knight conceives that winter pruning should be avoided as much as possible, for the only advantage gained by laying in a larger quantity of wood in the summer and autumn, than will be wanted in the spring, is the choice of good shoots, and there is no advantage in having more than are wanted; whereas the health of the tree always suffers by too much use of the knife through successive seasons.

As entering into the details of pruning in the most advantageous manner would lead him beyond his intended limits, he merely avails himself of the opportunity to offer a few observations on the proper treatment of luxuriant shoots of the peach-tree; a subject not understood by either English or foreign writers on gardening.

Referring to a paper, communicated by him to the Royal Society, on the Alburnum or sap of trees, he conceives that the facts detailed there afford sufficient evidence that the Alburnum of trees becomes, during winter, a reservoir of the sap or blood of the tree, as the bulb of the hyacinth, tulip, and potatoe, certainly do of the sap or blood of those plants. Now, a wall tree, from the advantageous position of its leaves, probably generates more sap than a standard tree of the same size, so that the gardener is compelled to destroy a large portion of the succulent shoots; the sap in consequence stagnates, and appears to choke the passages through the small branches, which consequently becomes incurably unhealthy and stunted in their growth, and nature affords means of relief by distributing the sap in the production of luxuriant shoots. These shoots, all horticultural writers have directed to be shortened in summer, but Mr. Knight, has found great advantages in leaving them unshortened, as they have uniformly produced the finest possible bearing wood for the succeeding year, and that the laterals from these shoots, if stopped at the first leaf, will often afford strong blossoms and fine fruit, the succeding season. He thinks that a luxuriant shoot should rarely or never be cut out or shortened, where space for training it can be found, but it should never be trained in a perpendicular direction.

Observations.—The intimate knowledge which this writer possesses of the operations of nature in the vegetable creation, entitles all his suggestions on horticultural subjects to the greatest attention. The mode of pruning recommended in this paper, appears to possess all the advantages attributed to it, besides that of bringing a fruit-tree into a bearing state one or two years earlier than by the common method. For the propriety of the treatment recommended for the luxuriant shoots of the peach-tree, we can offer our own experience for six or seven seasons, and the result has uniformly been, that the trees not only ceased to produce such shoots (whereas they had only been multiplied by amputation,) but have continued to produce fine healthy bearing wood, and a profusion of blossom and fruit. As soon as any branch assumes a more luxuriant appearance than its neighbors it should be trained if possible below a horizontal position.

Note.—If fruit trees were trained sufficiently near the ground so as to be covered with straw during winter, they might by these means be guarded from extreme cold, which would otherwise kill them.

DEFINITION OF TERMS.

Letter G.

GALBANUM, a gum issuing from the stem of an umbelliferous plant, growing in Persia, and many parts of Africa.

It is inflammable in the manner of a resin, and soluble in water like a gum.

It attenuates and dissolves tough phlegm, and is therefore of service in asthmas, and inveterate coughs, and in many other complaints.

GALENIC, or *Galenical*, in Pharmacy, a manner of treating diseases. Galenical medicines are those which are formed by the easier preparation of herbs, roots, &c., by infusion, decoction, &c., and by combining and multiplying ingredients; while those of *chemistry* draw their more intimate and remote virtues by means of fire, and elaborate preparations, as calcination, digestion, fermentation, &c.

GALL, in natural history, denotes any protuberance or tumor produced by the puncture of insects on plants and trees of different kinds.

GALVANISM, a term used to denote the influence of metals by mere contact with the animal body. It has been long asserted that when porter, (and some other liquors also) is drunk out of a pewter pot, it has a taste different from what it has when drunk out of glass or earthen ware.

GAS, among chemists, a term used to denote all the ærial and permanently elastic fluids except atmospheric air.

GASTRIC JUICE, among physicians, a thin pelucid, spumous, and saltish liquor, which continually distils from the glands of the stomach, for the dilution of the food.

GELATINE, in chemistry, a jelly, produced from animal substances by frequent washings in cold water; *glue*, *size*, and *isinglass*, are all composed, in part, of this substance.

Gelatine exists in great abundance in animals; forming the constituent part of their solid and fluid parts; its uses are numerous. In a state of jelly, it constitutes one of the most nourishing and palatable species of food.

GELATINOUS, in pharmacy and medicine, any thing approaching to the glutinous consistence of jelly.

GEM, in natural history, a common name for all precious stones, of which there are two classes, the pellucid and semi-pellucid.

The bodies composing the class of pellucid gems, are bright, elegant, and beautiful fossils, naturally and essentially compound, ever found in detached masses, extremely hard, and of great lustre.

The bodies composing the class of semi-pellucid gems, are stones, naturally and essentially compound, not inflammable, nor soluble in water; found in detatched masses, and composed of crystalline matter, debased by earths; however, they are but slightly debased, and are of great beauty and brightness, of a moderate degree of transparency, and are usually found in small masses.

The knowledge of gems depends principally on observing their hardness and color. For hardness, they are commonly allowed to stand in the following order; the diamond the hardest of all; then the ruby, sapphire, hyacinth, emerald, amethyst, garnet, carneol, chalcedony, onyx, jasper, agate, porphyry, and marble. In point of color the diamond is valued for its transpareney, the ruby for its purple, the sapphire for its blue, the emerald for its green, the hyacinth for its orange, the amethyst for its violet, the carneol for its carnation, the onyx for its tawny, the jasper, agate, and porphyry for their vermillion, green, and variegated colors, and the garnet for its transparent blood-red.

GEOMETRY, the science and doctrine of local extension, as of lines, surfaces, and solids, with that of ratios, &c.

The *usefulness* of this science extends to almost every art and science. It is by the help of it that engineers conduct all their works. On geometry, likewise, depends the theory of music, optics, perspective, drawing, mechanics, hydraulics, pneumatics, &c.

GERMINATION, in botany. When a seed is placed, in a situation favorable to vegetation, it very soon changes its appearance. The radicle is converted into a root, and sinks into the earth; the plumula, on the other hand, rises above the earth, and becomes the trunk or stem,

When these changes take place, the seed is said to germinate. The process itself has been called germination, which

requires oxygen gas, and a certain degree of heat and moisture to be present. Seeds do not germinate well if they are exposed to the action of light.

Oxymuriatic acid causes seeds to vegetate more rapidly when they are steeped in it or watered with it; supposed to be caused by the facility with which this acid parts with its oxygen. This acid seems even to augment the power of seeds. Cases are stated where seeds had been long kept, and refused to germinate, grew rapidly when treated with this acid. When a seed is placed in favorable circumstances it gradually imbibes moisture, and very soon after emits a quantity of carbonic acid gas, even though no oxygen gas should be present. If no oxygen gas be present, the process stops here, and no germination takes place. But if oxygen gas be present, it is gradually absorbed by the seed; and at the same time the farina of the cotyledons assume a sweet taste. The quantity of oxygen gas absorbed during germination, is always proportional to the carbonic acid gas emitted; that is, the carbonic acid emitted contains in it precisely the same quantity of oxygen as has been absorbed.

Gilding is the application of gold to the surfaces of bodies.

To write on paper with letters of gold, put some gum arabic into common writing ink, and write with it in the usual way. When the writing is dry, breathe on it; the warmth and moisture soften the gum, and will cause it to fasten on the gold-leaf, which may be laid on in the usual way, and the superfluous part brushed off. Or instead of this any japanner's size may be used.

To make shell-gold.—Grind up gold-leaf with honey in a mortar, then wash away the honey with water, and mix the gold powder with gum water. This may be applied to any article with a camel's hair pencil, in the same way as any other color.—Glasses, &c. may be gilt by drawing the figures with shell gold mixed with gum arabic and a little borax. Then apply sufficient heat to it, and lastly burnish it. The work being thus gilt, it is suffered to remain about twenty-four hours, when the parts that are designed to be burnished, are polished with a dog's tooth, or, what is better, with an agate burnisher. The gilding must not be quite dry when burnished; there is a state proper for the purpose, which is only to be known by experience.

Gluten, a substance found in wheat and various other vegetables, and constituting an essential ingredient in the formation of bread. It seems also to constitute the essential part of yeast. It is exceedingly, tenacious, ductile, and elastic, hence the superior lightness of wheat bread to that made from other grain: the carbonic acid gas produced by fermentation is retained by the gluten. The force of this gas acting on the gluten causes it to swell and form what is usually called light bread; wheat contains a larger portion of gluten than any other grain. It is also used for varnish, and a ground for paint, and is said in many cases to constitute the base of the substance called bird lime.

Gneiss, in mineralogy, is composed essentially of felspar, quartz, and mica forming plates which are laid on each other, and separated by thin layers of mica.

Gnomen, in dialling, the style, pin, or cock of a dial, which by its shadow shows the hour of the day. The gnomen of every dial represents the axis of the world.

Grafting or *graffing*, in gardening is the insertion of a scion into a stock or stem raised for the purpose. The usual time for grafting is from mid-February to mid-March, but in a forward season sooner, and in a backward one later.

Let the scions be taken from the trees two or three weeks before they are wanted: set them on end half buried (in mould or sand nearly dry) in a garden pot placed in a cool room. They should be taken from the outside of healthy trees just in their prime. *Budding* may be performed from the middle of June to the middle of August.

Granite, a genus of stones of the order of petræ, belonging to the class of saxa. The principle constituent parts of this stone are felspar or rhombic-quartz, mica and quartz.

Graphites, in mineralogy, a mineral consisting principally of carbon, with a

little iron, and generally a little silica or alumina.

Gravimeter, the name given by M. Guyton to an instrument for measuring specific gravities; he adopts this name rather than either areometer or hydrometer, because these latter terms are grounded upon the supposition that a fluid is always the thing weighed; whereas with regard to solids, the liquid is the known term of comparison to which the unknown weight is referred.

Gravity, in physiology, the natural tendency of bodies towards the centre.

Gravity (*specific*) is the relative, comparative or apparent gravity in any body, in respect of that of an equal bulk or magnitude of another body. In estimating the specific gravity of different substances, distilled water at a given temperature is fixed on as a standard. Thus 1000 ounces of water (Avoirdupoise)=62½ lbs. in a cubic foot is said to be=1000; gold = 19,258; gold hammered = 19,362; platina=19,500; platina rolled=22,069; cast iron=7207; bar iron either hardened or not=7788.

Graustein, in mineralogy, is a rock composed of small grains of felspar and hornblende, which graduate into each other, and form a mass almost homogenous, of an ash-gray color. It contains olivine and augite.

Gregorian year. The greatest part of Europe have long used the Gregorian style, but Great Britain retained the Julian, till the year 1752. The *Gregorian* is found not to be exactly conformable to the true solar year, but varies from it one hour and twenty minutes in each 400 years.

Gum, a thick transparent, tasteless fluid, which sometimes exudes from certain species of trees. Gum is dissolved by water; the solution is known by the name of mucilage. It is insoluble in alcohol, in which respect it differs from resin; that substance being soluble in alcohol, but insoluble in water.

Gunter's chain, the chain in common use for measuring land according to the true or statute measure, so called from M. Gunter, the reputed inventor.

The length of the chain is sixty-six feet, or twenty-two yards, or four poles of five yards and a half each, and it is divided into one hundred links of 7.92 inches each.

This chain is the most convenient of any thing for measuring land, because the contents thence computed are so easily turned into acres, the reason of which is that an acre of land is just equal to ten square chains, or ten chains in length and one in breadth, or equal to 100,000 square links. Hence the dimensions being taken in chains, and multiplied together, it gives the content in square chains, which therefore being divided by 10, or a figure cut off for decimals, brings the content to acres after which the decimals are reduced to roods, and perches by multiplying by 4 and 40. But the better way is to set the dimensions down in links as integers, considering each chain as one hundred links; then, having multiplied the dimensions together, producing square links, divide these by 100,000, that is, cut off five places for decimals, the rest are acres, and the decimals are reduced to roods and perches as before.

Example. Suppose in measuring a rectangular piece of ground, its length be 795 links, and its breadth 480 links—

```
        795
        480
      ------
      63600
     3180
    --------
A. 3,81600
        4
    --------
R. 3,264
       40
    --------
P. 10,560
```

So the content is 3 acres, 3 roods, and 10 perches.

Gypsum (*sulphate of lime,*) what formerly was called gypsum, or selanite, is now known to be sulphate of lime. It is also distinguished by the name of plaister stone, &c.

ON PLANTING TREES.

It is recommended that in digging each hole for receiving the tree it be large enough to receive the roots freely, and

then laying the sward which is pared off, at the bottom of the hole with the grass upwards and setting the tree upon it, placing the roots straight and regular as in their natural growth, upon which more sward is to be laid with the grass downwards, and the hole filled up with earth.

On clay soils it is stated to be improper to go below the good mould, though it be ever so shallow, and to be better to raise earth a foot or two above the ground upon the roots of the new planted trees, than to go beneath the surface of the clay; and in a few years the extra expense will be amply compensated by the flourishing state and healthy appearance of the trees.

SYRUP, BROWN, OR WHITE SUGAR FROM GRAPES.

By M. Focque.

The syrup that is prepared from juice of grapes, properly saturated, and concentrated to 30° Baume's hyd. keeps for any length of time, and in about two months, three-quarters of it is crystallized in spherical crystals, which are the size of millet seed, if the vessel has not been moved; otherwise they are smaller.

If the syrup is evaporated on a naked fire, it acquires a reddish-brown color, which spoils it for certain purposes; if a vapor bath is used, the syrup is finch-yellow, and yields 75 per cent. of crystals of the same color, which may be refined to a white color. The addition of brandy, or powder of sugar, to hasten the production of these crystals, has no effect. The white sugar made from grapes has not the sandy hardness of cane sugar; it is pulverulent and soft to the touch, and its taste is also sweeter than that of the syrup and crystals used together.

It is very easy to construct a vapor bath by making a bank of rubbish about three feet high, kept in by hurdles supported by stakes; the top of the rubbish should be covered with powdered charcoal, upon which a tinned copper, or plate tin pan 8 or 10 feet long, 3 feet 8 inches wide, and 6 inches deep, must set, the sides being supported by 4 planks; a flat steam pipe 18 inches wide from an adjacent boiler is to be introduced into the pan by one of its ends, and after running round it to be carried out again with a sufficient inclination to let the condensed water run again into the boiler, to which a common still head is to be adapted. For small families it is sufficient to place a shallow pan 3 feet wide upon a common boiler, at a distance just sufficient to let the steam escape under it.

To make about 100 or 125 lbs. of syrup 400 of the juice of grapes must be procured, 30 or 40 quarts of which are to be heated in 2 parcels, until the hand cannot be kept in it, and then poured into the remainder, after which is to be added 40 quarts of powdered chalk, or wood ashes, previously sifted, and washed three times with boiling water. The wood ashes are to be preferred, as they do not give a bad taste to the syrup, and as chalk contains particles of clay that fall down very slowly, it is requisite to filtrate the syrup through a flannel when that earth is used. The mixture is to be stirred, and then left to settle for a couple of hours. A spoonful of the clear liquid is then poured into a cup of milk which is made to boil; if the milk is turned, 2 or 3 quarts more chalk are to be added, and after some time the syrup is again tried with milk. When the syrup by these additions of chalk will no longer turn milk on being boiled therewith, it is ready to be evaporated. The trial of the juice with milk is better than to use litmus paper, for when the paper is not altered in color, there may still be left sufficient acid in the liquor to curdle milk. The saturated juice after being left till the next day to settle is to be drawn off, and the sediment drained upon a fine cloth, after which a pail of hot water should be poured in three separate parcels upon the sediment, in order to separate all the sugar it contains. If the color of the syrup is not esteemed of any consequence, it may be evaporated in a common boiler, observing to skim it well, until a drop let fall upon a cold plate grows sufficiently solid on cooling not to run upon the plate when the latter is inclined, or a hydrometer may be used. The syrup must then be poured into pots or casks, and covered up. When the color of the syrup is of consequence, the pressed juice must not be received in vessels that have been used for making wine, as the remains would color the juice, which must

also be evaporated by means of steam.—Syrup evaporated to 30° or 32° of the hydrometer, acquires in a month's time such consistency, that the vessel may be turned bottom upwards, without the syrup falling out: some syrup evaporated not quite so far, acquired this consistence in 15 or 20 days.

The juice of the white grapes, called at Paris, melier, yields 22 per cent. of dry saccharine matter, the red grapes 18, and the chasselas only 16. In Spain, the grapes being richer, yielded 33 per cent. of sugar.

Four hundred pounds of saturated juice of grapes usually grown about Paris, yielded from 100 to 125 lbs. of syrup at 30° hydrometer, in which spherical crystals were afterwards formed; these crystals when drained on a cloth weighed 75 lbs., but on being strongly pressed, their weight was reduced to 60 lbs.

On submitting the crystals to the usual method of refining, they were further reduced to 40 lbs. of good clayed Lisbon sugar, from which a loaf, weighing 16 lbs. of white sugar was afterwards obtained. (*Journ. de Phys.*)

Note.—The quantity of chalk, ordered by M. Facque, appears very great. In India, about three spoonsful of lime are added to fourteen gallons of cane juice. In America, a spoonful of lime is considered sufficient for fifteen gallons of sugar maple juice. According to Dubuc, apple juice requires about one drachm (gros) of chalk, and the juice of pears about two drachms per quart. Some error must therefore exist in this part of the original, especially as he orders the wood-ashes to be elixiviated before they are used, which, taking away their alkali, must render them less useful, and, indeed, nearly useless.

Parmentier orders half an ounce of washed wood-ashes, chalk, or whiting, to be added to 25 quarts of the juice of grapes in the South of France, and twice that weight of alkaline substances to be used in the North, where they do not ripen perfectly, so that it should seem as if four ounces of chalk would be sufficient, and then a much less quantity of water will be required for the purpose of washing out the saccharine matter from the residuum.

The juice of the sugar cane is said to contain on an average about one eighth of its weight of raw sugar. If we take a medium between the richest grape juice stated above (33 per cent.) and the poorest (16 per cent.) will give 24½ which is within one-half per cent. of one-fourth its weight of raw sugar or nearly twice the richness in saccharine matter as cane juice. Now, as grapes can be cultivated in latitudes where the temperature is too low for the sugar cane, it would seem an object worthy of consideration for the inhabitants to direct their attention to the subject, and instead of converting the grape into wine and brandy, produce, raisins, sugar, and molasses, not only sufficient for the inhabitants, but as articles of export.

CHARCOAL MANUFACTURED IN CLOSE VESSELS.

The advantages of this process are said to be these, viz: The quantity of charcoal obtained from a given quantity of wood is double that obtained in the ordinary method, while only one-eighth part of the wood is required to be consumed in the distillation. It is also better than the common, as a given quantity evaporates one-tenth more water than the other; hence iron masters may obtain twice as much iron from the use of a given quantity of wood, and in addition to this there is also prepared a number of other articles, each of which in order, 350 killogrammes (700 lbs.) of wood is said to yield 25 to 30 of tar, which retains so much acid that it is soluble in water; but when it is washed, and rendered thick by boiling for some time, it offers more resistance to water. If mixed with one-fifth of rosin it is rendered equally fit for the use of ships, &c., as the common tar. Four sorts of vinegar are prepared, all of which are perfectly limpid, which do not, like the common, contain any tartar, malic acid, resinous or extractive matter, nor indeed any mineral acid, lime, copper, or other substances. The simple vinegar marks=2° hyd. for salts, at 12° therm. cent.—it is stronger tasted than common vinegar, and produces a dis-

agreeable irritation. The aromatic vinegar is prepared with tarragon; the smell is agreeable, but it has the same fault as the former. The vinious vinegar is formed by adding some alcohol to simple vinegar; it has a very sensible odor of acetic ether; the alcohol softens the flavor in some degree, but the vinegar is still very sharp. The acid called strong vinegar, is in fact a very good acetic acid at $10\frac{1}{2}^{\circ}$ hydr., it is very white clear, and sharp, without the usual burnt flavor, and seems to form the basis of the preceding kinds. It can be sold for eight or nine francs (seven shillings) per pound, which is only half the price of that distilled from verdigris Although not so agreeable to the taste as common vinegar, these new kinds are more elegant to the eye, and do not mother.

Carbonate of soda, perfectly white and transparent, is made at the same establishment.

Impure acetate of alumine is also produced.

Acetate of soda, in well formed, very white, and pure crystals.

Acetate of copper, crystallized in small grains, more brilliant than common verdigris. It is also soluble in water, and much cheaper than that in present use.

Acetate of barytes, perfectly pure; it would be preferable to acetate of lime for preparing acetate of alumine, if it were not too dear.

Muriate of alumine is said to be preferable to alum in dying, but that prepared by Messrs. Mollerat is excessively acid, and contains lime and oxide of iron, which renders it useless in many cases.

Oxide of zinc, of a dirty white, and containing oxide of iron, and a little carbonic acid, which it appears to have absorbed after it was calcined.

Carbonate of zinc, rather whiter, but which also contains some iron, although the carbonic acid hides its color.

Both of the last substances might be used by painters instead of white lead.

Besides the above, the proprietors intend to make white lead, and also sugar of lead.

A cubic metre (yard) of wood yields 100 litres (quarts) of acid liquor.

Besides the above, 25 or 30 killogrammes (50 or 60 pounds) of thick oil.

Ann. de Chim.

REMEDY FOR POTATO CURL.

To prevent this disease, spread *hot lime* upon the land before planting the potatoes. Soot is also recommended.

UNDER DRAINING FOR HEDGES.

Where the soil is heavy, wet, and composed of clay, it is stated than an underdrain beneath the line where the sets are planted is of great service, and where old hedges want improving in such soils it is recommended to pass drains underneath them at no very great distance, in a cross direction.

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OBSERVER AND RECORD
OF AGRICULTURE, SCIENCE, AND ART.

EDITED BY D. PEIRCE.

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The object of this paper is to concentrate and preserve, in a form suitable for future reference, the most useful and interesting articles on the aforesaid subjects. Each number will contain sixteen octavo pages, printed on good paper, and when a sufficient amount is published to form a volume of convenient size, an alphabetical table of contents will be published and forwarded to subscribers, in order for binding. This number, shows the general plan of the work.

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CONSERVE OF GRAPE.

BY M. PARMENTIER.

To preserve the conserve of grape, twice as much juice of grapes is taken as the boiler will hold; the juice is slowly boiled, and the boiler filled up as fast as the liquor evaporates; when all the juice is got in, it is scummed, and the evaporation continued until the liquor is reduced to three-quarters. The fire is then diminished and the mass, in order to prevent its acquiring a burnt taste, is kept continually stirred with a large slice, till the operation is finished. If this slice is hung to the ceiling over the boilers, so as to reach to the bottom of it, the stirring will be much less fatiguing.

The conserve is properly prepared when it acquires a middling brown color, and when a piece as big as a nut is dropped upon a plate it does not spread upon the plate. It should indeed be of the consistence of honey, and poured very hot into clean vessels, which are not to be covered until it is quite cold.

A very considerable use of this conserve would be to give the requisite degree of strength to the juice of the grapes which are too watery to form good keeping wine, either on account of the backwardness of season, or the nature of the plant.

In preparing a conserve, the farmer must beware of employing too much heat; it must be recollected that sugar candy loses its power of crystallization by being kept too long over the fire. It is indeed by altering the form of the boilers, so as to evaporate the superfluous water with the least possible use of heat, that it has been found practicable of late, to obtain more sugar than before, with less treacle.

If the superfluous water could be evaporated without the use of fire, it would be desirable.

Montgolfier says that he has made experiments for twelve years on thickening the juices of fruits. His process is similar to the graduation of saline brines, and differs only in the use of a very simple ventilator, by means of which he caused 30 cubic feet of air per second, to pass through fagots of vine twigs from bottom to top. This quantity dissolved from 1 to 4 grains of water, according to its dryness; and hence a working man working the ventilator for 12 hours, caused the evaporation of nearly 300 lbs. of water; and 4 strong horses in a large ventilating apparatus, might be made to evaporate 10,000 lbs. of water in 24 hours, so that nearly 3,000 lbs. of conserve of grape might be prepared in that time.

He also found that each cubic foot of air lost one degree of temperature by dissolving a grain of water.

Note.—Graduating sirup by means of artificial ventilation might be extended to many operations.—*Annales de Chimie.*

LIQUID SUGAR FROM APPLES AND PEARS.

BY M. DUBUC.

Eight quarts of the full, ripe juice of apples called orange, was boiled for a quar-

ter of an hour, and 40 grammes of pow dered chalk added to it, and the boiling continued for 10 minutes longer. The liquor was then clarified by the whites of 3 eggs, and the liquor was strained twice through flannel, and afterwards reduced by boiling to one-half of its former bulk, and the operation finished by a slow heat until a thick pellicle rose on the surface, and a quart of the sirup weighed 2 lbs. 10 ounces. By this means 3 lbs. of liquid sugar was obtained, very agreeable in taste and smell, which sweetened water very well, and even milk without curdling it.

Eight quarts of juice of apples called *dauxlevesque*, yielded, by the same process 2 lbs. 12 ounces of liquid sugar; 8 quarts of the juice of sour apples called *blanc* mollet yielded 2 lbs. 10 ounces of good sugar.

Eight quarts of the juice of the watery apples called *Girard*, yielded 2½ lbs.

Fifty lbs. of the above 4 apples yielded nearly 42 lbs. of juice which took 3 ounces of chalk, and the white of 6 eggs and produced more than 6 lbs. of excellent liquid sugar.

In order to do without eggs, 20 lbs. of the juice of the above apples were saturated with 10 drachms of chalk, and repeatedly strained through flannel, but it was still thick, and disagreeable to the taste; 12 drachms of charcoal powder were then added, and the whole boiled for about 10 minutes, and then strained twice through a flannel; it was then clear, but higher colored than usual; but it produced very good sugar.

Six quarts of apple juice, were treated with 7 drachms of chalk, and 10 ounces baker's small coal, previously washed until it no longer colored the water.

Eight quarts of apple juice of several different kinds and in different stages of ripeness, of which one-third was still sour, were saturated with 12 drachms of chalk, and clarified with the whites of 6 eggs; some malate of lime was deposited in small crystals towards the end, and separated by passing the sirup very hot through flannel; very near 2 lbs. and a half of sugar were obtained.

Ten lbs. of bruised apples, similar to the last, were left to macerate for 24 hours, and 4 quarts of the juice were treated with 5 drachms of chalk and the white of an egg, it yielded 1 lb. 6 ounces of liquid sugar, so that the maceration had been of service.

Twenty-four lbs. of pears called *pillage*, yielded 9 quarts of juice, which required 18 drachms of chalk, and the white of 2 eggs, and yielded about 24 ounces of sugar, which was less agreeable to the taste than that of ripe apples.

Six quarts of juice from one part of the above pears, and two of ripe apples, *orange* and *girard*, treated with 8 drachms of chalk, and the whites of 2 eggs, yielded 26 ounces of very fine tasted sugar, superior to the preceding; 6 quarts of juice of an equal quantity of apples and pears, treated with 10 drachms of chalk, and 1 ounce of prepared charcoal, deposited some malate of lime, and yielded a sugar rather darker than the preceding, but very well tasted. Cadet de Vaux says, that apple juice does not curdle milk, and that a small quantity of chalk added to it destroys some part of the saccharine principle; but 8 quarts of juice from ripe apples called *orange*, which was evidently acid, as it curdled milk and reddened infusion of turnsol and that of violet, was treated with 4 drachms of chalk, and the white of an egg; it yielded 22 ounces of sirup, between 32° and 33° hyd. which did not curdle milk. Another 8 quarts of the same juice, evaporated to three-fourths of its volume, and strained, yielded 23 ounces of clear sirup which curdled milk, was browner than that of the neutralized juice, and approached toward treacle in smell and taste. Perhaps the apple called *Jean-hure*, used by Mr. Cadet, possesses the valuable properties of furnishing good sugar by mere evaporation. It is necessary to observe, that unless the fire is slackened towards the end, the sirup grows brown, and acquires the taste and smell of burnt sugar.

A cwt. of apples yield about 84 lbs. of juice, which produce nearly 12 lbs. of liquid sugar; supposing, therefore, the average price of apples to be 1 franc=20 cents (1*s.*) the cwt. and the charges amount to 40 cent. (4*d.*) good sugar may be prepared for 3 or 4 sols (2*d.*) per lb. The only extra apparatus necessary is a couple of copper evaporating pans.—*Ann. de Chimie.*

HINTS ON VARIOUS MODES OF PRINTING FROM AUTOGRAPHS.

By G. Cumberland, Esq.—Phil. Journ. No. 126.

After some remarks on the advantage which would result to authors from the invention of a mode of issuing their works to the public without the intervention of a publisher, and of taking off the copies as they were wanted; M. G. enumerates several kinds of materials which he conceives to be best adapted for accomplishing the purpose.

The first of these which was suggested to him was copper, to be written upon by a style through white wax: but this could only be adopted for small pieces. He next supposes a kind of copper or brass latten, to be rolled very thin, and written upon with very corrosive ink, which would soon eat through the plate, and thus produce a stencil by which the printing might be effected.

If capital letters only were used, a paper stencil might be made by means of punches, which would last as long as the metal one; as many thousand impressions have been taken from a stencil made of oiled paper. Tinfoil or bismuth might also be used for the same purpose. Pannels of wood covered with plaster of Paris are suggested for drawings; and it is added that good impressions have been obtained from small blocks of this substance. It is also imagined that diagrams or plans might be obtained from a smooth board covered with thick paper and cut in relief.

Pontipool ware (pewter and copper covered with wax) may easily be engraved upon with a style; and pencil drawings readily engraved in this manner.

If a material could be found that resists the action of fire, it is supposed that we might write with it upon blocks of wood, and char the rest a little way in, so as to leave a projecting letter. Glass, turtle-shell, silver, &c. are mentioned as susceptible of being etched upon; and M. G. likewise thinks "that if we could write upon a block of stone, or plate of glass, with an ink so thick as to leave the words in relief we might, by pressing putty on it, take a cast sufficiently durable to make many impressions, or thus cast it in plaster of Paris from the relievo on the smooth block, but this would print the words white on a black ground. This writer likewise remarks that a volute shell, ground down on a hone, is the most secure stamp or seal for prints, drawings, and similar property.

Retrospect.

A SPRING CRUTCH.

By Mr. George Prisley.—Church Street, Soho.—Trans. Society of Arts. Vol. 28.

The head of the crutch is fixed upon a short brass tube, which is fitted to slide in another, fastened upon the top of the crutch staff; within this tube an helical (spiral) spring is concealed, that supports the head of the crutch, which yielding in a certain degree to the pressure, prevents the shocks which common crutches occasion, and enables the person who uses crutches of this kind to move quicker and with less fatigue.

For the convenience of package, the staff of the crutch is made to divide in two parts, which put together in a brass tube, where a spring that presses against the inside of the tube, prevents any danger of their separating by accident.

The silver medal was given to Mr. Prisley for his contrivance by the Society of Arts.

Observations.—This instrument promises to be of great assistance to lame people; and is the more likely to be advantageous, from its imitating the mechanism of nature, which in the animal frame interposes elastic cartilages, that have the same effect as springs between all the bones, so that no unyielding substance can come in contact.

On the same principle, a similar mode of construction must be of great advantage for wooden legs. We think wooden legs of this sort have been already made by another person, but if we are mistaken, suppose Mr. Prisley will find it profitable to have them made for sale.

The joint in the middle of the crutch seems a needless addition to the expense, as they can so very seldom require to be divided. Perhaps for sending to persons in the country, it might be found more convenient to forward the heads and tubes, containing the springs by them-

selves, to which any carpenter could easily fit staffs on their arrival.—*ib.*

Mr. John Kent's Patent for a new and expeditious Method of moving all kinds of Goods or Materials from high Buildings or deep Places.

Dated March, 1810.—Repertory of Arts, No. 104, second series.

Mr. Kent states his invention to consist in an improvement on the principle of a lever on a movable fulcrum. A weight to be raised is suspended over a pully, by means of a rope or chain, one end of which is fixed to the weight and the other to the centre of a wheel resting on a horizontal plane, and supposed, by itself or by weight attached to it to be heavier than the weight to be raised. The diameter of the wheel is double that of the pulley over which the rope passes, and the lower edges of both are in the same horizontal plane, and therefore a power half the weight of the body to be raised will balance that body, since the length of the lever to which the power is applied is double the length of that to which the weight is attached. If the wheel be rolled over a certain space on the horizontal plane on which it rests, the weight with which it is connected will be raised through an equal space.

The patentee also describes his invention in a compound state in which he connects the movable centres of two sustaining wheels together by a plate of metal, or otherwise, on each side of these wheels, which are surmounted by a roller of a certain weight to the axis of which a sufficient force being applied will cause these wheels to move on the horizontal plane which supports them. If another pair of wheels and rollers be added to the former, the power will be increased one-half; that is, if the first pair balance a weight of four hundred weight by a power of two hundred weight, a second pair will balance two hundred weight by a power of one ; and a third one hundred weight by a power of a half, and so on.

Hence, by adding a continuation of sustaining or friction-wheels and rollers, any power may be gained without loss of time, provided that the said rollers, which are laid on the said sustaining or friction-wheels, are of a sufficient weight in themselves, or by the weight attached to them, either by being suspended to the axis of the rollers, or bearing on their axis, or any other way, as occasion may require. *ib.*

METHOD OF PREPARING OX-GALL IN A CONCENTRATED STATE, FOR THE USE OF PAINTERS AND OTHER PERSONS.

By Mr. Richard Cathery.—Meads Row, Asylum Lambeth.—Trans. Society of Arts, and Repertory of Arts, No. 111.

Take a fresh ox-gall, put it in a basin, and let it settle all night; then pour it off from the sediment into a clean earthen mug, and set it in a sauce-pan of boiling water over the fire, taking care that none of the water gets into the mug. Let it boil till it is quite thick, then take it out and spread it on a plate or dish, and set it before the fire to evaporate; and when as dry as you can get it, put it into small pots, and tie papers over their tops to keep the dust from it, and it will keep good for years.

One gall prepared in this way will last an artist a long time, and a small cup of it may be placed in the same box with his colors.

Ox-gall is particularly useful in coloring prints, as many colors will not work freely without it on them, on account of the oil used in the printing ink. It is also used for common drawings in water colors, as it clears away that greasiness which arises from moist hands upon paper, and makes the color work clear and bright. The prepared gall is likewise of great use in cleaning woolen cloths from grease or tar. The size of a pea of it, is sufficient for a table spoonful of water, dissolved in which it will be ready for use. *ib.*

ON RAISING AND PLANTING APPLE TREES.

It is recommended to plant early fruit trees on dry and sandy land; and those which produce fruit late in the season on the contrary are said to flourish best on a strong loam or clay. The more valuable fruit, the styre, hagloe, crab, and golden pippin, prefer a light soil. The grafts are directed to be taken from a

crab, and not from a degenerated apple, for the former will possess much of the hardiness, and vigor, while the latter will generally inherit all the disease of the parent tree. The autumn is named as the best time for planting.

OBSERVATIONS ON FERMENTATION, *by M. Gay Lussac.*—Spirituous fermentation is the result of mutual action of saccharine mucilage and of a peculiar ferment approaching in its chemical composition very nearly to animal matter.

If the nature of the mixture and the temperature be suitable, fermentation may both begin and proceed without the concurence of any other substance, especially of oxygen gas.

Animal and vegetable substances may be preserved from fermentation or decomposition by enclosing them in air tight glass vessels, and subjecting them for some hours to the heat of boiling water.

Three open vessels filled with cow's milk, with currant juice, and with a solution of gelatine in water, were scalded by immersion in boiling brine at first twice a day, and afterwards once a day, for the space of two months. The currant juice and jelly remained unchanged; the cream of the milk was converted into hard butter, and the milk itself was rather thinner than at first. Malt in close vessels may be made to ferment by adding carbonic acid.—*Ann. de Chim.*

SIR H. DAVY'S AGRICULTURAL CHEMISTRY.

(Continued from p. 141.)

All of these acids, except the acetic, malic, and the prussic acids, are white crystallized bodies. The acetic, malic, and prussic acids have been obtained only in the fluid ; they are all more or less soluble in water ; all have a sour taste except the gallic and prussic acids ; of which the first has an astringent taste, and the latter a taste like that of bitter almonds. The oxalic acid exists uncombined, in the liquor which exudes from the chick pea *(Cicer arietinum)* and may be procured from the wood sorrel *(Oxalis acetosella,)* common sorrel, and other species of Rumex ; and from the *Geranium acidum.* Oxalic acid is easily discovered and distinguished from other acids by its property of decomposing all calcareous salts, and forming with lime a salt insoluble in water ; and by its crystallizing in four sided prisms.

The citric acid is a peculiar acid existing in the juice of lemons and oranges. It may likewise be obtained from the cranberry, whortleberry, and hip.

Citric acid is distinguished by its forming a salt insoluble in water with lime ; but decomposable by the mineral acids.

The tartaric acid may be obtained from the juice of mulberries and grapes ; and likewise from the pulp of the tamarind. It is characterized by its property of forming a difficultly soluble salt with potassa, and an insoluble salt decomposable by the mineral acids with lime.

Benzoic acid may be procured from several resinous substances by distillation ; from benzoin, storax and balsam of Tolu. It is distinguished from the other acids by its aromatic odour, and by its extreme volatility.

Malic acid may be obtained from the juice of apples, barberries, plums, elderberries, currants, strawberries, and raspberries. It forms a soluble salt with lime ; and is easily distinguished by this test from the acids already named.

Acetic acid, or vinegar, may be obtained from the sap of different trees. It is distinguished from malic acid by its peculiar odour ; and from the other vegetable acids by forming soluble salts with the alkalies and earths.

Gallic acid may be obtained by gently and gradually heating powdered gall nuts, and receiving the volatile matter in a cool vessel. A number of white crystals will appear, which are distinguished by their property of rendering solutions of iron deep purple.

The vegetable prussic acid is procured by distilling laurel leaves, or the kernels of the peach and cherry, or bitter almonds. It is characterized by its property of forming a bluish green precipitate, when a little alkali is added to it, and it is poured into solutions containing iron. It is very analogous in its properties to the prussic acid obtained from animal substances ; or by passing ammonia over heated charcoal ; but this last

body forms with the red oxide of iron the deep bright blue substance called Prussian blue.

Two other vegetable acids have been found in the products of plants; the morolyxac acid in a saline exudation from the white mulberry tree, and the kinic acid in a salt afforded by Peruvian bark; but these two bodies have as yet been discovered in no other cases. The phosphoric acid is found free in the onion; and the phosphoric, sulphuric, muriatic, and nitric acids, exist in many saline compounds in the vegetable kingdom; but they cannot with propriety be considered as vegetable products. Other acids are produced during the combustion of vegetable compounds, or by the action of nitric acid upon them; they are the camphoric acid, the mucous or saclactic acid, and the suberic acid; the first of which is procured from camphor; the second from gum or mucilage, and the third from cork, by the action of nitric acid. From the experiments that have been made upon the vegetable acids, it appears that all of them, except the prussic acid, are constituted by different proportions of carbon, hydrogen, and oxygen; the prussic acid consists of carbon, azote and hydrogen with a little oxygen. The gallic acid contains more carbon than any of the other vegetable acids.

The following estimates of the composition of some of the vegetable acids have been made by Gay Lussac and Thenard.

100 parts of oxalic acid contain:

Carbon	26.566
Hydrogen	2.745
Oxygen	70.689

100 parts of tartaric acid contain:

Carbon	24.050
Hydrogen	6.629
Oxygen	69.321

100 parts of citric acid contain:

Carbon	33.811
Hydrogen	6.330
Oxygen	59.859

100 parts of acetic acid contain:

Carbon	50.224
Hydrogen	5.620
Oxygen	44.147

100 of mucous or saclactic acid contain:

Carbon	33.69
Hydrogen	3.62
Oxygen	62.69

These estimations agree nearly with the following definite proportions. In oxalic acid 7 proportions of carbon, 8 of hydrogen, and 15 of oxygen;* in tartaric acid, 8 of carbon, 28 hydrogen, 18 of oxygen; in citric acid, 3 carbon, 6 hydrogen, 4 oxygen; in acetic acid, 18 carbon, 22 hydrogen, 12 oxygen; in mucous acid, 6 carbon, 7 hydrogen, 8 oxygen.

The applications of the vegetable acids are well known. The acetic and citric acids are extensively used. The agreeable taste and wholesomeness of various vegetable substances used as food, materially depend upon the vegetable acid they contain.

19. *Fixed alkali* may be obtained in aqueous solution from most plants by burning them, and treating the ashes with quick lime and water. The vegetable alkali, or potassa, is the common alkali, in the vegetable kingdom.

This substance in its pure state is white, and semi-transparent, requiring a strong heat for its fusion and possessed of a highly caustic taste. In the matter usually called pure potassa by chemists, it exists combined with water; and in that commonly called pearl-ashes or pot-ashes in commerce, it is combined with a small quantity of carbonic acid. Potassa in its combined state, as has been mentioned, page 94, consists of the highly inflammable metal potassium, and oxygen, one proportion of each.

Soda, or the mineral alkali, is found in some plants that grow near the sea, and is obtained combined with water, or carbonic acid, in the same manner as potassa; and, consists, as has been stated, page 94, of one portion of sodium, and two proportions of oxygen. In its properties it is very similar to potassa; but may be easily distinguished from it by this character; it forms a hard soap with oil; potassa forms a soft soap.

Pearl-ashes, and barilla, and kelp, or the impure soda obtained from the ashes

* According to Dr. Thompson's experiments, oxalic acid contains of 3 proportions of carbon, 4 of oxygen, and 4 of hydrogen, a result very different, indeed, from that of the French chemists.

of marine plants, are very valuable in commerce, principally on account of their uses in the manufacture of glass and soap. Glass is made from fixed alkali, flint, and certain metallic substances.

To know whether a vegetable yields alkali, it should be burnt, and the ashes washed with a small quantity of water. If the water, after being for some time exposed to the air, reddens paper, tinged with turmeric, or renders vegetable blues green, it contains alkali.

To ascertain the relative quantities of pot-ashes afforded by different plants, equal weights of them should be burnt; the ashes washed in twice their volume of water; the washings should be passed through blotting paper, and evaporated to dryness; the relative weights of the salt obtained, will indicate very nearly the relative quantities of alkali they contain.

The value of marine plants in producing soda, may be estimated in the same manner with sufficient correctness for commercial purposes.

Herbs, in general, furnish four or five times, and shrubs two or three times as much pot-ashes as trees. The leaves produce more than the branches, and the branches more than the trunk. Vegetables burnt in a green state produce more ashes than in a dry state. The following table* contains a statement of the quantity of pot-ashes afforded by some common trees and plants.

10,000 parts of	Oak	15
	of Elm	39
	of Beach	12
	of Vine	55
	of Poplar	7
	of Thistle	53
	of Fern	62
	of Cow Thistle	196
	of Worm Wood	730
	of Vetches	275
	of Beans	200
	of Fumitory	790

The earths found in plants are four; silica, or the earth of flints, alumina, or pure clay, lime and magnesia. They are procured by incineration. The lime is usually combined with carbonic acid. This substance and silica are much more common in the vegetable kingdom than magnesia, and magnesia more common than alumina. The earths form a principal part of the matter insoluble in water, afforded by the ashes of plants. The silica is known by not being dissolved by acids; the calcareous earth, unless the ashes have been very intensely ignited, dissolves with effervescence in muriatic acid. Magnesia forms a soluble and crystallizable salt, and lime a difficultly soluble one with sulphuric acid.

Alumina is distinguished from the other earths, by being acted upon very slowly by acids; and in forming salts very soluble in water and difficult of crystallization with them.

The earths appear to be compounds of peculiar metals (mentioned page 94,) and oxygen, one proportion of each.

The earths afforded by plants are applied to no uses of common life; and there are few cases in which the knowledge of their nature can be of importance, or afford interest to the farmer.

The only *metalic oxides* found in plants are those of iron and manganesum: they are detected in the ashes of plants, but in very minute quantities only. When the ashes of plants are reddish brown they abound in oxides of iron. When black or purple in oxide of manganesum; when these colors are mixed they contain both substances.

The saline compounds contained in plants, or afforded by their incineration, are very various.

The sulphuric acid combined with potassa, or sulphate of potassa, is one of the most usual. Common salt is likewise very often found in the ashes of plants, likewise phosphate of lime, which is insoluble in water but soluble in muriatic acid. Compounds of nitric, muriatic, sulphuric, and phosphoric acids with alkalies and earths exist in the sap of many plants or are afforded by their evaporation and incineration. The salts of potassa are distinguished from those of soda, by their producing a precipitate in solutions of platina; those of lime are characterized by the cloudiness they occasion in solutions containing oxalic acid, those of magnesia, by being rendered cloudy by solutions of ammonia. Sul-

* It is founded upon the experiments of Kirwan, Vauquelin, and Pertuis.

phuric acid is detected in salts by the dense white precipitate it forms in solutions of baryta. Muriatic acid by the cloudiness it communicates to solution of nitrate of silver, and when salts contain nitric acid, they produce scintillations by being thrown upon burning coals.

As no applications have been made of any of the neutral salts, or analogous compounds found in plants, in a separate state, it will be useless to describe them individually. The following tables are given from M. Th. de Saussure's Researches on Vegetation, and contain results obtained by that philosopher. They exhibit the quantities of soluble salts, metalic oxides, and earths afforded by the ashes of different plants.

NAMES OF PLANTS.	Ashes from 1000 parts of the plant green.	Ditto, dry.	Water from 1000 parts of the plant green.	Constituents of 100 parts of the ashes.					
				Soluble salts.	Earthy phosphates.	Earthy carbonates.	Silica.	Metallic oxides.	Loss.
1. Leaves of oak, (*quercus robur,*) May 10.	13	53	745	47	24	0.12	3	0.64	25.24
2. Ditto, September 27,	24	55	549	17	18.25	23	14.5	1.75	25.5
3. Wood of a young oak, May 10.		5		26	28.5	12.25	0.12	1	32.58
4. Bark of ditto,		60		7	4.5	63.25	0.25	1.75	22.75
5. Entire wood of oak,		2		38.6	4.5	32	2	2.25	20.65
6. Alburnum of ditto,				32	24.	11	7.5	2	23.5
7. Bark of ditto,		60		7	3	66	1.5	2	21.5
8. Cortical layers of oak,		73		7	3.75	65	0.5	1	22.75
9. Extract of wood of ditto,		61		51					
10. Soil from wood of ditto,		41		24	10.5	10	32	14	8.5
11. Extract from ditto,		111		66					
12. Leaves of the poplar, (*populus nigra,*) May 26,	23	66	652	36	13	29	5	1.25	15.75
13. Ditto, September 12,	41	93	565	26	7	36	11.5	1.5	18
14. Wood of ditto, September 12,		8	26		16.75	27	3.3	1.5	24.5
15. Bark of ditto,		72		6	5.3	60	4	1.5	23.2
16. Leaves of hazel, (*Corylus avellana,*) May 1,		61		26	23.3	22	2.5	1.5	24.7
17. Ditto, washed in cold water,		57		8.2	19.5	44.1	4	2	22.2
18. Leaves of ditto, June 22,	28	62	655	22.7	14	29	11.3	1.5	21.5
19. Ditto, September 20,	31	70	557	11	12	36	22	2	17
20. Wood of ditto, May 1,		5		24.5	35	8	0.25	0.12	32.2
21. Bark of ditto,		62		12.5	5.5	54	0.25	1.75	26
22. Entire wood of mulberry, (*morus nigra,*) November,		7		21	2.25	56	0.12	0.25	20.38
23. Alburnum of ditto,		13		26	27.25	24	1	0.25	21.5
24. Bark of ditto,		89		7	8.5	45	15.25	1.12	23.13
25. Cortical layers of ditto,		88		10	16.5	48	0.12	1	24.38
26. Entire wood of hornbeam, (*carpinas betulus,*) Novem.	4	6	346	22	23	26	0.12	2.25	26.63
27. Alburnum of ditto,	4	7	390	18	36	15	1	1	29
28. Bark of ditto,	88	134	346	4.5	4.5	59	1.5	0.12	30.38
29. Wood of horse-chesnut, (*æsculus hypocastanum,*) May 10,		35		9.5					
30. Leaves of ditto, May 10,	16	72	782	50					
31. Leaves of ditto, July 23,	29	84	652	24					
32. Ditto, September 27,	31	86	630	13.5					
33. Flowers of ditto, May 10.	9	71	873	50					
34. Fruit of horse-chesnut, (*æsculus hypocastanum,*) Octob. 5,	12	34	647	82	12		0.5	0.25	5.25
35. Plants of peas, (*pisum sativum,*) in flower,		95		49.80	17.25	6	2.3	1	24.65
36. Ditto, ripe,		81		34.25	22	14	11	2.5	17.25
37. Plants of vetches, (*vicia faba,*) before flowering, May 23,	16	150	895	55.5	14.5	3.5	1.5	0.5	24.50

Continued on next page.

NAMES OF PLANTS.	Ashes from 1000 parts of the plant green.	Ditto, dry.	Water from 1000 parts of the plant green.	Constituents of 100 parts of the ashes.					
				Soluble salts.	Earthy phosphates.	Earthy carbonates.	Silica.	Metallic oxides.	Loss.
38. Ditto in flower, June 23,	20	122	876	55.5	13.5	4.12	1.5	0.5	24.38
39. Ditto ripe, June 23,		66		50	17.75	4	1.75	0.5	26
40. Ditto, seeds separated,		115		42	5.75	36	1.75	1	12.9
41. Seeds of ditto.		33		69.28	27.92			0.5	2.3
42. Ditto, in flower, raised in distilled water,		39		60.1	30			0.5	9.4
43. (*Solydaga vulgaris*,) before flowering, May 1,		92		67.5	10.75	1.5	1.5	0.75	18.25
44. Ditto, just in flower, July 15,		57		59	59	1.5	1.5	0.75	21
45. Ditto, seeds ripe, September 20,		50		48	11	17.25	3.5	1.5	18.75
46. Plants of turnsol, (*helianthus annuus*,) a month before flowering, June 23.		147		63	67	11.56	1.5	0.12	16.67
47. Ditto, in flower, July 23,	13	137	877	61	6	12.5	1.5	0.12	18.78
48. Ditto, bearing ripe seeds, September 20.	23	93	753	5.15	22.5	4	3.75	0.5	17.75
49. Wheat, (*triticum sativum*,) in flower,				43.25	12.75	0.25	32	0.5	12.25
50. Ditto, seeds ripe,				11	15	0.25	54	1	18.75
51. Ditto, before flowering,		79		60	11.5	0.25	12.5	0.25	15.5
52. Ditto, in flower, June 14,	16	54	699	41	10.75	0.25	26	0.5	21.5
53. Ditto, seeds ripe,		33		10	11.75	0.25	51	0.57	23
54. Straw of wheat,		43		22.5	6.2	1	61.5	1	78
55. Seeds of ditto,		13		47.16	44.5		0.5	0.25	7.6
56. Bran,		52		4.16	46.5		0.5	0.25	8.6
57. Plants of maize, (*zea mays*,) a month before flowering, June 23,		122		69	5.75	0.25	7.5	0.25	17.25
58. Ditto, in flower, July, 23,		81		69	6	0.25	7.5	0.25	17
59. Ditto, seeds ripe,		46							
60. Stalks of ditto,		84		72.45	5	1	18	0.5	3.05
61. Spikes of ditto,		16							
62. Seeds of ditto,		10		62	36		1	0.12	0.88
63. Chaff of barley, (*hordeum vulgare*,)		42		20	7.75	12.5	57	0.5	2.25
64. Seeds of ditto,		18		29	32.5		35.5	0.25	2.8
65. Ditto,				22	22		21	0.12	29.88
66. Oats,		31		1	24		60	0.25	14.75
67. Leaves of *rhododendron ferrugineum*, raised on Jura, a limestone mountain, June 20,		30		23	14	43.25	0.75	15.63	15.68
68. Ditto, raised on Breven, a granitic mountain, June 27,		25		21.1	16.75	16.75	2	5.77	31.52
69. Branches of ditto, June 20,		8		22.5	10	39	0.5	5.4	22.48
70. Spikes of ditto, June 27,		8		24	11.5	29	1	11	24.5

PREPARATION OF INDIGO.

By the observations of Lechenault, it appears that in Java they make an indigo which is superior to that formed by fermentation.

The plant is washed to separate the dirt, and then boiled in copper pots, containing about seven or eight quarts of water, until the water attains a green color. The water is then poured into earthen jars, holding about 80 or 90 quarts, and beat up until the scum appears bluish, the fecula is then permitted to subside, and afterwards dried.

Indigo certainly exists in many plants. It may be discovered by leaving the expressed juice of a plant exposed to the air for some days, and then evaporating it;

the indigo will be separated as a blue or green powder, which will yield a purple smoke when placed on a hot iron. It may also be dissolved in sulphuric acid, which, with indigo, forms a permanent blue solution.

If the indigo is mixed with green fecula, as in woad, the plant must be exhausted by water, and then treated with boiling alcohol. The first solutions contain much of the fecula, but the succeeding ones, which are bluish, contain more of the indigo. If these solutions are evaporated almost to dryness, and alcohol again added, it will take up the fecula, and leave the indigo.

Indigo ought to be looked for in *Galega officinalis*, (goat's rue,) from whence Linnæus says, a fine blue color is extracted; and in *Scabiosa succisa*, (devil's bit,) from whence the Swedes prepare a blue fecula, by treating it in the manner of woad. The plants which yield permanent green colors, probably contain, besides indigo, a yellow coloring matter.

The above process is also considered free from the unwholesome effluvia produced by the old method.

Ann. de Chim.

WIND MILL (ON MECHANICS.)

(Continued from page 16.)

That the wind may act with the greatest efficiency upon the sails, the wind shaft must have the same direction as the wind. But as this direction is perpetually changing, some apparatus is necessary for bringing the wind shaft and sails into their proper position; this is done by turning the axis and sails round in a horizontal direction. There are two methods of effecting this. In the old mills the whole of the mill or building which contains the machinery is sustained upon a vertical post, firmly fixed as a stand or foot, upon which the whole machine can be turned by a lever, to present the sails to any quarter of the horizon from whence the wind blows; and hence these are called post wind mills; and are necessarily made of wood. The other kind is called a smock mill, in which only the dome cap or head which contains the axis of the sails and covers the great cog wheel, turns round horizontally; the other parts of the machinery being contained in a fixed building which rises up in a form of a conical tower of masonry, and is surmounted by the movable cap or dome, which is supported on rollers, so as to turn round easily.

As both the common methods of adjusting the wind shaft require human assistance, it would be very desirable that the same effect should be produced solely by the wind. This may be done by fixing a large wooden vane or weather cock at the extremity of a long horizontal arm which lies in the same vertical plane with the wind shaft.

By these means when the surface of the vane and its distance from the centre of motion is sufficiently great, a very gentle breeze will exert a sufficient force upon the vane to turn the machinery, and will always bring the sails and wind shaft to their proper position. This weather cock, it is evident, may be applied either to machines which have a movable roof, or to those which revolve upon a vertical arbor.

This method is practised in small machines; but a vane of sufficient power to turn a large mill about would be unwieldy. A much better method is therefore practised in the best mills.

The head is contrived to turn itself about whenever the wind changes, in the following manner:—A small pair of sails, or fans are fixed up in a frame projecting from the back part of the head, it has a pinion of 10 leaves upon its axis, engaging in a wheel of 60 teeth upon an inclined axis ; and this has a pinion of 12 leaves at the other end of it, turning a bevilled wheel of 72 teeth upon a vertical iron axis, at the lower end of which is a pinion of 11 teeth; this works in a circle of 120 cogs, fixed round on the out side of the fixed kirb. By these means, whenever the fan is turned, it moves the head of the mill slowly round, and in proportionate power. The axis turns in the circle which contains 120 cogs.

Note. It is supposed that the axis of the fan wheel shall be at right angles to the other so that when either turns, the other will be at rest. Sails may be adjusted to any force of wind in the following manner. Suppose a wind wheel to

consist of 4 arms and the sails connected to those arms at one edge, so as to yield to the force of wind, and the elasticity of the sails bring them up to the wind again whenever its force abates, (this is the more necessary as engineers are not agreed upon the proper angle of the sails with the wind's course,) the idea may be formed by the manner in which the feathers of birds are acted on by the wind. The mill may be stopped by a rod made to extend through the axis from one end to the other, so that when the arms are attached to one end by a cord or cogs, and power applied to the other end of the rod the sails may be turned with one edge to the course of the wind; that is in a line parallel with the axis of the wheel.

This rod may be moved by the person who has charge of the mill when required, to start or put the wheel in motion, or to stop it. A governor may also act upon it, when necessary, operating by centrifugal force and motion carried to the governor from the axle of the wind wheel, by a band, cogs, or any other method. By these means the sails are presented to the wind with their sides or acting faces, approaching to line with its course in proportion to the degree of force with which it blows. Or instead of the cogs and combination of wheels, as above described, the same effect may be produced by one or two screws to work into the cogs on the movable circle.

The axis of the screw is placed at right angles to the axis of the wind wheel, and may have a fan wheel attached at each end if necessary. Where two screw wheels are used they are placed at opposite parts of the periphery of the movable circle.

DEFINITION OF TERMS.

Letter H.

Hemorrhage—a flux of blood from the vessels which contain it, whether proceeding from a rupture of the blood vessels or any other cause. A hemorrhage from the lungs is called *hemoptysis;* from the urinary organs, *hemturia;* from the stomach, *hematemesis ;* from the nose, *epistaxis.*

Hermetical seal, among chemists, a method of stopping glass vessels, used in chemical operations, so closely, that the most subtile spirit cannot escape through them. It is commonly done by heating the neck of the vessel in a flame, till ready to melt, and then twisting it close together with a pair of pincers. Or, vessels may be hermetically sealed, by stopping them with a glass plug, well luted; or by covering the vessel with another ovum philosophicum.

Hexagon, in geometry, a figure of six sides and angles; and if these sides and angles be equal, it is called a regular hexagon.

The side of every regular hexagon, inscribed in a circle, is equal in length to the radius of that circle. Hence it is easy, by laying off the radius six times upon the circumference, to inscribe an hexagon in a circle.

Homicide, properly so called, is the killing of a man by a man. Of this there are several species, as homicide by self-defence, homicide by misadventure, justifiable homicide, manslaughter, chance-medley, and murder.

Hornblende, this mineral enters into the composition of many mountains. It is also amorphous, but frequently also crystallized. The primitive form of its crystals is a rhomboidal prism, the faces of which are inclined at angles of 124° 34′ and 55° 26′, and whose bases are angles of 122° 56′ and 57° 4′. The most common variety is a six-sided prism, terminated by trihedral or tetrahedral summits.

Horse power.—A horse's power of draught or carriage is thus expressed, (according to professor Leslie.) If we represent his force when moving at the rate of 2 miles an hour by the number 100, his force at 3 miles per hour will be 81; at 4 miles 64; at 5 miles 49; at 6 miles 36. Desaguliers and Smeaton consider the force of one horse equal to 5 men. Watt estimated one horse sufficient to raise 33,000 pounds to the height of one foot in a minute.

Hydraulics.—The science which has for its object the motion of fluids is called hydraulics; and its immediate application is to furnish us with the means of conducting water from one situation to an-

other, by canals or aqueducts, and to elevate it by pumps, jets-d'eaux, and other hydraulic engines, either for the purpose of ornament or use.

Hydro-carbonates, combinations of carbon with hydrogen. A gas of this name is obtained from moistened charcoal by distillation.

Hydrodynamics, treats of the state and force of fluids at rest, or in motion, whether liquids or gases. It is divided into hydrostatics, hydraulics, pneumatics, and acoustics, (see the separate articles.)

Ency. Amer.

Hydrogen, in chemistry, one of the simple combustibles, the base of hydrogen gas, formerly called inflammable air.

Hydrogen gas.—To obtain this put one part of iron filings into a retort, attached to the pneumatic cistern, and pour thereon two parts of sulphuric acid previously diluted with four times its bulk of water. Immediately the mixture begins to boil or effervesce with violence, and air bubbles rush abundantly from the beak of the retort.

Allow them to escape for a little, till you suppose that the common air which previously filled the retort has been displaced by the newly generated air. Then place an inverted jar over the beak of the retort.

The bubbles rush in abundantly and soon fill the jar.

Hydrogenized-sulphurets, certain bases combined with sulphureted hydrogen.

Hydrography, the art of measuring and describing the sea, rivers, lakes, and canals.

Hydrometer, an instrument much used for determining the specific gravities of liquids. It usually consists of a hollow sphere of glass or metal, and balanced by another below, containing quick silver or a metallic weight. The larger ball has a shorter neck into which is screwed a graduated stem which by a small weight causes the instrument to descend in the fluid with part of the stem. When this instrument is swimming in a fluid the part of the fluid displaced by it will be equal in bulk to the part of the instrument under water, and equal in weight to the whole instrument. This instrument, therefore, marks the difference in the density of fluids by the place at which the surface cuts the stem as it floats, or by the proportionate addition or diminution of weight which is required to make it float at the same level in each.

The areometer is more simple and accurate. A glass phial, about two inches in diameter, and seven or eight long is corked tight; into the cork is fixed a straight wire one-twelfth of an inch in diameter, and thirty inches long. The phial is loaded with shot so as to sink in the heaviest liquid, leaving the wire just below the surface. The liquor is then placed in a glass cylinder three or four feet long, with a scale of equal parts on the side, by which the point to which the top of the wire sinks is marked.

This instrument is so delicate that the sun's rays falling upon it, will cause the wire to sink several inches; and it will rise again when carried into the shade.

Hydro-oxides, metallic oxides combined with water.

Hydrostatics have for their object the weight and pressure of fluids; and in this branch of science the art of determining the specific gravities of bodies is usually included. Fluids like solids are impelled by their gravity, and press upon every thing that oppose their fall, but from their nature they press in a different manner from solid bodies, hence arise the peculiar phenomena concerning which we are now to inquire. 1st, That the parts of the same fluid act with respect to their weight and pressure independently of each other. 2d, Fluids press equally in all directions. 3d, All the parts of the same fluid are in equilibrium with each other, whether they are contained in one vessel or many, provided they communicate with each other; and their surfaces also are always in a plane parallel to the horizon. A syphon draws liquid from a vessel because the pressure of the atmosphere is removed from the parts entering the syphon, and so long as the surface of liquid in the vessel is higher than the discharging end of the syphon it will continue to flow, but no longer, because the equilibrium of atmospheric

pressure of all parts of the surface in the vessel is again restored.

Although what has been said respecting the surfaces of fluids being at the same level (in a system generally connected by pipes,) while at rest, and the fluid matter at the same density ; yet when the equilibrium to the system is disturbed by any extraneous force an undulatory motion will ensue, in which the different parts of the surface will be sometimes above, sometimes below, the general level, and the undulation will continually diminish until at length friction, and other causes will restore the equilibrium—thus if a tube have one end stopped with a plug to which a thread or wire is attached, and the end thus stopped be plunged to the depth of one or two feet in a vertical direction below the surface of water, and the plug be then suddenly withdrawn, the water will rise in the tube above the surface of the water into which the tube is plunged, and this in proportion to the depth of the lower end of the tube.

Note. This appears to be the principle upon which Montgolfier's Hydraulic Ram acts to raise water from a lower to a higher level. The water issuing from this machine, at or near the lower part of it, at a certain velocity closes the orifice, by carrying up the valve; the current is, by these means diverted, and acts upon the valve opening into the air vessel, which it opens, and a portion of water and air rush into the vessel until the pressure of the air in the vessel acting upon the water restores the equilibrium; the valve in the air vessel then shuts; and the first mentioned valve at the same time opens, by descending in the water. The water then runs out of the orifice as at first; and again closes it by shutting the valve. The valve in the air vessel is again opened, and other portions of water and air pass into the air vessel and so on; the valves opening and closing alternately, while the compressed air in the vessel by its elastic force causes the water to ascend in the discharge pipe in a constant stream during each pulsation, as the valves, alternately open and close.

Hydrosulphurets in chemistry. Sulphureted or sulphurated hydrogen gas, possesses the properties of an acid. It is absorbed by water, in considerable quantities, and the solution reddens vegetable blues; it combines also with alkalies and earths; and with several metallic oxides. The combinations which sulphureted hydrogen forms with bases, have been called hydrosulphurets. Sulphuretted hydrogen combines with alkalies, and earths, and forms with them compounds which may be distinguished by the following properties.

1. They are all soluble in water, and the solution is colorless.

2. When the solution is exposed to the air, it becomes green or greenish-yellow, and deposits sulphur on the sides of the vessel in the state of a fine black crust.

3. After long exposure to the air, the solution becomes limpid and colorless; and on examination is found to contain only the sulphate of the base of the original hydrosulphuret.

4. The solution of the hydrosulphurets precipitates all metallic solutions; iron and lead, black; antimony, orange; arsenic, yellow.

Hygrometer. A machine, or instrument whereby to measure the degrees of dryness, or moisture of the atmosphere.

There are several ways of making these instruments, founded upon the circumstance of certain substances possessing the properties of imbibing and parting with moisture. Thus, a piece of sponge suspended to one end of a lever, and the other end of the lever formed into a hand or index to move by the side of a segment of a circle marked off into regular divisions or degrees, and a small cord attached to the lever on the index side of the fulcrum with small grains of shot attached to it at regular distances asunder, so that when the sponge imbibes the greatest degree of moisture, the cord and attached shot is entirely suspended in space, but when the sponge loses a portion of its moisture it rises and the cord descends and a portion of it rests on a small platform or floor and in proportion to the degree of dryness of the sponge. The index at the same time pointing to the number on the circle opposite, denoting the degree of moisture or weight of the sponge. Or a horizontal axis may be

made with a small part of its length cylindrical, and the remainder tapering conically with a spiral thread cut into it, after the manner of the fuzee of a watch; the sponge is suspended by a fine silk thread to the cylindrical part of this axis, upon which it winds. This is balanced by a small weight suspended also by a thread, which winds upon the spiral fuzee.

Then when the sponge grows heavier in moist weather it descends and turns the axis, and so draws up the weight; which coming to a thicker part of the axis, it becomes a balance to the sponge, and its motion is shown by an attached scale and vice versa, when the air becomes drier.

Salt of tartar, or any other salt, or potashes may be put into the scale of a balance, and used instead of the sponge.

Hyperbola in geometry, the section of a cone made by a plane, so that the axis of the section, inclines to the opposite leg of the cone, which in the parabola is parallel to it, and in the ellipsis intersects it. The axis of the Hyperbolical section will meet also, with the opposite side of the cone, when produced above the vertex.

Hyperbolic cylindroid, is a solid figure, whose generation is given by Sir Christopher Wren, in the Philosophical Transactions. Thus, two opposite hyperbolas being joined by the transverse axis, and through the centre, a right line being drawn at right angles, to that axis; and about that, as an axis, the hyperbolas being supposed to revolve; by such revolution, a body will be generated, which is called the hyperbolic cylindroid, whose bases, and all sections parallel to them, will be circles. In a subsequent transaction, the same author applies it to grinding of hyperbolical glasses; affirming that they must be formed in this way, or not at all. Hyperbolic leg of a curve, is that which approaches infinitely near to some asymptote. Sir Isaac Newton reduces all curves, both of the first and higher kinds, into those with hyperbolic legs, and those with parabolic ones.

Hyperbolic line is used by some authors for what we call the hyperbola itself. In this sense, the plane surface terminated by the curve line, is called the hyperbola, or hyperbolic space; and the curve line that terminates it, the hyperbolic line.

Hypothenuse, in geometry, the longest side of a right-angled triangle; or it is that side which subtends the right angle.

Euclid, lib. 1, proportion XLVII. demonstrates, that, in every rectilinear right angled triangle, the square of the hypothenuse is equal to the squares of both the other sides.

This celebrated problem was discovered by Pythagoras, who is said to have sacrificed a hecatomb to the muses, in gratitude for the discovery.

PHOTOGENIC DRAWING.

At the last sitting of the Academy of Sciences, M. Arago announced one of the most important discoveries in the fine arts that has distinguished the present century, the author of which has already acquired universal reputation by his miraculous diorama—M. Daguerre. It is well known that certain chemical substances, as chlorate of silver, have the property of changing their color by the mere contact of light; and it is by a combination of this nature, that M. Daguerre has succeeded in fixing upon paper prepared with it, the rays that are directed on the table of the camera obscura, and rendering the optical tableau permanent. The exact representation of whatever objects this instrument is directed to, is, as every body is aware, thrown down with vivid colors upon the white skreen, prepared to receive them, and the rays of light that are thus reflected have the power of acting in the way above alluded to, on chlorate of silver or certain preparations of it.

In this manner an exact representation of light and shade, of whatever object may be wished to be viewed, is obtained with the precise accuracy of nature herself, and it is stated to have all the softness of a fine aqua-tint engraving. M. Biat compares it to the retina of the eye, the objects being represented on one and the other surface with almost equal accuracy.

"What is the secret of the invention? What is the substance endowed with such astonishing sensibility to the rays of light, that it not only penetrates itself with them, but preserves their impres-

sion; performs at once the functions of the eye and of the optic nerve—the material instrument of sensation and sensation itself?"

Description of Photogenic Drawing.—The subject (says Mr. Talbot) naturally divides itself into two heads—the preparation of the paper, and the means of fixing the design. In order to make what may be called ordinary photogenic paper, the author selects in the first place, paper of a good firm quality, and smooth surface; and thinks that none answers better than superfine writing paper. He dips it in a *weak* solution of common salt, and wipes it dry; by which the salt is uniformly distributed throughout its substance. He then spreads a solution of nitrate of silver on one surface only, and dries it at the fire. The solution should not be saturated, but six or eight times diluted with water. When dry, the paper is fit for use. He has found, by experiment, that there is a certain proportion between the quantity of salt and that of the solution of silver which answers best, and gives the maximum effect. If the strength of the salt is augmented beyond this point, the effect diminishes, and in certain cases becomes exceedingly small. This paper, if properly made, is very useful for all ordinary photogenic purposes. For example, nothing can be more perfect than the images it gives of leaves and flowers, especially with a summer's sun. The light passing through the leaves, delineates every ramification of their nerves. If a sheet of paper, thus prepared, be taken and washed with a *saturated* solution of salt and then dried, it will be found (especially if the paper has been kept some weeks before the trial is made,) that its sensibility is greatly diminished, and in some cases, seems quite extinct. But if it be again washed with a liberal quantity of the solution of silver, it becomes again sensible to light, and even more so than it was at first. In this way by alternately washing the paper with salt and silver, and drying it between times, M. Talbot has succeeded in increasing its sensibility to the degree that is requisite for receiving the images of the camera obscura. In conducting this operation, it will be found that the results are sometimes more, and sometimes less satisfactory, in consequence of small and accidental variations in the proportions employed. It happens sometimes that the chloride of silver is disposed to darken of itself, without any exposure to the light. This shows that the attempt to give it sensibility has been carried too far. The object is, to *approach* to this condition as near as possible, without *reaching* it; so that the substance may be in a state ready to yield to the slightest extraneous force, such as the feeble impact of the violet rays, when much attenuated. Having, therefore, prepared a number of sheets of paper, slightly different from one another in the composition, let a piece be cut from each, and, having been duly marked or numbered, let them be placed side by side in a very weak diffused light, for about a quarter of an hour; then, if any one of them, as frequently happens, exhibits a marked advantage over its competitors, M. Talbot selects the paper which bears the corresponding number to be placed in the camera obscura.

With regard to the second object—that of fixing the images—M. Talbot observed, that, after having tried *ammonia*, and several other re-agents with very imperfect success, the first which gave him a successful result, was the iodide of potassium, much diluted with water. If a photogenic picture is washed over with this liquid, an *iodide of silver* is formed, which is absolutely unalterable by sunshine.

This process requires precaution; for, if the solution is too strong, it attacks the dark parts of the picture, it is requisite, therefore, to find, by trial, the proper proportions. The fixation of the pictures in this way, with proper management, is very beautiful and lasting. The specimen of *lace* which M. Talbot exhibited to the society, and which was made five years ago, was preserved in this manner. But his usual method of fixing is different from this, and somewhat simpler, or, at least, requiring less nicety. It consists in immersing the picture in a strong solution of *common salt*, and then wiping off the superfluous moisture, and drying it.

It is sufficiently singular, that the same substance which is so useful in *giving* sensibility to the paper, should also be capable, under other circumstances, of *destroying* it; but such is nevertheless the fact. Now, if the picture which has been thus washed and dried, is placed in the sun, the white parts color themselves of a pale lilac tint; after which they become insensible. Numerous experiments have shown the author that the depth of this lilac tint varies according to the quantity of salt used, relatively to the quantity of silver, but by adjusting these, the images may, if desired, be retained of an absolute whiteness. He mentions, also, that those preserved by *iodine* are always of a very pale primrose yellow, which has the extraordinary and very remarkable property of turning to a full gaudy yellow, whenever it is exposed to the heat of a fire; and recovering its former color again when it is cold.

Brit. Assoc. Atheneum.

FILES AND RASPS MADE FROM CLAY.*

Files and other instruments for the abrasion of various substances may be made by folding up separate pieces of wet clay, in muslin, cambric, and Irish linen, forcing them by the pressure of the hand into the interstices of the threads, so that on divesting them of the covering and having them well baked a file is produced of a new species, said to be capable of operating on steel; and very useful in cutting glass, polishing, and rasping wood, ivory, and all sorts of metals.

DESCRIPTION OF AN EYE BATH.

This apparatus consists of a stand or pedestal supporting a glass vessel, of either a globular or any other proper form. This last has a neck at the lower end, and an aperture at the top to fit the eye. The neck is cemented into a brass tube, screwed into an ornamental piece of brass work, in the upper part of the pedestal. This tube contains a common pewter syringe, the end of which is cemented into the neck of the glass vessel. When the instrument is used, the glass vessel is to be partly filled with water (or any other liquid with which the eye is to be syringed,) so as to cover the orifice of the syringe; the patient then places his eye over the aperture in the glass vessel, and suddenly lifts up the brass slider, to which the handle of the syringe is fixed, so as to force the liquor contained in the syringe through that in the glass vessel into the eye; the liquor which covers the point of the syringe takes off the force with which the liquor would be thrown into the eye, so as to render the operation not in the least painful.

* From the success of this experiment we should suppose that clay might be burned hard enough to separate clover seed from its chaff, and in some cases used advantageously for grinding grain. The little expense required in forming and burning them would enable the proprietor to renew them when necessary, without inconvenience. Each piece might be made one or two inches thick and have both sides formed into furrows similar to a mill stone and be confined to the face of a block of stone or wood by bolts, screws and nuts, so that when one side becomes too smooth to operate well, the sides might be reversed; or the furrows might be made upon the edges of each piece, and the whole of them (sufficient to form a complete rubber,) bound together by two iron hoops bound upon them while hot, in the manner that French bur mill stone blocks are confined together. Or each hoop might be formed of two semicircles, with a flanch at each end, so formed that the two pieces might be drawn with sufficient force around the pieces of burned clay by a screw bolt. The edges of each piece might then be alike and each in turn made a rubbing surface by removing the screw bolts, and again attaching them after the pieces were changed and properly adjusted.

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OBSERVER AND RECORD
OF AGRICULTURE, SCIENCE, AND ART.

EDITED BY D. PEIRCE.

No. 11] Philadelphia, Monday, August 5, 1839. [Vol. I.

The object of this paper is to concentrate and preserve, in a form suitable for future reference, the most useful and interesting articles on the aforesaid subjects. Each number will contain sixteen octavo pages, printed on good paper, and when a sufficient amount is published to form a volume of convenient size, an alphabetical table of contents will be published and forwarded to subscribers, in order for binding. This number, shows the general plan of the work.

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M. COZZI'S METHOD OF OBTAINING CREOSOTE.

A quantity of tar is to be placed in an alembic, and heated; the products of the distillation to be collected in a cylindrical vessel half filled with water.

These products consist of acetic acid, eupione, parufine, and at the last, creosote, which is recognised by its specific gravity being greater than that of the water.

The impure creosote is to be separated from the other products, which are lighter, by means of a syphon, and sulphuric acid diluted with half its weight of water is to be added to it when separated; the creosote now occupies the surface of this liquid, which is heavier. This mixture is to be heated and having been caused to pass through a boiling mixture of acid and water, is to be collected and placed in a wide mouthed bottle, which is to be one-third full. It is to be left thus exposed to the contact of the air for three days, the air being frequently changed by opening the bottle.

This product, composed in great part of creosote as experiment will prove, when distilled a second time in a retort, heated by means of the flame of alcohol, will give a reddish colored product. This product will, by three repetitions of this process, afford creosote as limpid as water, of an oleaginous consistence, strongly refracting light of a specific gravity of 1.007, and boiling at 205° R.

The creosote obtained by the method of M. Cozzi, has a peculiar odor and burning taste; it coagulates albumen, has no action upon the paper of turnsol, or upon turmeric paper; it is soluble in water; in acetic acid, and in alcohol; 100 parts of water at 20° dissolves a quarter part.

M. Cozzi has proven that this process is economical, and that as much creosote as would cost eighteen francs, by another method, may be obtained for 13.50 fr. by this method.

M. Cozzi says that creosote may be used: 1. To preserve animal aliments, and to prevent the putrefaction of dead bodies of men and animals. 2. To dissolve caoutchouc, gumlac, mastic, turpentine, copal, amber, and other resins, and to form with these solutions, coverings which do not crack, and varnishes which have a brilliancy not to be obtained by the use of alcohol and the volatile oils. 3. To dissolve coloring matters and furnish solutions which may be used in dying.

He has already used creosote for the preservation of wood; the experiments on this point have been submitted to the Society for the Encouragement of the Useful Arts.

Journ. de Chim. Med.

A VALUABLE GREEN COLOR EXTRACTED FROM COFFEE BERRIES.

An unchangeable emerald green color is obtained as follows: a certain quantity of coffee is boiled in river water; spoiled

coffee is preferable. By means of a proportionate quantity of pure soda, a green precipitate is obtained, which is suffered to dry for six or seven days upon polished marble, stirring it about occasionally in order that every part may come in contact with the atmosphere, from which it receives a new vivacity of tint. Neither the acids, light nor moisture, have power to injure this green lake.

Reg. Art. Sci.

SIR H. DAVY'S AGRICULTURAL CHEMISTRY.

(Continued from p. 153.)

Table continued from p. 153.

NAMES OF PLANTS.	Ashes from 1000 parts of the plant green.	Ditto, dry.	Water from 1000 parts of the plant green.	Constituents of 100 parts of the ashes.					
				Soluble salts.	Earthy phosphates.	Earthy carbonates.	Silica.	Metallic oxides.	Loss.
71. Leaves of fir, (*Pinus abies,*) raised on Jura, June 20,		29		16	12.27	43.5	2.5	1.6	24.13
72. Ditto, raised on Breven, June 27,		29		15	12	29	19	5.5	19.5
73. Branches of pine, June 20,		15		15					
74. Whortleberry, (*Vaccinium myrtillus,*) raised on Jura, Aug. 29,		26		17	18	42	0.5	3.12	19.38
75. Ditto, raised on Breven,		22		24	22	22	5.	9.5	17.5

Besides the principles, the nature of which has been just discussed, others have been described by chemists as belonging to the vegetable kingdom. Thus a substance somewhat analogous to the muscular fibre of animals has been detected by Vauquelin in the papaw; and a matter similar to animal gelatine by Braconnot, in the mushroom; but in this place it would be improper to dwell upon peculiarities, my object being to offer such general views of the constitution of vegetables, as may be of use to the agriculturist. Some distinctions have been adopted by systematical authors, which I have not entered into, because they do not appear to me essential to this inquiry. Dr. Thomson, in his elaborate and learned system of chemistry, has described six vegetable substances, which he calls mucus, jelly, sarcocol, asparagin, inulin, and ulmin. He states that mucus exists in its purest form in linseed; but Vauquelin has lately shown that the mucilage of linseed is, in its essential characters, analogous to gum; but that it is combined with a substance similar to animal mucus; vegetable jelly, Dr. Thomson himself considers as a modification of gum. It is probable, from the taste of sarcocol, that it is gum combined with a little sugar. Inulin is so analogous to starch, that it is probably a variety of that principle; ulmin has been lately shown by Mr. Smithson to be a compound of a peculiar extractive matter and potassa; and asparagin is probably a similar combination. If slight differences in chemical and physical properties be considered as sufficient to establish a difference in the species of vegetable substances, the catalogue of them might be enlarged to almost any extent. No two compounds procured from different vegetables are precisely alike; and there are even differences in the qualities of the same compound, according to the time in which it has been collected, and the manner in which it has been prepared: the great use of classification in science is to assist the memory; and it ought to be founded upon the similarity of properties which are distinct, characteristic, and invariable.

The analysis of any substance containing mixtures of the different vegetable principles, may be made in such a manner as is necessary for the views of the agriculturist, with facility. A given quantity, say 200 grains, of the substance should be powdered, made into a paste or mass, with a small quantity of water,

and kneaded in the hands, or rubbed in a mortar for some time, under cold water; if it contain much gluten, that principle will separate in a coherent mass. After this process, whether it has afforded gluten or not, it should be kept in contact with half a pint of cold water for three or four hours, being occasionally rubbed or agitated: the solid matter should be separated from the fluid by means of blotting paper; the fluid should be gradually heated; if any flakes appear, they are to be separated by the same means as the solid matter in the last process, i. e. by filtration. The fluid is then to be evaporated to dryness. The matter obtained is to be examined by applying moist paper, tinged with red cabbage juice, or violet juice, to it: if the paper become red, it contains acid matter; if it become green, alkaline matter; and the nature of the acid or alkaline matter may be known by applying the tests described, pages 149, 150, and 151. If the solid matter be sweet to the taste, it must be supposed to contain sugar; if bitterish, bitter principle or extract; if astringent, tannin; and if it be nearly insipid, it must be principally gum or mucilage. To separate gum or mucilage from the other principles, alcohol must be boiled upon the solid matter, which will dissolve the sugar and the extract, and leave the mucilage; the weight of which may be ascertained.

To separate sugar and extract, the alcohol must be evaporated till crystals begin to fall down, which are sugar; but they will generally be colored by some extract, and can only be purified by repeated solutions in alcohol. Extract may be separated from sugar by dissolving the solid, obtained by evaporation from alcohol, in a small quantity of water, and boiling it for a long while in contact with the air. The extract will gradually fall down in the form of an insoluble powder, and the sugar will remain in solution.

If tannin exist in the first solution made by cold water, its separation is easily effected by the process described pages 124 and 125. The solution of isinglass must be gradually added, to prevent the existence of an excess of animal jelly in the solution, which might be mistaken for mucilage.

When the vegetable substance, the subject of experiment, will afford no more principles to cold water, it must be exposed to boiling water. This will unite to starch if there be any, and may likewise take up more sugar, extract, and tannin, provided they be intimately combined with the other principles of the compound.

The mode of separating starch is similar to that of separating mucilage.

If after the action of hot water anything remain, the action of boiling alcohol is then to be tried. This will dissolve resinous matter, the quantity of which may be known by evaporating the alcohol.

The last agent that may be applied is ether, which dissolves elastic gum, though the application is scarcely ever necessary; for if this principle be present, it may be easily detected by its peculiar qualities.

If any fixed oil or wax exist in the vegetable substance, it will separate during the process of boiling in water, and may be collected.

Any substance not acted upon by water, alcohol, or ether, must be regarded as woody fibre.

If volatile oils exist in any vegetable substances, it is evident they may be procured, and their quantity ascertained, by distillation.

When the quantity of fixed saline, alkaline, metallic, or earthy matter in any vegetable compound, is to be ascertained, the compound must be decomposed by heat, by exposing it, if a fixed substance, in a crucible, to a long continued red heat; and if a volatile substance, by passing it through an ignited porcelain tube. The nature of the matter so produced, may be learnt by applying the tests mentioned in pages 151 and 152. The only analyses in which the agricultural chemist can often wish to occupy himself, are those of substances containing principally starch, gluten, sugar, oils, mucilage, albumen, and tannin.

The two following statements will afford an idea of the manner in which the results of experiments may be arranged.

The first is a statement of the composition of ripe peas, deduced from experiments made by Einhof; the second are

of the products afforded by oak bark, deduced by experiments conducted by myself.

3840 parts of ripe peas afford—

Of starch,	1265 parts.
Fibrous matter analogous to starch, with the coats of the peas,	840 "
A substance analogous to gluten,	550 "
Mucilage,	249 "
Saccharine matter,	81 "
Albumen,	66 "
Volatile matter,	540 "
Earthy phosphates,	11 "
Loss,	229 "

1000 parts of dry oak bark, from a small tree deprived of epidermis, contain—

Of woody fibre,	876
tannin,	57
extract,	31
mucilage,	18
matter rendered insoluble during evaporation, probably a mixture of albumen and extract,	9
loss, partly saline matter,	30

DEFINITION OF TERMS.

Letter I.

Impetus, in mechanics, the force with which one body impels or strikes another.

Incline Plane, in mechanics, one that makes an oblique angle with the horizon.

Incurvation, of the rays of light, their bending out of a rectilinear or straight course, occasioned by refraction.

Induction, in logic, a conclusion from the particular to the general. Strict conclusions are made from the general to the particular. The general premise being true, the application to the particular case which is included in it follows with logical certainty. Induction gives only probability. If, for instance, we conclude, from the earth being habitable, that the other planets are so, the conclusion is only probable. Induction rests upon the belief that general laws and rules are expressed in the particular case; but a possibility always remains that these general laws and rules are not perfectly known. An induction may be perfect or imperfect. To make it perfect, the premises must include all the grounds that can affect the result. If this is not the case it is imperfect. For instance, every terrestrial animal lives, every ærial animal lives, every aquatic animal lives, every reptile lives, therefore, every animal lives. If we now allow that there exists no animal not included in the four enumerated classes, the induction is perfect.

Inertia of matter, in philosophy, is defined by Sir Isaac Newton to be a passive principle, by which bodies persist in their motion to rest, receive motion in proportion to the force impressing it, and resist as much as they are resisted. It is also defined by the same author to be a power implanted in all matter, whereby it resists any change endeavored to be made in its state.

Inflection, or point of inflection, in the higher geometry, is the point where a curve begins to bend a contrary way.

Infusion.—A method of obtaining the virtues of plants, roots, &c., by steeping them in a hot or cold liquid.

Ink.—There are two principal kinds of ink, writing and printing ink.

Writing ink.—When to an infusion of gall nuts some solution of sulphate of iron (green copperas) is added, a very dark blue precipitate takes place. This principitate is the gallic acid of the galls united to the iron of the green vitriol, forming gallet of iron, which is the basis of writing ink. If galls and sulphate of iron only were used, the precipitate would fall down, leaving the water colorless; and in order to keep it suspended in the water, forming a permanently black, or rather a very dark blue fluid, gum arabic is added, which, by its viscid nature, prevents the precipitate from falling down. Various receipts have been given for the composition of writing ink, but very few have been founded upon a knowledge of its real nature. The receipt given by M. Ribencourt is as follows: Take eight ounces of Aleppo galls, in coarse powder; four ounces of logwood in thin chips; four ounces of sulphate of iron, (green copperas;) three ounces of gum arabic in powder; one ounce of sulphate of copper, (blue vitriol;) and one ounce of sugar-candy. Boil the galls and logwood together in

twelve pounds of water, for one hour, or till half the liquid has been evaporated. Strain the decoction through a hair sieve, or linen cloth, and then add the other ingredients, stir the mixture till the whole is dissolved, more especially the gum, after which, leave it to subside for 24 hours, then decant the ink, and preserve it in bottles of glass, or stoneware, well corked. The following will also make a good ink: to one quart of soft water, add four ounces of galls, one ounce of copperas roughly bruised, and two ounces of gum arabic. Let the whole be kept near the fire a few days, and occasionally well shaken.

Red writing ink, is made in the following manner. Take of the raspings of Brazel wood a quarter of a pound, and infuse them two or three days in vinegar. Boil the infusion for an hour over a gentle fire, and afterwards filter it while hot. Put it again over the fire and dissolve in it, first, half an ounce of gum arabic and afterwards of alum and white sugar, each half an ounce.

Printing ink is a black paint, composed of lampblack and linseed or suet oil boiled, so as to acquire considerable consistence and tenacity. The art of preparing it is kept a secret, but the obtaining of good lamp black appears to be the chief difficulty in making it.

The ink used by the copper plate printers differs from the last only in the oil not being so much boiled, and the black which is used being Frankford black.

Sympathetic inks are such as do not appear after they are written with, but which may be made to appear at plea sure, by certain means to be used for that purpose. A variety of substances have been used for that purpose; we will describe the best of them.

1. Dissolve some sugar of lead in water, and write with the solution. When dry, no writing will be visible. When you want to make it appear, wet the paper with a solution of alkaline sulphuret (liver of sulphur) and the letters will immediately appear, of a brown color; even exposing the writing to the vapors of these solutions will render it apparent.

2. Write with a solution of gold in aqua-regia, and let the paper dry gently in the shade. Nothing will appear; but draw a sponge over it wetted with a solution of tin in aqua-regia, the writing will immediately appear of a purple color.

3. Write with an infusion of galls, and when you wish the writing to appear, dip it into a solution of green vitriol; the letters will appear black.

4. Write with distilled sulphuric acid, and nothing will be visible. To render it so, hold it to the fire, and the letters will instantly appear black.

5. Juice of lemons, or onions, a solution of sal-ammoniac, green vitriol, &c., will answer the same purpose, though not so easily, nor with so little heat.

6. *Green sympathetic ink.*—Dissolve cobalt in nitro-muriatic acid, and write with the solution. The letters will be invisible till held to the fire, when they will appear green, and will disappear completely again, when removed into the cold. In this manner they may be made to appear and disappear at pleasure.

A very pleasant experiment of this kind is to make a drawing representing a winter scene, in which the trees appear void of leaves, and to put the leaves on with this sympathetic ink; then, upon holding the drawing near to the fire, the leaves will begin to appear in all the verdure of spring, and will very much surprise those who are not in the secret.

Blue sympathetic ink.—Dissolve cobalt in nitric acid; precipitate the cobalt by potass; dissolve this precipitated oxide of cobalt in acetic acid, and add to the solution one-eighth of common salt; this will form a sympathetic ink, that, when cold, will be invisible, but will appear blue by heat.

On the composition of a new Indelible writing ink, by Dr. Traill.—To prepare the ink, the inventor directs that the *gluten of wheat* be separated from the starch as completely as possible, by the usual process, and when recent, to be dissolved in pyroligneous acid with the aid of heat; this forms a saponaceous fluid, which is to be tempered with water until the acid has the usual strength of vinegar. He grinds each ounce of this fluid with from eight to ten grains of the best lamp black, and one and a half

grains of indigo. The following are the qualities of this ink.

1st. It is formed of cheap materials.

2d. It is easily made, the coloring matter readily incorporating with the vehicle.

3d. Its color is good.

4th. It flows freely from the pen.

5th. It dries quickly.

6th. When dry it is not removable by friction.

7th. It not affected by soaking in water.

8th. Slips of paper witten on by this ink have remained immersed in solutions of chemical agents, capable of immediately effacing or impairing common ink, for seventy-two hours, without change, unless the solutions be so concentrated as to injure the texture of the paper. The author offers this composition as a writing ink, to be used on paper, for the drawing out of bills, deeds, wills, or wherever it is important to prevent the alteration of sums, or signatures, as well as for handing down to posterity, public records in a less perishable material than common writing ink. He concludes his paper by stating, that should it be found to present an obstacle to the commission of crime; should it even in a single instance, prevent the perpetration of an offence so injurious to society, as the falsification of a public or private document, the author will rejoice in the publication of his discovery, and consider that his labor has not been in vain.

Edin. New. Phil. Journ.

To make *India Ink*, see page 6.

To make *Lithographic Ink*, see page 15.

Ink, removing the stains of.—The stains of ink on cloth, paper, or wood may be removed by almost all acids; but those acids are to be preferred which are least likely to injure the texture of the stained substance. The muriatic acid, diluted with five or six times its weight of water, may be applied to the spot, and, after a minute or two, may be washed off, repeating the application as often as may be found necessary. But the vegetable acids are attended with less risk, and are equally effectual. A solution of the oxalic, citric (acid of lemons) or tartarous acids, in water, may be applied to the most delicate fabrics without any danger of injuring them, and the same solutions will discharge writing, but not printing ink. Hence they may be employed in cleaning books which have been defaced by writing on the margin without impairing the text. Lemon juice, and the juice of sorrel, will also remove ink stains, but not so easily as the concrete juice of lemons or citric acid.

Inolithus, in mineralogy, a stone consisting of carbonate of lime, carbonic acid gas, and a little iron; entirely soluble in nitric acid, with effervescence.

Inscribe, in geometry. A figure is said to be inscribed in another, when all its angles touch the sides or planes of the other figure.

Insolation, in chemistry, a term made use of to denote an exposure to the sun, to promote the chemical action of one substance upon another.

Instruments, (*mathematical.*) A pocket case of mathematical instruments contains the following particulars, viz: 1, A pair of plain compasses—2, A pair of drawing compasses, with its several parts —3, A drawing-pen and pointer—4, A protractor, in form of a semicircle, or sometimes of a parallelogram—5, A parallel ruler—6, A plain scale—7, A sector, besides the black-lead pencil for drawing lines.

Insurance, is a contract whereby, for a stipulated consideration, called a *premium*, one party undertakes to indemnify another against certain risks. The party undertaking to make the indemnity is called the *insurer* or *underwriter*, and the one to be indemnified the *assured* or *insured.* The instrument, by which the contract is made, is denominated a *policy.*

Integer, in arithmetic, a whole number in contradistinction to a fraction.

Internal, in general, signifies whatever is within a thing.

Euclid proves that the sum of the three angles of every triangle is equal to two right angles; whence he deduces several useful corollaries. He likewise adduces from the same proposition this theorem, viz: that the sum of the angles of every rectilinear figure is equal to twice as

many right angles as the figure hath sides, excepting or subtracting four.

Intersection, in the mathematics, signifies the cutting of one line or plane by another: thus we say that the mutual intersection of two planes is a right line.

Invention, in science, is distinguished from *discovery*, as implying more creative combining power, and generally signifies the application of a discovery to a certain purpose.

Involution, in mathematics, the raising of a quantity from its root to any power assigned. Thus $2 \times 2 \times = 8$. Here 8, the third power of 2, is found by involution. By continuing the process, we can obtain any power of 2, and so with other numbers.

Iodine, the name of an undecompounded principle or element in chemistry. It had escaped the observation of chemists until 1812, when a manufacturer of saltpetre at Paris detected it in the ashes of sea-weeds, in the following manner. In evaporating the ley from these ashes, to procure the carbonate of soda which they contain, he noticed that the metallic vessels with which he operated were powerfully corroded, and that the corrosion was increased as the liquor became more concentrated. Having at hand, one day, a bottle of sulphuric acid, he added some of it to a portion of the mother-water, and was surprised to see a rich violet vapor disengaged; this vapor was the iodine. He at once communicated the observation to M. Clement Desormes, who sat about collecting some of the vapor, and after examining its leading properties, announced it as a new body. Its real nature was soon after unfolded through the accurate researches of Gay Lussac and Sir H. Davy. Its history proved singularly interesting in modifying the then prevailing theory of chemistry. Sir H. Davy had a few years previously promulgated the new theory of chlorine, which was still received with suspicion among chemists. The strong analogies, however, between this substance and chlorine, in their relations to combustibles, both bodies forming compounds by uniting with them, similar to acids containing oxygen or oxides, were conceived to give great weight to the views of Sir H. Davy, and operated completely to overthrow the erroneous hypothesis of oxygenation invented by Lavoisier. Its investigation, therefore, may be said to have formed a new era in chemistry. The physical properties of iodine are as follows; it is a soft, friable, opaque solid, of a blueish black color, with a metallic lustre, usually in scales, but sometimes in distinct crystals of the form of rhomboids, or rhomboidal tables, referable to an octahedron, with a rhombic base as their primary form; its specific gravity is 4.946. It possesses an odor somewhat analogous to that of chlorine. It is a non-conductor of electricity, and possesses in an eminent degree the electrical properties of oxygen and chlorine.

Iodine enters into fusion at 225° Fahr., and boils at 347°; but when moisture is present, it sublimes rapidly at a temperature considerably below 212°, and gives rise to a dense vapor of the usual violet hue. It is scarcely soluble in water, but is readily taken up by alcohol and ether, to which it imparts a reddish brown color. It extinguishes vegetable colors, but with less energy than chlorine. It is not inflammable. Its range of affinity for other bodies is very extensive; the most important compounds it forms with these we shall describe after alluding to its natural state and preparation. It exists most abundantly in the various species of fucus, which form the greatest part of the sea-weeds of our coast; it also occurs in the sponge, and in the coverings of many molluscous animals, and has been found in a great number of mineral waters, as those of Salz in Piedmont, Saratoga in New York, &c., and more recently has been detected in some silver ores from Mexico, and in an ore of zinc from Upper Silesia. But it is from the incinerated sea-weed, or kelp, that the iodine, in large quantities, is obtained. As the soap manufacturers are in the habit of obtaining their soda from kelp, iodine may be procured, very economically, from the residuums of their operations, according to the process invented by Dr. Ure, which is as follows.

The brown iodic liquor of the soap-boiler, or the solution of kelp from which

all the crystallizable ingredients have been separated by concentration, is heated to about 230° Fahr., poured into a large stone-ware basin, and saturated with diluted sulphuric acid. When cold, the liquor is filtrated through woollen cloth, and to every 12 oz. (apothecaries' measure) of it, is added 1000 grains of black oxide of manganese in powder. The mixture is put into a glass globe, or large matrass with a wide neck, over which a glass globe is inverted, and heat is applied, which causes the iodine to sublime copiously, and to condense in the upper vessel. As soon as the balloon becomes warm, another is substituted for it; and when the second becomes heated, the first is again applied. The iodine is withdrawn from the globes by a little warm water, which dissolves it very sparingly, and it is purified by undergoing a second sublimation. The test made use of for the detection of iodine in any solution, when it is suspected to be present, is starch, with which iodine has the property of uniting, and of forming with it a compound, insoluble in cold water, which is recognised with certainty by its deep blue color. The solution should be cold at the time of adding the starch; and if the color does not become apparent simply on the addition of the starch, a few drops of sulphuric acid should be cautiously added, when, if any iodine is present, the blue color will make its appearance. This test is so exceedingly delicate, that a liquid containing $\frac{1}{450,000}$ of its weight of iodine, receives a blue tinge from a solution of starch.—Iodine has a powerful affinity for hydrogen, which it takes from animal and vegetable substances in the same manner as chlorine, and uniting with it forms hydriodic acid.

The following are the methods for obtaining this acid in the gaseous and in the liquid state: Into a flask to which a recurved tube is fitted, dipping under a jar of mercury, are introduced eight parts of iodine and one of phosphorus, and to the mixture a few drops of water are added; the water is immediately decomposed, the phosphorus, seizing the oxygen, forms phosphoric acid, while the hydrogen combines with the iodine. As there is not water present in sufficient quantity to dissolve the hydriodic acid, it passes over in the gaseous state, and is collected over the mercury. In contact with air it smokes or fumes like the muriatic acid, and, like it, reddens vegetable blues. It is distinguished, however, from that acid, by the superior affinity possessed by chlorine for hydrogen, in consequence of which, if chlorine and hydriodic acid gases are mingled together, the yellow color of the former disappears, and the violet vapor of iodine makes its appearance, which proves the decomposition of the hydriodic acid by the chlorine. If the decomposition is complete, the vessel will be wholly occupied by muriatic acid gas. To obtain the hydriodic acid in a liquid state, we have only to conduct the gas through water, until it is fully charged with it; or it may be obtained by transmitting a current of sulphuretted hydrogen gas through water in which iodine, in fine powder, is suspended. The iodine, from a greater affinity for hydrogen than the sulphur possesses, decomposes the sulphuretted hydrogen; and hence sulphur is set free, and hydriodic acid produced. The constitution of hydriodic acid is,

	By volume.	By weight.
Iodine,	50	124
Hydrogen,	50	1
	100	125

The solution of hydriodic acid is easily decomposed. Thus, on exposure for a few hours to the air, the oxygen of the atmosphere forms water with the hydrogen of the acid, and liberates the iodine. Nitric and sulphuric acids likewise decompose it by yielding oxygen, the former being converted into nitrous, and the latter into sulphurous acid. The free iodine becomes obvious on the application of the above mentioned test; the compounds of hydriodic acid with the solifiable bases may be easily formed, either by direct combination, or by acting on the basis in water with iodine. Sulphurous and muriatic acids, as well as sulphuretted hydrogen, produce no change on the hydriodates, at the usual temperature of the air; but chlorine, nitre, and concentrated sulphuric acid, instantly decom-

pose them, and separate the iodine. The hydriodates of potash and soda are the most interesting of their number, because they are the chief sources of iodine in nature. The latter salt is probably the one which affords the iodine obtained from kelp; while it is believed, that it is the hydriodate of potash which is most generally found in mineral springs. (Hence the necessity of adding sulphuric acid to the residual liquor of the soap-boiler, in order to procure the iodine, which requires to be separated from its combination with the alkali to which it is united, in the condition of hydriodic acid; and peroxide of manganese is also added, in order to facilitate the decomposition of the hydriodic acid.) Iodine forms acids also by uniting with oxygen and with chlorine. When it is brought into contact with protoxide of chlorine, immediate action ensues; the chlorine of the protoxide unites with one portion of iodine, and its oxygen with another, forming two compounds—a volatile orange colored matter, the chloriodic acid, and a white solid substance, which is iodic acid. Iodic acid acts powerfully on inflammable substances; with charcoal, sulphur, sugar, and similar combustibles, it forms mixtures which detonate when heated. It enters into combination with metallic oxides, giving rise to salts called *iodates*. These compounds, like the chlorates, yield pure oxygen by heat, and deflagrate when thrown on burning charcoal: Iodic acid is decomposed by sulphurous, phosphorous, and hydriodic acids, and by sulphuretted hydrogen. Iodine, in each case, is set at liberty, and may be detected, as usual, in starch. Chloriodic acid, which is also formed by simply immersing dry iodine in chlorine gas, deliquesces in the open air, and dissolves very freely in water. Its solution is very sour to the taste; and it reddens vegetable blues, but afterwards destroys them. It does not unite with alkaline bases; in which respect it wants one of the characteristics of an acid, and has hence been called by Gay Lussac a *chloride of iodine*. Iodine unites with nitrogen, forming a dark powder, which is characterized chloride of nitrogen, by its explosive property. In order to form it, iodine is put into a solution of ammonia; the alkali is decomposed; its elements unite with different portions of iodine, and thus cause the formation of hydriodic acid and iodide of nitrogen. Iodine forms with sulphur a feeble compound, of a grayish black color. With phosphorus, also, it combines with great rapidity at common temperatures, attended with the emergence of heat. It manifests little disposition to combine with metallic oxides; but it has a strong attraction for the pure metals, producing compounds which are called *iodurets*, or *iodides*. The iodides of lead, copper, bismuth, silver and mercury, are insoluble in water, while the iodides of the very oxidizable metals are soluble in that liquid. If we mix a hydriodate with the metallic solutions, all the metals which do not decompose water will give precipitates, while those which decompose that liquid will give none.

Iodine, besides being employed for philosophical illustrations, is used in the arts for pigments, dyes, and medicine. The proto-ioduret of mercury is used in England as a substitute for vermilion in the preparation of paper-hangings; and a compound hydriodate of potassa 65, iodate of potassa 2, and ioduret of mercury 33, is employed in printing calico. The tincture of iodine, 48 grs. to 1 oz. of alcohol, is a powerful remedy in the goitre, and other glandular diseases; but it is so violent in its action on the system, as to require great caution in its administration. The hydriodate of potash or of soda is also applied to medical uses; and it is inferred that the efficacy of many mineral springs, in certain diseases, is owing to the presence of one or the other of these salts.

Iridium; the name of a metal discovered in 1803, by M. Tennant, in the black residuum from the solution of the ore of platinum. Its name was bestowed in allusion to the rainbow, (*iris*,) in consequence of the changeable color it presents while dissolving in muriatic acid. Its color is white; it is brittle, and very difficult of fusion; specific gravity, 18.68.

Ipecacuanha, process to make Sirup of.

Take of Ipecac. bruised,	-	1 part
Water, - - -		14 "

Boil in a covered vessel down to 12 parts
Then filter, and add sugar, - 24 "
Boil to a sirupy consistence.

The above is from the Paris Codex, and contains about sixteen grains of ipecac. to the ounce, or about two and a half grains of emetia.

To get clear of the gum and starch which make a sirup soon spoil, other recipes recommend alcoholic maceration, and subsequent evaporation in making the sirup, to dissipate the spirit.

As a better process than either of the above mentioned, I would suggest the following, being an improvement upon them:

Take of ipecac. finely bruised, two ounces; place in a small displacement filter, and, to extract the soluble active principles, pass over it a weak alcohol, (15) lb. iss. Evaporate by a gentle heat to four ounces, and add four pints of simple sirup; then boil for a while, that the sirup may be of proper consistence.

There are several compound sirups of ipecac. combining its virtues with those of senega, bark, and opium.

Sirup of ipecacuanha is employed to stimulate the mucous membrane of the bronchiæ in certain pulmonary affections, and from its frequent use would seem to form an indispensable ingredient in French and German prescriptions for this purpose.—*Jour. Phar.*

Iron, properties of. It has a styptic taste, and emits a smell when rubbed. Its specific gravity varies from 7.6 to 7.8. It is attracted by the magnet or load-stone, and is itself the substance which constitutes the load-stone. But when iron is perfectly pure, it retains the magnetic virtue a short time. It is malleable in every temperature, and its malleability increases in proportion as the temperature augments; but it cannot be hammered out nearly so thin as gold or silver, or even copper. Its ductility, however, is more perfect; for it may be drawn out into wire as fine, at least, as the human hair. Its tenacity is such, that an iron wire 0.078 of an inch in diameter, is capable of supporting 549.25 lbs. avoirdupois without breaking. When heated to about 158° Wedgewood, it melts. This temperature being nearly the highest to which it can be raised, it has been impossible to ascertain the point at which this melted metal begins to boil and to evaporate. Neither has the form of its crystals been examined; but it is well known that the texture of iron is fibrous; that is, it appears when broken to be composed of a number of fibres or strings, bundled together.

When exposed to the air, its surface is soon tarnished, and it is gradually changed into a brown or yellow powder, well known under the name of rust; this change takes place more rapidly if the atmosphere is moist. It is occasioned by the gradual combination of the iron with the oxygen of the atmosphere, for which it has a very strong affinity.

When iron filings are kept in water, provided the temperature is not under 70°, they are gradually converted into a black powder, while a quantity of hydrogen gas is emitted. This is occasioned by the slow decomposition of the water. The iron combines with its oxygen, while the hydrogen makes its escape under the form of a gas. If the steam of water is made to pass through a red-hot iron tube, it is decomposed instantly. The oxygen combines with the iron, and the hydrogen gas passes through the tube, and may be collected in proper vessels. This is one of the easiest methods of procuring pure hydrogen gas.—These facts are sufficient to show that iron has a strong affinity for oxygen, since it is capable of taking it from air and water. It is capable also of taking fire, and burning with great rapidity. Twist a small iron wire into the form of a cork-screw, by rolling it round a cylinder; fix one end of it into a cork, and attach to the other a small bit of cotton thread dipt in melted tallow. Set fire to the cotton, and plunge it while burning into a jar filled with oxygen gas. The wire catches fire from the cotton, and burns with great brilliancy, emitting very vivid sparks in all directions. For this very splendid experiment we are indebted to Dr. Ingenhouz. During this combustion the iron combines with oxygen, and is converted into an oxide.

Mr. Proust has proved that there are only two oxides of iron; and the protoxide has usually a black color, but the peroxide is red.

The protoxide of iron may be obtained by four different processes. 1. By keeping iron filings a sufficient time in water at the temperature of 70°. The oxide thus formed is a black powder, formerly much used in medicine under the name of martial ethiops, and seems to have been first examined by Lemeri; but a better process is that of De Roover. He exposes a paste formed of iron filings and water to the open air, in a stone-ware vessel; the paste becomes hot, and the water disappears. It is then moistened again, and the process repeated till the whole is oxydized. The mass is then pounded, and the powder is heated in an iron vessel till it is perfectly dry, stirring it constantly.—2. By making steam pass through a red-hot iron tube, the iron is changed into a brilliant black brittle substance, which, when pounded, assumes the appearance of martial ethiops. This experiment was first made by Lavoisier. 3. By burning iron wire in oxygen gas. The wire as it burns is melted, and falls in drops to the bottom of the vessel, which ought to be covered with water, and to be of copper. These metallic drops are brittle, very hard, and blackish, but retain the metallic lustre. They were examined by Lavoisier, and found precisely the same with martial ethiops. They owe their lustre to the fusion which they underwent.—4. By dissolving iron in sulphuric acid, and pouring potass into the solution. A green powder falls to the bottom, which assumes the appearance of martial ethiops, when dried quickly in close vessels. This first oxide of iron, however formed, is always composed of 73 parts iron and 27 of oxygen, as Lavoisier and Proust have demonstrated. It is attracted by the magnet, and is often itself magnetic. It is capable of crystallizing, and is often found native in that state.

The peroxide or red oxide of iron may be formed by keeping iron filings red-hot in an open vessel, and agitating them constantly till they are converted into a dark red powder. This oxide was formerly called saffron of Mars. Common rust of iron is merely this oxide combined with carbonic acid gas. The red oxide may be obtained also by exposing for a long time a diluted solution of iron in sulphuric acid to the atmosphere, and then dropping into it an alkali, by which the oxide is precipitated. This oxide is also found native in great abundance. Proust proved it to be composed of 48 parts of oxygen, 52 of iron. Consequently the peroxide, when converted into red oxide, absorbs 0.40 of oxygen; or which is the same thing, the red oxide is composed of 66.5 parts of black oxide and 33.5 parts of oxygen. One hundred parts of iron, when converted into protoxide, absorb 37 parts of oxygen, and the oxide weighs 137 ; when converted into peroxide it absorbs 52 additional parts of oxygen, and the oxide weighs 189. The peroxide cannot be decomposed by heat; but when heated along with its own weight of iron filings, the whole, as Vauquelin first observed, is converted into black oxide. The reason of this conversion is evident. This 100 parts of peroxide are composed of 52 parts of iron, combined with two different doses of oxygen : 1, with 14 parts, which, with the iron, makes 66 of protoxide ; 2, with 32 parts, which, with the protoxide, make up the 100 parts of peroxide. Now, the first of these doses has a much greater affinity for the iron than the second has. Consequently the 34 parts of oxygen, which constitute the second dose, being retained by a weak affinity, are easily abstracted by the 100 parts of pure iron, and combining with the iron, the whole almost is converted into black oxide : for 100 parts of iron, to be converted into black oxide, require only 27 parts of oxygen. The peroxide of iron is not magnetic. It is converted into black oxide by sulphuretted hydrogen and many other substances, which deprive it of the second dose of oxygen for which they have a stronger affinity, though they are incapable of decomposing the protoxide. Iron is capable of combining with all the simple combustible bodies. A small mixture of it constitutes that particular kind of iron, known by the name of cold short iron, because it is brittle when cold, though it is malleable when hot. Rinman has shown that the brittleness and bad qualities of cold short iron may be removed by heating it strongly

with limestone, and with this the experiments of Levasseur correspond. There are a great many varieties of iron, which artists distinguish by particular names; but all of them may be reduced under one or other of the three following classes: cast iron, wrought or soft iron, and steel. Cast iron, or pig iron, is the name of the metal when first extracted from its ores. The ores from which iron is usually obtained are composed of oxide of iron and clay. The object of the manufacturer is to reduce the oxide to the metallic state, and to separate all the clay with which it is combined. These two objects are accomplished at once by mixing the ore reduced to small pieces with a certain portion of limestone and of charcoal, and subjecting the whole to a very violent heat in furnaces constructed for that purpose. The charcoal absorbs the oxygen of the oxide, flies off in the state of carbonic acid gas, and leaves the iron in the metallic state; the lime combines with the clay, and both together run into fusion, and form a kind of fluid glass; the iron is also melted by the violence of the heat and being heavier than the glass, falls down and is collected at the bottom of the furnace. Thus the contents of the furnace are separated into two portions; the glass swims at the surface, and the iron rests at the bottom. A hole at the lower part of the furnace is now opened, and the iron allowed to flow out into moulds prepared for its reception.

The cast iron thus obtained is distinguished by the following properties: it is scarcely malleable at any temperature. It is generally so hard as to resist the file; it can neither be hardened nor softened by ignition and cooling. It is exceedingly brittle. It melts at 130° Wedgewood. It is more sonorous than steel. For the most part it is of a dark-gray or blackish color; but sometimes it is whitish, and then it contains a quantity of phosphuret of iron, which considerably impairs its qualities. A great number of utensils are formed of iron in this state. To convert it into wrought iron, it is put into a furnace, and kept melted, by means of the flame of the combustibles, which is made to play upon its surface. While melted every part of it is stirred by a workman, that every part of it may be exposed to the air. In about an hour the hottest part of the mass begins to heave and swell, and to emit a lambent blue flame. This continues nearly an hour; and by that time the conversion is completed. The heaving is evidently produced by the emission of an elastic fluid. As the process advances, the iron gradually acquires more consistency; and at last, notwithstanding the continuance of the heat, it congeals altogether. It is then taken while hot and hammered violently, by means of a heavy hammer driven by machinery. This not only makes the particles of iron approach nearer to each other, but drives away several impurities which would otherwise continue attached to the iron. In this state it is the substance described under the name of iron. As it has never yet been decomposed, it is considered at present, when pure, as a simple body; but it has seldom or never been found without some small mixture of foreign substances. These substances are either some of the other metals, or oxygen, carbon, or phosphorus. When small pieces of iron are stratified in a close crucible, with a sufficient quantity of charcoal powder, and kept in a strong-red heat for eight or ten hours, they are converted into steel, which is distinguished from iron by the following properties: It is so hard as to be unmalleable while cold, or at least, it acquires this property by being immersed while ignited into a cold liquid; for this immersion, though it has no effect upon iron, adds greatly to the hardness of steel. It is brittle, resists the file, cuts glass, affords sparks with flint, and retains the magnetic virtue for any length of time. It loses this hardness by being ignited and cooled very slowly. It melts at above 130° Wedgewood. It is malleable when red-hot but scarcely so when raised to a white heat. It may be hammered out into much thinner plates than iron. It is more sonorous, and its specific gravity, when hammered, is greater than that of iron. By being repeatedly ignited in an open vessel, and hammered, it becomes wrought iron, which is a simple substance, and if perfectly pure would contain nothing but

iron. Steel is iron combined with a small portion of carbon, and has been for that reason called carburetted iron. The proportion of carbon has not been ascertained with much precision.

From the analysis of Vauquelin, it amounts, at an average, to $\frac{1}{150}$ part. Mr. Clouet seems to affirm that it amounts to $\frac{1}{32}$ part; but he has not published the experiments which led him to a proportion which so far exceeds what has been obtained by other chemists. That steel is composed of iron combined with pure carbon, and not with charcoal, has been demonstrated by Morveau, who formed steel by combining together directly iron and diamond. At the suggestion of Clouet, he enclosed a diamond in a small crucible of pure iron and exposed it, completely covered up in a common crucible, to a sufficient heat. The diamond disappeared, and the iron was converted into steel. The diamond weighed 907 parts, the iron 57800, and the steel obtained 56384 ; so that 2313 parts of the iron had been lost in the operation.

From this experiment it follows, that steel contains about $\frac{1}{60}$ of its weight of carbon. This experiment was objected to by Mr. Mushet, but the objections were fully refuted by Sir George McKenzie. Rinman, long ago, pointed out a method by which steel may be distinguished from iron. When a little diluted nitric acid is dropt upon a plate of steel, allowed to remain a few minutes, and then washed off, it leaves behind it a black spot; whereas the spot formed by nitric acid on iron is whitish green. We can easily see the reason of the black spot ; it is owing to the carbon of the iron which is converted into charcoal by the acid. This experiment shows us, that carbon is much more readily oxidized when combined with iron than when crystallized in the diamond. Cast iron is iron combined with a still greater proportion of carbon than is necessary for steel. The quantity has not yet been ascertained with precision ; Mr. Clouet makes it amount to $\frac{1}{8}$ of the iron. The blackness of the color and the fusibility of cast iron, are proportional to the quantity of carbon which it contains. Cast iron is almost always contaminated with foreign ingredients: these are chiefly oxide of iron, phosphuret of iron, and silica. It is easy to see why iron is obtained from its ore in the state of cast iron. The quantity of charcoal along with which the ore is fused, is so great that the iron has an opportunity of saturating itself with it. The conversion of cast iron into wrought, is effected by burning away the charcoal, and depriving the iron wholly of oxygen: this is accomplished by heating it violently while exposed to the air. Mr. Clouet has found that when cast iron is mixed with $\frac{1}{4}$ of its weight of black oxide of iron, and heated violently, it is equally converted into pure iron. The oxygen of the oxide, and the carbon of the cast iron, combine and leave the iron in a state of purity. The conversion of iron into steel is effected by combining it with carbon. This combination is performed in the large way by three different processes, and the products are distinguished by the names of natural steel, steel of cementation, and cast steel.

Natural steel is obtained from the ore by converting it first into cast iron, and then exposing the cast iron to a violent heat in a furnace while its surface is covered with a mass of melted scoriae five or six inches deep. Part of the carbon combines with the oxygen which cast iron always contains, and flies off in the state of carbonic acid gas. The remainder combines with the pure iron, and constitute it steel.

This steel is inferior to the other species; its quality is not the same throughout; it is softer, and not so apt to break; and as the processes by which it is obtained are less expensive, it is sold at a lower price than the other species. It is obvious that iron and carbon are capable of combining together in a variety of different proportions. When the carbon exceeds, the compound is carburet of iron or plumbago. When the iron exceeds, the compound is steel or cast iron in various states, according to the proportion. All these compounds may be considered as subcarburets of iron. The hardness of iron increases with the proportion of charcoal with which it combines, till the carbon amounts to about $\frac{1}{60}$ of the whole mass. The hardness is

then a maximum; the metal acquires the color of silver, loses its granulated appearance, and assumes a crystallized form. If more carbon is added to the compound, the hardness diminishes in the proportion of its quantity. The affinities of iron and its oxides are arranged by Bergman as in the following table:

Iron.	*Oxide of Iron.*
Nickel,	Oxalic acid,
Cobalt,	Tartaric acid,
Manganese,	Camphoric,
Arsenic,	Sulphuric,
Copper,	Saclatic,
Gold,	Muriatic,
Silver,	Nitric,
Tin,	Phosphoric,
Antimony,	Arsenic,
Platinum,	Fluoric,
Bismuth,	Succinic,
Lead,	Citric,
Mercury,	Lactic,
	Acetic.
	Boracic,
	Prussic,
	Carbonic.

Irritability (*irritabilitas ;* from *irrito*, to provoke; *visinsita* of Haller; *vis vitalis* of Garter ; *oscillation* of Boorhaave; *tonic power* of Stahl; *muscular power* of Bell; *inherent power* of Cullen;) the contractility of muscular fibres, or a property peculiar to muscles, by which they contract upon the application of certain *stimuli* without a consciousness of action. This power may be seen in the tremulous contraction of muscles when lacerated, or when entirely separated from the body. The action of every stimulus is in the inverse ratio to the frequency of its application. A small quantity of spirits, taken into the stomach, increases the action of its muscular coat and also of its various vessels, so that digestion is thereby facilitated. If the same quantity, however, be taken frequently it loses its effect. The more the irritability of a part is accumulated, the more that part is disposed to be acted upon. It is on this account that the activity of all animals while in perfect health, is much livelier in the morning than at any other part of the day, for during the night the irritability of the whole frame, and especially that of the muscles destined for labor, viz: the muscles for voluntary action, is reaccumulated. The same law explains why digestion goes on more rapidly the first hour after food is swallowed than at any other time, and also accounts for the danger that accrues to a famished person upon first taking food.

Irritation (*counter*,) in medicine consists of blisters, hot water, preparations of mustard, and such other substances as cause irritation when applied externally to the human system.

The principle upon which this class of remedies operate is still a subject of discussion amongst medical practitioners. Cases are stated, where dropsy has been cured by the spilling of boiling water upon the leg of the patient. Another where a person took ten grains of opium. Hot water was applied to the thighs, legs and arms alternately for twenty-four hours; when the patient recovered. He was found at first by his medical attendant in an apoplectic state; tartar emetic and white vitriol failed to produce vomiting. Another person had taken a quantity of prussic acid ; boiling water was poured over his legs without any effect. The legs were then scarified in numerous places and another quantity of boiling water poured over the limbs thus scarified. The first sign of restoration was a slight spasmodic contraction of the muscles, and in a short time spasmodic action took place in many parts of the body. He was ultimately restored to health. The oil of mustard is applied by moistening a piece of flannel or linen with it—the parts contiguous to those effected are selected for the application. The oil is previously diluted. Thirty drops in an ounce of Spt. Vini. or 6 or 8 drops in a dram of ol. amygdalæ. It is recommended in chronic rheumatism, neuralgia, paralysis, cholic, &c. If given internally the proportion is 2 drops to a six-ounce mixture. Dose, ℥ss.

Ivory, in natural history, &c. a hard, solid, and firm substance, of a white color, and capable of a very good polish. It is observed that Ceylon ivory and that from the island of Achem do not become yellow from wearing, as all other ivory does. To soften ivory and other bones,

lay them for twelve hours in aquafortis, and then three days in the juice of beets, and they will become so soft that they may be worked into any form. To harden them again, lay them in strong vinegar. Dioscorides says, that by boiling ivory for the space of six hours with the root of mandrogoras, it will become so soft that it may be managed as one pleases.

Ivory-black, is the coal of ivory or bone formed by great heat, while deprived of all access of air.

The improved method of obtaining ivory-black, is to calcine bones (and other substances used for that purpose,) to blackness in air tight vessels, they are then crushed in their dry state between metal rollers, till they are sufficiently broken to pass through a hopper into the eye of a mill stone, by which they are reduced to a fine powder in the same manner as corn is reduced to flour. The powder thus obtained is then passed through a dressing machine (constructed with brushes in the usual way) the meshes of which are about sixty-eight to an inch ; the part which passes through it is fit for use and is damped down with a small quantity of water for sale; the remainder is returned to the hopper and ground again.

PROCESS OF MAKING THE SCHWEINFURT GREEN DYE.

One part of verdigris is to be dissolved in a sufficient quantity of good vinegar, by heat in a copper kettle. When it is dissolved add to the same a solution of one part of white arsenic in water. A dusky green precipitate generally ensues, which must be re-dissolved by the addition of more vinegar. This mixture is now to be boiled, when a granulated precipitate will be produced, of the most beautiful green color, which after being separated from the liquid (either by filtration or by decanting after the color has subsided,) is to be well washed and dried, when it is ready for use either as a dye or pigment. If the liquor, after this process, should be found to contain more copper, more of the solution of arsenic may be added, but if it contains instead an excess of arsenic, then more of the solution of copper may be added, completing the process as before mentioned. And if the liquid should contain an excess of the acetic acid it may be advantageously employed in the solution of more verdigris.

The color prepared by the preceding process is of a bluish green; but as a deeper and more yellowish green is frequently required, this is obtained by dissolving a pound of common potash in water to which add ten pounds of the green color prepared by the former process, and warm the mixture over a gentle fire ; when the desired tint will be acquired. If allowed to boil long, the color will approximate in hue to Scheele's green, nevertheless it is in all the tints of greater brilliancy and beauty. The alkaline fluid that remains may be advantageously employed in making Scheele's green.—*Reg. Art. Sci.*

A CHEAP AND VALUABLE FILTERING MACHINE* may be constructed as follows: Procure a large stone bottle with the bottom knocked out, stop up the neck partially with small stones, over these form a layer of small pebbles then another of gravel, increasing every layer in fineness, and putting on, lastly, a stratum of fine sand of the depth of several inches. The sand, gravel, &c. should, of course, be previously well washed, until the water runs off clear and tasteless. The upper stratum of sand is to be taken out occasionally and washed.—*ib.*

VALUABLE FLUX FOR THE BLOW PIPE.

Take of borax 1 ounce, nitre 2 drachms, pounded flint glass 2 drachms, and calcined horse's hoof half an ounce; these are to be well fused together in a crucible, taking care to add the horse's hoof *last*, and stirring it well with an iron spatula; when it is quite fluid, pour it into cold water, which will render it brittle, and thereby it may be easily pulverized. It is to be kept in well closed phials, free from moisture, and the expense will be very trifling, compared with its great importance.—*ib.*

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* Alternate layers of charcoal with the sand is an improvement.

OBSERVATIONS AND EXPERIMENTS UPON MECHANICAL AGENTS.

Sir H. Davy, in conjunction with Mr. Faraday, has made a variety of experiments with the view of ascertaining whether the vapors arising from the liquified gases might not be rendered available as mechanical agents, in lieu of steam, and be applicable to the same purposes. These experiments having been detailed in a paper read at the Royal Institution, we have made the following selections from it, considering them to be well deserving the attention of our scientific mechanical readers.

Sulphuretted hydrogen, which condenses readily at 3° Fahrenheit, under a pressure equal to that which balances the elastic force of an atmosphere compressed to 1-14th, had its elastic force increased so as to equal that of an atmosphere compressed to 1-17th, by an increase of 47° of temperature.

Liquid muriatic acid at 3° exerted an elastic force equivalent to that of an atmosphere compressed to 1-20th; by an increase of 22°, it gained an elastic force equivalent to that of an atmosphere compressed to 1-25th; and by a further addition of 26° an elastic force equivalent to that of air condensed to 1-40th of its primitive volume. Sir H. Davy considers that the denser the vapor, or the more difficult the gas is of condensation, the greater will be its power under changes of temperature as a mechanical agent—Thus:

Carbonic acid exerted a force nearly equal to that of air compressed to 1-20th at 12° Fahrenheit; and of air compressed to 1-36th at 32°, making an increase equal to the weight of 13 atmospheres by an increase of 20° of temperature; and this immense elastic force of 36 atmospheres being exerted at the freezing point of water.

From the above experiments, as well as others on the same subject, Sir H. Davy is of opinion that "the small differences of temperature required to produce an elastic force equal to the pressure of many atmospheres will render the risk of explosion extremely small; and (he continues) if future experiments should realize the views here developed the mere difference of temperature between sunshine and shade, and air and water, or the effects of evaporation from a moist surface, will be sufficient to produce results which have hitherto been obtained only by a great expenditure of fuel.

Sir H. Davy has employed a very simple method of liquifying the gases by the application of heat. The gas is placed in one leg of a bent sealed tube confined by mercury, and applying heat to ether, alcohol or water, in the other end. In this manner prussic gas, and sulphurous acid gas were liquified by the pressure of the vapor of ether.

The reproduction of these gases occasioned cold.—*ib.*

GAS FROM PYROLIGNEOUS ACID.

When wood acid is made to pass through an iron tube heated to bright ignition, and the acid allowed to enter the tube by drops in quick succession, gas of a very excellent quality is obtained.

ib.

PURE HYDROGEN GAS INODOROUS.

A perfectly inodorous hydrogen gas may be obtained by putting an amalgam of potassium and mercury into distilled water; and by the addition of an acid, or the muriate of ammonia to the water, the same odor is produced as in the solution of zinc by diluted sulphuric acid; this shows that pure hydrogen is inodorous, and that the odor which usually accompanies the gas is owing to impurities.

ib.

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OBSERVER AND RECORD
OF AGRICULTURE, SCIENCE, AND ART.

EDITED BY D. PEIRCE.

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The object of this paper is to concentrate and preserve, in a form suitable for future reference, the most useful and interesting articles on the aforesaid subjects. Each number will contain sixteen octavo pages, printed on good paper, and when a sufficient amount is published to form a volume of convenient size, an alphabetical table of contents will be published and forwarded to subscribers, in order for binding. This number, shows the general plan of the work.

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ON BLEACHING SILK.

BY M. ROAD.

WHITE raw silk becomes still whiter by the sun; the fine yellow silk entirely loses its color, and becomes of a good white; the dirty yellow silk acquires, by a long exposure to the light, a dingy reddish white color. Yellow silk, partly bleached by soap, being exposed for four or five days to the sun, is rendered of many shades of white.

Yellow raw silk, boiled for eight hours in water, and the water evaporated, left—1, a dry, friable, reddish, resin-like substance, very soluble in water; 2, coloring matter very soluble in alcohol, forming a greenish-yellow solution; 3, a substance insoluble in boiling water, soluble in hot alcohol, and falling down as it cools in light and very white flakes; 4, a blackish brown residue, burning like animal substances, insoluble in water or alcohol, but soluble in concentrated acids. White raw silk yields the same products, except the coloring matter. Yellow raw silk was boiled for some hours in alcohol, and the solution poured off while hot. The solution was very clear, and of a fine gold color, more or less deep: on cooling, a flaky substance fell down, and remained upon the filter in the form of a fine, yellow, opake jelly, which was much reduced by drying, and formed only very light and thin pellicles. The coloring matter was separated from it by cold alcohol. The fat matter, insoluble in cold alcohol, was analogous to wax, spermaceti, and adipocire.

Fine yellow silk becomes, by this operation, of a good white, but ordinary silk remains colored. This reddish tinge may be given to yellow raw silk, bleached by the sun, by leaving it for some months on the grass, macerating it in oxymuriatic acid, or by boiling it for some hours in alcohol.

Although oxymuriatic acid does not change the color of yellow raw silk, it produces a remarkable change in the gummy substance. Solutions of caustic soda, or of neutralized soda, boiled for several hours on silk, did not take up so much soluble matter as alcohol.

The good effects of soap have been long known; but it was thought prudent to analyze that made use of, as also the water. The soap was found to contain 52.29 per cent. of water, 41.58 of oil, and 6.13 of soda: but, according to Lelievre, Darcet, and Pellitier, the soap they examined contained only 30.46 per cent. of water, 60.95 of oil, and 8.59 of soda; so that soap may contain more than 20 per cent. of superfluous water, without losing its solid form.

The Seine water, at Paris, yielded, on evaporating, 10 litres (610.3 cub. in.) of it, on an average, 2 grammes (30.8 grains) of muriate of lime mixed with carbonate, equal to 1.21 grammes of lime. From this it appears, that in bleaching 30 chilogrammes, (about 60 lbs.) of silk, with 7.5 (about 15 lbs.) of soap, and 750 (about 1500 lbs.) of water, 0.6 (about 1 lb. 5 oz.)

of soap is decomposed; and when water from the Gobelins river is used, which contains more calcareous salts, 1.8, or about a quarter of the soap, is rendered useless.

Raw silk, treated with a solution of soap, yielded as much gum, and more waxy and coloring matter, than when either water or alkalies were employed: and on examining, by means of alcohol, silk that had been treated with different liquids, that which had been treated with a solution of soap yielded very little fat or coloring matter to the alcohol, and much less than the other specimens.

The stiffness of silk is owing to gum, which forms 23 or 24 per cent. of it. When dry, the gum is friable, and yields a very light reddish-yellow powder; smelling and tasting like extracts. It is not softened by heat, but blackens, and is converted into coal. It is soluble in six times its weight of water, forming a transparent brown-red solution, which is yellow when spread out thin, and becomes greenish and putrid when exposed to the air. The solution lathers like that of soap. Concentrated sulphuric or muriatic acid deepens the color of this solution; nitric acid changes it to a golden yellow; sulphurous acid, and especially the gas, brightens the solution, and changes it to a pale greenish-yellow. Alcohol, of the specific gravity of 0.8293, and 80° Cels. (176° Fahr.,) does not dissolve this gum. Oxymuriatic acid throws down, from a solution of the gum, an abundant white precipitate, which becomes reddish in the air; its solubility in water is not altered, but it is rendered soluble in alcohol, whether hot or cold. Alkalies do not alter the solution of the gum, but nut-galls throw down a precipitate.

The coloring matter, which is only found in yellow silk, is a resinous substance, almost solid at 12° Cels. (54° Fahr.,) and entirely liquid at 30° (86° Fahr.,) which forms about $\frac{1}{55}$th or $\frac{1}{60}$th per cent. of the silk. It has a strong smell, arising from the volatile oil combined with it, which resembles oil of aniseed, and may be separated from the yellow raw silk by means of alcohol The most concentrated solutions of this coloring matter are rendered colorless in a few days by the sun.

It is not soluble in water, but soluble in 8 or 10 times its weight of alcohol. Caustic alkalies, especially ammonia, has some action upon it. The solution of soap, although it has but little action in the cold, dissolves a greater quantity than the alkalies at a boiling heat. Sulphuric and muriatic acids render it black, but sulphurous acid partly takes away its color. Oxymuriatic acid converts it immediately into a solid white substance analogous to wax.

The wax of silk is found in all kinds of silk, and forms about $\frac{1}{200}$th or $\frac{1}{300}$th part of China silk. It is hard, brittle, and slightly colored; it melts at 75 or 80° (167 or 176° Fahr.,) insoluble in water, but very soluble in alkalies or soap. Alcohol, sp. grav. 0.8293, takes up only $\frac{1}{2000}$th, of its weight at 20 or 25° (68 or 77° Fahr.,) and at a boiling heat, about $\frac{1}{300}$th or $\frac{1}{400}$th.

The solution is scarcely colored, it grows turbid even while hot, and lets fall white flakes. When cooled, these form a bluish-white mass, which diminishes greatly on drying, and is reduced to very thin plates, slightly transparent.

White raw silk contains only this wax, and some oil, which with gum appears to give color to silk.

Silk is usually treated with a solution of soap, in order to render it soft, white, and brilliant, without affecting its strength. White raw silk, boiled for three hours with 300 parts of water, is rendered soft and brilliant; but yellow requires 400 parts, and 4 or 5 hours boiling, and even then it retains much of its color. It requires $\frac{1}{100}$th part of pure caustic soda, with the usual quantity of water and usual time of boiling, as when soap is employed, to prepare white raw silk; and $\frac{1}{75}$th or $\frac{1}{80}$th, to prepare yellow raw silk. The preparation with soap varies in different manufactories; but, on the average, yellow raw silk to be bleached, requires 60 or 70 chilogrammes of soap for 100 of silk, and at least four or six hours boiling; the white raw silk only 30 or 35 of soap, and four hours boiling:

the mean proportion of water being 25 or 30 times the weight of the silk.

Comparative experiments being made, the white raw silk, prepared with soap, was very white and brilliant, with soda soft, but less white, as having a yellowish-gray tinge; with water, although very soft, dull, and having a yellowish-gray tinge. Yellow raw silk exhibited the same differences, but the soda had not acted so strongly upon it as the water.

The white silks lost upon an average 24 to 25 per cent. and the yellow 26 to 28. The silks prepared with soap were stronger than those boiled in water, or with soda; and were of superior brilliancy when dried. In boiling silk, copper vessels have some inconveniences, on account of the ease with which they are oxidized: and as calcareous salts present in the water diminish the soap, it is necessary to use very pure water, and only a certain quantity, which is 15 or 16 times the weight of the silk: $\frac{1}{12}$th or $\frac{1}{6}$th of soap is sufficient for white raw silk; but for yellow raw silk, it is necessary to add 50 or 60 per cent. of soap. Even an equal weight of soap, and the subsequent use of sulphurous acid gas, does not render these silks as white as the other, when treated with 25 per cent. of soap. As to the time of boiling, the silk which was boiled the least time was whiter, more brilliant, and had lost less of its weight than that which had boiled a longer time.

Silk, if the boiling be continued too long, loses the white color it has acquired; the following experiments were made to determine the cause of this alteration; white raw silk, boiled in a vessel which permitted $\frac{2}{5}$ths of the water to be evaporated, was not so white as that boiled in a vessel that did not permit any evaporation to take place.

Very white silk, which had been boiled with soap, was again boiled for an hour in soap-liquor and in solution of gum; it acquired a reddish tint, that could not be got rid of by boiling water.

Silk, already bleached by soap, was boiled again for four hours, with a quarter its weight of soap. The white silk, thus doubly bleached, had a greenish-gray tint; it was dull and harsh, having acquired some resemblance to thread in hardness; it had lost $\frac{1}{5\frac{1}{3}}$ of its weight, and 7 per cent. of its strength.

The yellow raw silk, was whiter than at the first bleaching, but had lost some of its softness and brillancy, with $\frac{1}{107}$th of its weight, and 5 or 6 per cent. of its strength.

White raw silk, bleached by soap, and very white, being boiled, after careful washing, for many hours in distilled water, and the water afterwards evaporated, yielded a small quantity of animal matter, not analogous to the products above spoken of, but which burned in the same manner as silk.

As silk is completely bleached in less than an hour, the boiling should not exceed that time; the soap and silk being put in about half an hour before the water boils, and the silk frequently turned. A less time would suffice for trames and organzines.

It is to the alterations which take place when the boiling is too long continued, that the impossibility of aluming silk in the hot bath is owing; and the loss of brilliancy when silk is dyed of colors rather brown, for which a boiling heat is necessary.—*Ann. de Chim.* Vol. 65.

SIR H. DAVY'S AGRICULTURAL CHEMISTRY.

(Continued from p. 164.)

To ascertain the primary elements of the different vegetable principles, and the proportions in which they are combined, different methods of analysis have been adopted. The most simple are their decomposition by heat, or their formation into new products by combustion.

When any vegetable principle is acted on by a strong red heat, its elements become newly arranged. Such of them as are volatile are expelled in the gaseous form; and are either condensed as fluids, or remain permanently elastic. The fixed remainder is either carbonaceous, earthy, saline, alkaline, or metallic matter.

To make correct experiments on the decomposition of vegetable substances by heat, requires a complicated apparatus, much time and labor, and all the resources of the philosophical chemist; but

such results as are useful to the agriculturist may be easily obtained.

The apparatus necessary, is a green glass retort, attached by cement to a receiver, connected with a tube passing under an inverted jar of known capacity, filled with water. A given weight of the substance is to be heated to redness in the retort over a charcoal fire; the receiver is to be kept cool, and the process continued as long as any elastic matter is generated. The condensible fluids will collect in the receiver, and the fixed residuum will be found in the retort. The fluid products of the distillation of vegetable substances are principally water, with some acetous and mucous acids and empyreumatic oil, or tar, and in some cases ammonia. The gasses are carbonic acid gas, carbonic oxide, and carburetted hydrogen; sometimes with olefiant gas, and hydrogen; and sometimes, but more rarely, with azote. Carbonic acid is the only one of those gasses rapidly absorbed by water; the rest are inflammable; olefiant gas burns with a bright white light; carburetted hydrogen with a light like wax; carbonic oxide with a feeble, blue flame. The properties of hydrogen and azote have been described in the last lecture. The specific gravity of carbonic acid gas, is to that of air as 20.7 to 13.7, and it consists of one proportion of carbon 11.4, and two of oxygen 30. The specific gravity of gaseous oxide of carbon, is, taking the same standard, 13.2, and it consists of one proportion of carbon, and one of oxygen. The specific gravities of carburetted hydrogen and olefiant gas are respectively 8 and 13; both contain four proportions of hydrogen; the first contains one proportion, the second two proportions of carbon. If the weight of the carbonaceous residuum be added to the weight of the fluids condensed in the receiver, and they be subtracted from the whole weight of the substance, the remainder will be the weight of the gasseous matter.

The acetous and mucous acids, and the ammonia formed, are usually in very small quantities; and by comparing the proportions of water and charcoal with the quantity of the gasses, taking into account their qualities, a general idea may be formed of the composition of the substance. The proportions of the elements in the greater number of the vegetable substances which can be used as food, have been already ascertained by philosophical chemists, and have been stated in the preceding pages; the analysis by distillation may, however, in some cases, be useful in estimating the powers of manures in a manner that will be explained in a future lecture.

The statements of the composition of vegetable substances, quoted from MM. Gay Lussac and Thenard were obtained by these philosophers by exposing the substances to the action of heated hyperoxymuriate of potassa; a body that consists of potassium, chlorine, and oxygen, and which afforded oxygen to the carbon and the hydrogen. Their experiments were made in a peculiar apparatus, and required great caution, and were of a very delicate nature. It will not therefore be necessary to enter upon any details of them.

It is evident from the whole tenor of the statements which have been made, that the most essential vegetable substances consist of hydrogen, carbon, and oxygen in different proportions, generally alone, but in some few cases combined with azotes. The acids, alkalies, earths, metallic oxides, and saline compounds, though necessary in the vegetable economy, must be considered as of less importance, particularly in their relation to agriculture, than the other principles: and as it appears from M. de Saussure's table, and from other experiments, they differ in the same species of vegetable when it is raised on different soils.

MM. Gay Lussac and Thenard have deduced three propositions, which they have called *laws*, from their experiments on vegetable substances. The *first* is, "that a vegetable substance is always acid, whenever the oxygen it contains is to the hydrogen in a greater proportion than in water."

The *second*, "that a vegetable substance is always resinous or oily or spirituous, whenever it contains oxygen in a smaller proportion to the hydrogen than exists in the water."

The *third*, "that a vegetable sub-

stance is neither acid nor resinous; but is either saccharine or mucilaginous, or analagous to woody fibre or starch, whenever the oxygen or hydrogen in it are in the same proportions as in water."

New experiments upon other vegetable substances, besides those examined by MM. Gay Lussac and Thenard, are required before these interesting conclusions can be fully admitted. Their researches establish, however, the close analogy between several vegetable compounds differing in their sensible qualities, and combined with those of other chemists, offer simple explanations of several processes in nature and art, by which different vegetable substances are converted into each other, or changed into new compounds.

Gum and sugar afford nearly the same elements by analysis: and starch differs from them only in containing a little more carbon. The peculiar properties of gum and sugar must depend chiefly upon the different arrangement, or degree of condensation of their elements; and it would be natural to conceive from the composition of these bodies, as well as that of starch, that all three would be easily convertible one into the other; which is actually the case.

At the time of the ripening of corn, the saccharine matter in the grain, and that carried from the sap vessels into the grain, becomes coagulated, and forms starch. And in the process of malting, the converse change occurs. The starch of grain is converted into sugar. As there is a little absorption of oxygen, and a formation of carbonic acid in this case, it is probable that the starch loses a little carbon, which combines with the oxygen to form carbonic acid; and probably the oxygen tends to acidify the gluten of the grain, and thus breaks down the texture of the starch, gives a new arrangement to its elements, and renders it soluble in water.

Mr. Cruikshank, by exposing syrup to a substance named phosphuret of lime, which has a great tendency to decompose water, converted a part of the sugar into a matter analogous to mucilage. And M. Kirchhoff, recently, has converted starch into sugar by a very simple process, that of boiling in very diluted sulphuric acid.

The proportions are 100 parts of starch, 400 parts of water, and 1 part of sulphuric acid by weight. This mixture is to be kept boiling for 40 hours; the loss of water by evaporation being supplied by new quantities. The acid is to be neutralized by lime; and the sugar crystallized by cooling. This experiment has been tried with success by many persons. Dr. Tuthill, from a pound and a half of potato starch, procured a pound and a quarter of crystalline brown sugar; which he conceives possessed properties intermediate between cane sugar, and grape sugar.

It is probable that the conversion of starch into sugar is effected merely by the attraction of the acid for the elements of sugar; for various experiments have been made, which prove that the acid is not decomposed, and that no elastic matter is set free; probably the color of the sugar is owing to the disengagement, or new combination of a little carbon, the slight excess of which, as has been just stated, constitutes the only difference perceptible by analysis between sugar and starch.

M. Bouillon la Grange, by slightly roasting starch, has rendered it soluble in cold water; and the solution evaporated afforded a substance, having the charaters of mucilage.

Gluten and albumen differ from the other vegetable products, principally by containing azote. When gluten is kept long in water it undergoes fermentation; ammonia (which contains its azote) is given off with acetic acid: and a fatty matter, and a substance analogous to woody fibre remain.

Extract, tannin, and gallic acid, when their solutions are long exposed to air, deposite a matter similar to woody fibre; and the solid substances are rendered analogous to woody fibre by slight roasting; and in these cases it is probable that part of their oxygen and hydrogen is separated as water.

All the other vegetable principles differ from the vegetable acids, in containing more hydrogen and carbon, or less oxygen; many of them therefore are

easily converted into vegetable acids by a mere substraction of some proportions of hydrogen. The vegetable acids, for the most part, are convertible into each other by easy processes. The oxalic contains most oxygen, the acetic the least: and this last substance is easily formed by the distillation of other vegetable substances, or by the action of the atmosphere on such of them as are soluble in water; probably by the mere combination of oxygen with hydrogen and carbon, or in some cases by the subtraction of a portion of hydrogen.

(*To be Continued.*)

DEFINITION OF TERMS.—*Letter J.*

Japanning, is properly the art of varnishing and painting ornaments on wood, in the same manner as it is done by the natives of Japan, in the East Indies. The substances which admit of being japanned are almost every kind that are dry and rigid, or not too flexible; as wood, metals, leather, and paper, prepared for the purpose.

Wood and metals do not require any other preparation, but to have their surface perfectly even and clean; but leather should be securely strained, either in frames or on boards; as its bending, or forming folds, would otherwise crack and force off the coats of varnish. Paper should be treated in the same manner, and have a previous strong coat of some kind of size; but it is rarely made the subject of japanning till it is converted into papier mache, or wrought by other means into such form, that its original state particularly with respect to flexibility, is changed. One principal variation from the method formerly used in japanning is the omitting any priming or undercoat on the work to be japanned In the other practice, such a priming was always used; the use of which was to save in the quantity of varnish, by filling up the inequalities in the surface of the substance to be varnished. But there is a great inconvenience arising from the use of it, that the japan coats are constantly liable to be cracked, and peeled off, by any violence, and will not endure near so long as the articles which are japanned without any such priming.

Of the nature of Japan grounds.—When a priming is used, the work should first be prepared by being well smoothed with fish skin, or glass-paper, and being made thoroughly clean, should be brushed over once or twice with hot size, diluted with two-thirds of water, if it is of the common strength. The priming should then be laid on as even as possible, and should be formed of a size, of a consistency between the common kind and glue, mixed with as much whiting as will give it a sufficient body of color to hide the surface of whatever it is laid upon, but not more. This must be repeated till the inequalities are completely filled up, and then the work must be cleaned off with Dutch rushes, and polished with a wet rag. When wood or leather is to be japanned, and no priming is used, the best preparation is to lay two or three coats of coarse varnish, composed in the following manner:

Take rectified spirits of wine one pint, and of coarse seed-lac and resin each two ounces; dissolve the seed-lac and resin in the spirit, and then strain off the varnish. This varnish, as well as all others formed of the spirit of wine, must be laid on in a warm place; and if it can be conveniently managed, the piece of work to be varnished should be made warm likewise; and for the same reason, all dampness should be avoided; for either cold or moisture chills this kind of varnish, and prevents its taking proper hold of the substance on which it is laid. When the work is so prepared, or by the priming with the composition of size and whiting above described, the proper japan ground must be laid on, which is much the best formed of shell-lac varnish, and the color desired, except white, which requires a peculiar treatment; and if brightness is wanted, then also other means must be pursued.

The colors used with the shell-lac varnish may be any pigments whatever, which give the tint of the ground desired. As metals never require to be undercoated with whiting, they may be treated in the same manner as wood or leather.

Method of painting Japan work.—Japan work ought properly to be painted

with colors in varnish; though for the greater despatch, and in some very nice work, in small, for the freer use of the pencil, the colors are sometimes tempered in oil, which should previously have a fourth part of its weight of gum animi dissolved in it; or in default of that gum sandarach, or gum mastich. When the oil is thus used, it should be well diluted with oil of turpentine, that the colors may lie more evenly and thin; by which means fewer of the polishing or upper coats of varnish become necessary. In some instances, water-colors are laid on grounds of gold, in the manner of other paintings; and are best, when so used in their proper appearance, without any varnish over them; and they are also sometimes so managed as to have the effect of embossed work. The colors employed in this way for painting, are best prepared by means of isinglass size, corrected by honey or sugar candy. The body, of which the embossed work is raised, need not, however, be tinged with the exterior color, but may be best formed of very strong gum water, thickened to a proper consistence by bole armenian and whiting in equal parts; which being laid on the proper figure, and repaired when dry, may be then painted with the proper colors, tempered with the isinglass size, or in the usual manner, with shellac varnish.

Manner of varnishing Japan work. —The finishing of japan work depends on the laying on and polishing the outer coats of varnish which are necessary, as well in the pieces that have only one simple ground of color as with those that are painted. This is in general done best with common seed-lac varnish, except in these instances, and those occasions, where particular methods are deemed to be more expedient; and the same reasons which decide as to the fitness or impropriety of the varnishes, with respect to the colors of the ground, hold equally with regard to those of the painting. For where brightness is the most material point, and a tinge of yellow will injure it, seed-lac must give way to the whiter gums; but where hardness and a greater tenacity are most essential, it must be adhered to; and where both are so necessary, that it is proper one should give way to the other in a certain degree reciprocally, a mixed varnish must be adopted. This mixed varnish, as we have already observed, should be made of the picked seed-lac. The common seed-lac varnish, which is the most useful preparation of the kind hitherto invented, may be thus made. Take of seed-lac three ounces, and put it into water to free it from the sticks and filth that are frequently intermixed with it, and which must be done by stirring it about, and then pouring off the water, and adding fresh quantities, in order to repeat the operation till it is freed from all impurities, as is very effectually done by this means. Dry it then and powder it grossly, and put it with a pint of rectified spirit of wine, into a bottle, of which it will not fill above two-thirds. Shake the mixture well together, and place the bottle in a gentle heat, till the seed-lac appears to be dissolved; the shaking being in the mean time repeated as often as may be convenient; and then pour off all that can be obtained clear by this method, and strain the remainder through a coarse cloth. The varnish thus prepared, must be kept for use in a bottle well stopped. When the spirit of wine is very strong it will dissolve a greater proportion of the seed-lac; but this quantity will saturate the common, which is seldom of a strength sufficient to make varnishes in perfection.

As the chilling which is the most inconvenient accident attending varnishes of this kind, is prevented or produced more frequently, according to the strength of the spirit, we shall, therefore, take this opportunity of showing a method by which weaker rectified spirits may with great ease at any time be freed from the phlegm, and rendered of the first degree of strength. Take a pint of the common rectified spirit of wine, and put it into a bottle, of which it will not fill above three parts; add to it half an ounce of pearl-ashes, salt of tartar, or any other alkaline salt, heated red-hot and powdered as well as it can be without much loss of its heat. Shake the mixture frequently for the space of half an hour; before which time, a great part of the phlegm

will be separated from the spirit, and will appear, together with the undissolved part of the salts, in the bottom of the bottle. Let the spirit be poured off or freed from the phlegm and the salts, by means of a tritorium, or separating funnel; and let half an ounce of the pearl-ashes, heated and powdered as before, be added to it, and the same treatment repeated. This may be done a third time, if the quantity of phlegm separated by the addition of the pearl-ashes appears considerable. An ounce of alum reduced to powder, and made hot, but not burnt, must then be put into the spirit, and suffered to remain some hours, the bottle being frequently shaken; after which the spirit, being poured off from it, will be fit for use.

The addition of the alum is necessary to neutralize the remains of the alkaline salt, which would otherwise greatly deprave the spirit, with respect to varnishes and lacquer where vegetable colors are concerned, and must consequently render another distillation necessary. The manner of using the seed-lac, or white varnish, is the same, except with regard to the substance used in polishing; which, where a pure white of a great clearness of other colors is in question, should be itself white; whereas the browner sorts of polishing dust, as being cheaper, and doing the business with greater despatch, may be used in other cases. The pieces of work to be varnished, should be placed near a fire or in a room where there is a stove, and made perfectly dry; and then the varnish may be rubbed over them by the proper brushes made for that purpose, beginning in the middle, and passing the brush to one end, and then with another stroke from the middle, passing it to the other. But no part should be crossed, or twice passed over, in forming one coat, where it can be possibly avoided. When one coat is dry, another must be laid over it; and this must be continued at least five or six times, or more, if on trial there is not sufficient thickness of varnish to bear the polish, without laying bare the painting or ground color underneath. When a sufficient number of coats is thus laid on, the work is fit to be polished: which must be done in common cases by rubbing it with a rag dipped in tripoli or rotten-stone, finely powdered; but towards the end of the rubbing, a little oil of any kind should be used along with the powder; and when the work appears sufficiently bright and glossy, it should be well rubbed with the oil alone, to clean it from the powder, and give it a still brighter lustre.

Jatropha, the *cassada plant*, a genus of the monadelphia order, in the monœcia class of plants, and in the natural method ranking under the thirty-eighth order, tricocea. There are nine species, of which the most remarkable are—1. The curcas, or English physic nut. 2. The gossypifolia, cotton leaved jatropha. 3. The multifida, or French physic nut. 4. The manihot or bitter cassada. 5. The janipha, or sweet cassada. 6. The elastica. The root of the bitter cassada has no fibrous or woody filaments in the heart, and neither boils nor roasts soft. The sweet cassada has all the opposite qualities. The bitter, however, may be deprived of its noxious qualities (which reside in the juice) by heat. Cassada bread is therefore made of both the bitter and sweet. The scrapings of fresh bitter cassada are successfully applied to ill disposed ulcers. Cassada roots yield a great quantity of starch, which the Brazilians export in little lumps, under the name of tapioca. A fermented drink called ouyeau, is prepared with this root, West India potatoes and molasses. The sixth species is the hevea guianensis, of Aublet, or tree that yields the elastic resin *caoutchouc* (India rubber.)

Jelly, in chemistry. If we press out the juice of ripe blackberries, currents, and many other fruits, and allow it to remain for some time in a state of rest, it partly coagulates into a tremulous soft substance, well known by the name of jelly. If we pour off the incoagulated parts, and wash the coagulum with a small quantity of water, we obtain jelly approaching to a state of purity. In this state it is nearly colorless, unless tinged by the peculiar coloring matter of the fruit; it has a pleasant taste, and a tremulous consistency. It is scarcely soluble in cold water, but very soluble in hot water, and when the solu-

tion cools, it again coagulates into the form of a jelly. When long boiled, it loses the property of gelatinizing by cooling, and becomes analogous to mucilage. This is the reason that in making current jelly or any other jelly, when the quantity of sugar added is not sufficient to absorb all the watery parts of the fruit, and consequently it is necessary to concentrate the liquid by long boiling, the mixture often loses the property of coagulating, and the jelly, of course, is spoiled.

Jelly combines readily with alkalies. Nitric acid converts it into oxalic acid, without separating any azotic gas. When dried it becomes transparent. When distilled it affords a great deal of pyromucous acid, a small quantity of oil, and scarcely any ammonia. Jelly exists in all the acid fruits, as oranges, lemons, gooseberries, &c. If the juice of these fruits is allowed to gelatinize, and then poured upon a searce, the acid gradually filtrates through and leaves the other; which may be washed with a little cold water, and allowed to dry. Its bulk gradually diminishes, and it concretes into a hard transparent brittle mass, which possesses most of the properties of gum. Perhaps, then, jelly is merely gum combined with vegetable acid.

Joint tenants, are those that come to and hold land or tenements by one title, pro indiviso, or without partition.

These are distinguished from sole or several tenants, from parceners, or from tenants in common; and they must jointly implead and jointly be impleaded by others, which property is common between them and coparceners; but joint tenants have a sole quality of survivorship, which coparceners have not; for if there are two or three joint tenants and one has issue and dies, then he or those joint tenants that survive, shall have the whole by survivorship.

If an estate is given to a pleurality of persons, without adding any restrictive, exclusive or explanatory words, as if an estate is granted to A and B and their heirs, this makes them immediately joint tenants in fee of the lands. If there are two joint tenants, and one releases the other, this passes a fee without the word heirs, but the tenants in common cannot release to each other, for the release supposes the party to have the thing in demand, but tenants in common have several distinct freeholds which they cannot transfer otherwise than as persons who are sole seized.

The right of survivorship shall take place immediately upon the death of the joint tenant, whether it is a natural or civil death. Joint tenants may make partition; the one party may compel the other to make partition, which must be by deed; that is to say, all the parties must by deed actually convey and assure to each other the several estates which they are to take and enjoy, severally and separately.

Jointure.—A jointure, strictly speaking, signifies a joint estate, limited to both husband and wife, but in common acceptation, it extends also to a sole estate, limited to the wife only, and may be thus defined, viz: a competent livelihood of freehold for the wife, of lands and tenements, to take effect, in profit for possession presently after the death of the husband, for the life of the wife at least.

Judgments.—The opinion of the judges so called, and is the very voice and final doom of the law, and therefore is always taken for unquestionable truth; or it is the sentence of the law pronounced by the court, upon the matter contained in the record.

Judgments are of four sorts.—1. Where the facts are confessed by the parties, and the law determined by the court, which is termed judment by demurrer. 2. Where the law is admitted by the parties, and the facts only are disputed, as in judgment upon a demurrer. 3. Where both the fact and the law arising thereon are admitted by the defendant, as in case of judgment by confession or default. 4. Where the plaintiff is convinced that fact, or law, or both, are insufficient to support his action, and therefore abandons or withdraws his prosecution, as in case of a judgment upon a nonsuit or retraxit.—Judgments are either interlocutory or final. Interlocutory judgments are such as are given in the middle of a cause, up-

on some plea, proceeding, or default, which is only intermediate, and does not finally determine or complete the suit; as upon dilatory pleas, when judgment in many cases is that the defendant shall answer over; that is put in a more substantial plea. Final judgments are such as at once put an end to the action, by declaring that the plaintiff has either entitled himself, or has not to recover the remedies he sues for.

Juglans, the walnut, a genus of the monœcia class, and polyandria order of plants; and in the natural method ranking under the fiftieth order amentaceæ.

Juniperus, the juniper tree; a genus of the monadelphia order, in the monœcia class of plants; and in the natural method ranking under the fifty-first order, coniferæ.

The propagation of the juniper is by seed. Juniper berries have a strong, not a disagreeable smell, and a warm, pungent, sweet taste, which, if they are long chewed, or previously well bruised, is followed by a bitterish one. The pungency seems to reside in the bark; the sweet in the juice; the aromatic flavor is oily vesicles spread through the substance of the pulp, and distinguishable even by the eye; and the bitter in the seeds.

Justification, in law, is an affirming or showing good reason in court, why one does such a thing as he is called to answer; as to justify in a cause of replevin.

ON SMUT IN WHEAT.

BY T. BACHELOR.

This gentleman having had his attention particularly called to the subject of this paper by some observations in the Magazine, determined to commence a series of experiments, to ascertain, if possible, the nature and cause of the disease, as well as to discover whether or not it was infectious. The experiments were made on a limited scale, as they occupied little more than two poles of a garden, sheltered from the north winds by a clipped hedge of more than four feet high. The ground had not been manured for the purpose, but was in rather better condition than arable lands generally are; and the kind of wheat which was subjected to the experiments was the common red lammas. The crop was pulled about the middle of August, and the roots and ears carefully numbered, as well as accurately assorted.

No. 1, was clean wheat rubbed with dry smut and sown at the interval of an hour: of this, sixty-two roots produced 538 ears of corn; twelve of these roots had all good ears; fifteen of them all smutty ears; and the remaining thirty-five had some ears of both kinds;—the whole number of good ears was 246, and of smutty ears 292.

No. 2, was the same wheat soaked for an hour in water, in which smut had been thoroughly mixed: of this, fifty-two roots produced 443 ears, of which 264 were good, and 179 smutty; the different roots producing some all good ears, some all smutty, and some of both kinds, as before.

No. 3, was conducted the same as No. 1;—sixty-one roots produced 384 ears, of which 156 were good, and 228 smutty.

No. 4, was conducted the same as No. 2:—sixty-three roots produced 355 ears, of which 144 were good, and 211 smutty.

No. 5, was clean corn picked out of many smutty ears:—and eight roots produced eighty-five ears, eleven of these were blasted ears, seventy-three were good, and one only was smutty; some of the roots had all the ears good, and some mixed ears, but there was no root entirely smutty.

No. 6 and No. 7, were both clean wheat of different samples, and were sown without any preparation: 120 roots produced 933 ears, of which five only were smutty; three of these five were on the same root, which produced three good ears. As the proportion here was 183 good ears to one of smut, Mr. Bachelor concludes that it is nearly the same as happens in common crops, for he had no reason to believe that they were caused by any infection of the seed previous to sowing; and he conceives the case analogous to the gaol fever, canine madness, &c., among animals; which, though known to be infectious, yet often originate in a manner for which no cause can be assigned. He also observes that

though these plants were all sheltered from the north-east wind, yet there was mildew on ever individual stalk. From this circumstance he denies the supposed connexion or affinity between *smut* and *mildew*, or, that the north-east wind (as some have confidently asserted,) is the cause of either.

The first four experiments were stated to have been made for the purpose of ascertaining whether the smutty powder possesses the power of propagation; and it is argued from the result that it has; because the difference of proportion between the smut in these, and lot No. 6 and 7 was too great to have happened by chance, when the corn was all sown in the same day, on the same soil, and under similar circumstances.

No. 8, was smutted wheat dressed with hot lime, and sown after an interval of twenty hours: of this, twenty-seven roots produced 243 ears, six of them only being smutty, and these were distributed on six different roots.

No. 9, was the same smutted wheat rubbed over with mercurial ointment, and sown twenty-two hours afterwards: of this, ten roots produced 107 ears, of which nine were smutty.

No. 10, was the same wheat washed in water and soaked twenty-three hours: of this, thirty-three roots produced 275 ears, ninety-eight of them being smutty.

No. 11, was smutted wheat dressed with lime, in the same manner as No. 8, and after an interval of forty-eight hours: of this, twenty-seven roots produced 250 ears, and every one of them good.

No. 12, was smutted wheat soaked fifty-four hours in water; twenty roots produced 200 ears, but sixty-eight of them were smutty.

No. 13, was dry smut, nineteen roots produced 173 ears, of which, nineteen only were smutty, and these were distributed on six roots only.

No. 14, was clean wheat bruised with a hammer, (as bruising had been sometimes thought a cause of smut,) only five seeds vegetated, which produced eighty-one ears, all good corn.

No. 15, was smutted wheat dressed with lime and urine, and sown an hour afterwards; eleven roots produced 103 ears, and all without smut.

No. 16, was the same wheat soaked in urine only, and sown at the same interval: twenty roots produced 131 ears, but forty-one of them were smutty.

No. 17 and No. 18, were smutted wheat, dressed with lime and urine, and sown; the first at an interval of three hours, the latter, of six hours: No. 17; had no smut out of 194 ears, and No. 18 only three smutty ears out of 198.

No. 19, was the same smutted wheat, soaked in urine only, for six hours, and there were seventy-one ears smutty, out of 110.

No. 20 and No. 21, were wheat of different samples, but equally smutty. These were each soaked for eight hours: No. 20, which was soaked in urine and lime, produced fifty-five ears of good wheat, and no smut; and No. 21, soaked in urine only, produced sixty-three ears of smut, to forty-one good ears.

No. 22, was smutted wheat, dressed with mercurial ointment, and sown at the end of five days; ten roots produced fifty-seven good ears, and four smutty ears.

No. 23, was the same wheat, soaked in water for the same time; seventy-nine roots produced only fifty-two good ears, and 105 ears were smutty.

No. 24, was the same wheat dressed with lime, and suffered to remain also five days before sowing: the produce from sixteen roots was fifty-six ears, of which fifty-five were good, and one blasted, but there was no smut.

From the result of the seventeen last experiments, it is contended, that dressings are useful in obviating the smut in wheat, it being evident, also, that *all* are not equally useful, since that which was washed with water alone, was proportionably more productive of smut than that which was dressed with urine; and that dressed with urine alone, more productive of smut than that which was dressed with lime. The experiments Nos. 16, 19, and 21, relate to urine alone, and the produce was, in the aggregate, more than two-thirds smutty. It is inferred, therefore, that urine alone cannot be of any utility in preventing the infec-

tion of smut, and that these experiments form additional proof that the disease is infectious. The experiments, Nos. 8, 11, and 24, are on the power of lime as an antidote, which perfectly succeeded in Nos. 11 and 24, though it was not entirely infallible in No. 8. But, on the whole, the results were what might reasonably be expected by those who held lime to be the most effectual, though not in all cases an infallible, remedy. The experiments, Nos. 15, 17, 18, and 20, with a mixture of lime and urine, are noticed as very efficacious, but are not held to be sufficient to determine whether the virtues of lime are increased or diminished by a mixture of urine: and the same doubts are conceived to apply to salt, though no experiment was made with that substance. Smearing the wheat over with mercurial ointment, as in Nos. 9 and 22, was apparently useful in preventing the smut, but was at the same time prejudicial to vegetation, by excluding air and water from the corns: this unusual prescription was employed on account of its known efficacy in destroying vermin animalculæ; and consequently it would have destroyed the smut, if caused by the depredations of the latter, as some have supposed. The general appearance of the corns was good, and they were found to be heavy.

According to the best observations of this writer, there were no previous tokens of smut, most certainly no appearance of blue mucus on the chaff, or sickly yellow on the ear; but the smut balls might be distinguished as soon as the ear made its appearance. Mr. Bachelor has, both in this and former years, seen ears completely smutted that had never seen the light, and therefore these could not possibly have been burnt by the cold north-east winds.

The distinguishing external character of a smutty ear is said to be its dark blue green color, in which it is similar to the stalk below the ear; but the stalks and leaves of sound wheat, and smutty wheat, are stated to be precisely the same.

The opinion that smut is caused by cold north-east winds is combatted with much successful argument; and these experiments, conducted on the spot completely sheltered from such winds, are referred to as decisive of that point, but it is admitted that *blasted* ears may be occasioned by lightning, or some other atmospheric cause; but as it is certain that blasted ears like those of smut, generally proceed from the same root, it is contended, that to that root we ought principally to look for the cause of the disease: for these diseases may perhaps derive their origin, in part, from seminal infection, and in part from such substances as the root may meet in the soil, or it may be constitutional defect in the seed.

Nor does it appear to this writer that the blight or withering of the leaves has much to do with the mildew, since the former happens early in the spring, and the latter, late in the summer; and he apprehends it can never be seriously believed that the smut can be communicated to the growing crop, though it certainly may to the seed.

On a comparison of the powder of smut with wheat-flour, by using a microscope which magnified the diameter of the object about 120 times, the smutty powder appeared to consist entirely of globules, perfectly similar in size and appearance, and partially transparent, as light was perceptible through the middle of them, and their apparent size, when magnified, was about one-fourteenth part of an inch, and consequently their real diameter about the 1680th part; but the appearance of wheat-flour was considerably different, for this consisted of globules of various sizes, mostly about one-half more in diameter than those of the smutty powder, and among these a quantity of smaller particles, of a size and shape scarcely definable.

Mr. Bachelor has little doubt that the larger parts of wheat-flour are the starch, and the smaller kind compose the vegetable gluten, which possesses much alliance to animal matter. The meal of a blasted ear of wheat consisted of particles much smaller than those of smut, and is therefore presumed to be a different substance: and though it might be thought, from the disagreeable smell of smut, that the vegetable gluten, (the only part liable to putrefaction,) was also the only part destroyed by that disease, while the farina,

or material of starch, was only blackened by it, yet strong difficulties are asserted to oppose this opinion, the most material of which is the indissoluble nature of the particles of smut, which seemed to be little affected by the power of boiling water, spirit of salt, oil of vitriol, or aquafortis: but a solution of soda appeared to exert the greatest power on this mysterious substance, which, though it did not dissolve the globules, yet seemed to render many of them more white and pelucid, and separated from a substance, the particles of which were too small to be distinguished by the magnifying power employed.

If then the infectious nature of the smutty powder be acknowledged, and if the infecting substance consists of the relics of any putrid matter, it is contended that there is the strongest reason to believe that either *lime*, *potash*, *soda*, *spirit of salt*, *oil of vitrol*, *aquafortis*, *arsenic*, or *corrosive sublimate*, are capable of destroying or neutralizing this substance, so far as to prevent any infection from taking place: and among these ingredients *lime* is held to be the most eligible, both on account of its cheapness, and the little power it possesses of destroying vegetation: many instances, however, of its inefficacy may arise from the mildness of its operation, and it may be many hours before it can produce its full effect. This writer is of opinion that the failure of lime to destroy smut may almost always be traced to an imperfect application, for it has been the unvarying complaint of many writers on husbandry, that "seed is seldom steeped a sufficient length of time." And though he considers *lime* the most efficacious of all remedies for smut, yet he thinks there is no rational ground to expect a perfect cure of smutty seed, unless it be steeped in strong lime-water for at least 12 hours.

NOTE.—The spirit of salt is mentioned in the above experiments, but not a simple brine made with salt and water. It is certainly worthy of experiment to make trials of this substance at different temperatures from that of the freezing point, to that of boiling water, (32° to 212° Fahr.,) or to still greater extremes each way.

Unleached wood-ashes, and ley produced from this substance, of the same range of temperatures is also worthy of trial: this as well as the brine possesses the advantage of cheapness, and can be procured almost at any time and in any place where they may be required for this purpose. *In making trial of the brine or ley, perhaps it would be well to extend the experiments with these substances at different degrees of strength from the weakest solution up to the point of saturation where it ceases to be a liquid.* *Agric. Mag., No. 27.*

For the Observer and Record.

REMARKS UPON THE TEETH OR COGS OF WHEELS, SHOWING THE PROPER FORM TO BE GIVEN TO THEIR ACTING SIDES OR FACES.

Wheels working in contact should always fulfil the following conditions, namely:

1. The relative velocity of the peripheries should be uniform.

2. There should be the least possible rubbing or friction between the acting sides or faces of the teeth.

3. There should be the least possible crowding asunder of the wheels.

4. The shape of the teeth should be such that those formed upon the exterior convex surface (called spur-wheels) of the smallest size, should work into or between those on any intermediate convex surface from those of the same size up to the largest, and also into or between teeth placed in a straight line (called a rack.)

5. The same small spur-wheel should (besides working between the teeth of the aforesaid spur-wheels and rack, and *driving* them, or being *driven by them*) be capable of driving wheels with the teeth formed on the interior surface or concave part, and also be driven by them, if required.

In order that the reader may readily understand the following description, I will, in the first place give the definition, of some of the terms used. The part of the tooth which joins the wheel, I call the *base* of the tooth: the opposite extremity, I call the *end* of the tooth.

The parts of the teeth that are in contact respectively, when in operation, I name the *faces* or *acting sides* of the teeth.

The parts that join the base, end, and faces, I call the *edges* of the teeth.

The concentric convex circle at the base of the spur-cogs, I call the *periphery* or *circumference* of the wheel.

The straight lines meeting the periphery and the centre, are named *radii.*

The straight lines that intersect the periphery and radii, and at right angels to the latter, are called *tangents.*

A curve where all the radii are so many tangents to a circle developed, and are also all respectively perpendicular to the several points of the curve described, (which has for its greatest radius a line equal to the periphery of the circle evolved,) is named an *involute.*

The *diameter* of the wheel is a straight line passing through the centre of the wheel from the periphery on opposite sides of the centre, or axis.

The interior surface of the wheel is called the *concave surface.*

Where the acting faces of the teeth extend beyond a straight line from the base to the end of the tooth, they are called *convex faces.* And where the parts between the base and end do not extend so far as to meet a straight line, the term *concave face* is used.

Where the ends of all the teeth of a wheel are equidistant from the centre, and where the base of each, is connected with the periphery of a cylinder, it is called a *spur-wheel.* When the base of the teeth are connected with the frustum of a cone it is called a *bevil-wheel,* and when the cone, from the base to the apex is at an angle of forty-five degrees from the centre it is called a *mitre-wheel.*

When the base and end of each tooth is equidistant from the centre or axle of the wheel, it is denominated a *face-wheel.*

Where all parts of the teeth are in straight lines, and are intended to move in that direction to and fro, the term *rack* is given. When the motion is intended to be to and fro, and not in straight lines, I use the term *circular rack.*

The circle upon which the divisions between the respective teeth, and the spaces between them, are laid off, is called the *pitch circle or line,* and the points thus laid off for the respective acting faces of the teeth is called the *pitch* of the wheel.

Now let us suppose a wheel or pattern on which we wish to form teeth for a spur-wheel: the periphery of the wheel and the part for the ends of the cogs being concentric, and the former extending the fourth of an inch beyond the parts which are to form the edges of the teeth, so that a wire or string can be wound or wrapped round the periphery at the base of the teeth. The parts for the edges of the teeth, also, dressed to perfect planes at right angles to the axle of the wheel. The planes thus prepared, are to be covered with varnish, or otherwise prepared to receive a fine true mark or scribe with a pointed instrument, as hereafter described.

1. Prepare an extremely fine wire, the length of which should be a little more than the circumference of the wheel with the thickness of one tooth at the base added: paint the wire of a light color, and let it become dry,—reduce the heads of two small needles, each to a point as near the eye as possible consistent with the necessary strength, when they are used as scribes, to trace lines on the edges of the teeth; pass a needle upon each end of the wire and confine them upon it at a distance asunder, equal to the thickness of a tooth at the base, added to the circumference of the wheel: by riveting the ends or in any other convenient manner. Decide upon the thickness of each tooth and space between each respectively at the base, and mark with black ink the divisions on the wire, with a fine pen, (this should be done with perfect uniformity if possible.) Then wrap the wire round the circumference of the wheel, and let the needles pass each other equal to the thickness of a tooth; confine one of them by sticking the point into the wood, (at the angle between the wheel and tooth,) parallel with the axis of the wheel; then with the point of the other needle, while the needle itself is kept parallel with the axis of the wheel, trace a line from the base of the

tooth to its end; the wire is kept stretched during the operation: the curve thus formed is an *involute.* The point which traced this, is then to be made fast at the place of beginning, and the other side of the tooth traced in like manner with the point of the other needle; the two are then made fast at the base of the cog or tooth, and a mark made with pen and ink on the wheel or pattern, at the base of each tooth, opposite to the respective marks or divisions on the wire. The wire is then moved round equal to the thickness of a tooth and the space between two; and another tooth laid off, or marked from base to end, as the one before described, and in like manner all the teeth which are of that character. These are *convex involute spur teeth.*

2. When teeth are formed upon a concave surface, they are to be *concave involutes*, formed from a circle at the ends of the teeth.

3. In a *straight* rack the acting faces of the teeth are parallel with each other, and at right angles to its motion.

4. Face wheels have the faces of teeth parallel with the axis of the wheel.

Bevil wheels, with teeth on the convex surface, are a modification of spur-wheels already described, and are laid off on the same principle, one being on the surface of a cylinder, and the other on the surface of the frustum of a cone: the teeth may be laid off upon one end, or both, whichever may be most convenient; care should be observed to have the acting sides of the teeth in the same planes as the axis of the wheel. When they are laid off from one side, the large end of the frustum of the cone is to be preferred, and the base, sides, and ends of the teeth, be formed of straight lines pointing toward the apex of the cone. These are *convex involute bevil teeth*; and those upon the interior surface of the frustum of a cone also, are composed of straight lines, pointing toward the apex of the cone, and are *concave involute bevil teeth.*

Those upon the exterior and interior surface of a cylinder, have the acting faces composed of straight lines parallel with the axis of the wheel. Face wheels have the teeth made convex, in the line of the wheel's motion, in proportion to the diameter of the wheel into which it is to work, or be engaged, and the teeth on the interior or concave surface of a rack, are made similar to those on the interior surface of a cylinder of the same curve; and those upon the exterior (or convex) surface of a circular rack, are to be made similar to those on the exterior convex wheel of the same curve. A small flexible thread, or a rigid straight edge, with a point or scriber attached, may also be used to trace the involute curves upon the edges of the teeth; but as the thread is liable to stretch, and there is some difficulty in preventing the straight edge from sliding upon the circumference of the wheel, the wire is preferable.

It appears to the writer of this, that the teeth of wheels and racks, made upon the principles here described, will fulfil the aforesaid conditions, better than where the acting sides or faces are composed of epicycloidal, cycloidal, or concentric circular curves, or any part of either; and that the involute can be constructed as rigorously correct as either; and with as little labor. E. O. R.

FLAME OF HYDROGEN RENDERED LUMINOUS.

Dr. Hare, of Philadelphia, has rendered the flame of hydrogen luminous, like that of oil, by adding a small quantity of oil of turpentine to the usual mixture for generating that gas. The light seems greater than that of carburetted hydrogen. He found also that the addition of 1-17th of oil of turpentine to alcohol gives this fluid the property of burning with a highly luminous flame, and there is a certain point in the proportions when the mixture burns without smoke like a gas light.—*Reg. of Arts and Sciences.*

PRESERVATION OF FRUITS BY CARBONIC ACID GAS.

Cherries, grapes, pears, apples, and chestnuts (and perhaps all other fruits,) placed in glass vessels filled with this gas, obtained from carbonate of lime by sulphuric acid, are said to be preserved without undergoing any change for a long period. Cherries at the end of six

weeks had the same appearance as when preserved in brandy.—*ib.*

EMPLOYMENT OF MINERAL TAR, OR PYROLIGNEOUS LIQUOR, FOR THE PROTECTION OF WALLS OF MASONRY OR OF MUD.

When the walls are thoroughly dry, towards the end of summer, (having previously been either newly built or put into a new state of thorough repair,) they are to be coated over once, twice, or thrice with the tar. The last coat, immediately when put on, may be powdered with sand; and this when solidified, may be white-washed.

In France, earthen walls, and the walls of court yards, and terraces, are treated in this manner, and so rendered of great durability. *Farmer's Register.*

PREVENTION OF DRY ROT IN TIMBER.

The gas of the kreosote, (supposed creosote,) procured from the distillation of coal or vegetable tar, which, when driven off in the shape of gas, will penetrate every part of the largest logs, and render the wood almost as hard as iron; so hard indeed, as not to be easily worked. It is understood that in Belgium they are using it as blocks for the rail-roads. The worm, (*teredo navalis*) as proved at Sheerness, will not touch it, while pieces of the same wood, *steeped in corrosive sublimate, sulphurous acid,* and *other active solutions,* were bored through and through. *ib.*

TIME FOR SOWING SEEDS OF DIFFERENT KINDS.

As it is admitted that, the duly adjusting the periods of sowing seeds for different kinds of crops, according to the forwardness of the season is of great importance in agriculture, and as the temperature is far from being the same in different seasons, at the same period of the year, it is thought best to adopt the budding and leafing of trees as a standard for determining the most proper period. The budding and leafing of the birch, is said to be considered in Sweden as a directory for sowing barley, and it is recorded in the *Amoritates Academico*, that the illustrious Linnæus exhorted his countrymen to observe with care what time each tree expands its buds, as information which might lead to the most useful purposes. For these reasons the prudent husbandman is advised to watch the budding of trees, and to collect from this circumstance the proper time for sowing, and to make the operations of nature a calender for his own labors, and it is contended that more favorable crops than would otherwise be obtained will amply reward his diligence.

NOTICE TO SUBSCRIBERS.

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EDITOR.

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